CROP CULTIVATION

A crop is defined as a domesticated plant. Crop cultivation involves management and raising of crops to stage of harvesting.

**Importance of crop to man**

1. They provide food for both humans and livestock.
2. They provide raw materials for industries. Examples include coffee, cotton, tea, sugar cane etc.
3. Crops provide income and foreign exchange to both farmers and the general economy.
4. Cover crops such as beans and peas prevent soil erosion. They also keep soil temperature law and reduce the rate of moisture loss from the soil.
5. They tame the environmental conditions through their micro-climatic influence.
6. They also provide herbs for treatment of various ailments.

**CLASSES OF CROPS**

Crops can be classified as

1. Annual
2. Perennial

**Annual crops** are these that grow, mature and are harvested with in a year.

They include;

* 1. Cereals
	2. Legumes
	3. Field crops
	4. Root/ starchy crops
	5. Vegetables
1. **Cereals**

These are crops that yield grain. Examples include maize, finger millet, sorghum, wheat and barley.

**Botanical characteristics of cereals**

* + They belong to the family graminae.
	+ They are all monocotyledons.
	+ Roots are extensively branched and fibrous.
	+ They normally have a high starch content.

**Maize (*Zea mays*)**

It was brought to e. Africa by Portuguese traders.

**Varieties**

These include;

* + Kitale synthetics
	+ Kitale hybrids
	+ composite varities eg Kawanda composite

**Uses of maize**

* + Can be eaten roasted or boiled.
	+ Can be turned into flour and taken as posho.
	+ Can be taken as porridge.
	+ It can be used as feed for livestock.
	+ Used for manufacture of glucose, explosives, starch etc.

**Growth requirements (conditions)**

* 1. Deep, well drained fertile soils.
	2. Substantial rainfall during the growth period and a dry spell for ripening, harvesting and drying.
	3. An altitude of between 10 and 2500m above sea level.
	4. An average temperature of about 240c.

**Seed-bed preparation**

Maize requires a rough seed bed. This reduces soil erosion and encourages water infiltration.

**Planting**

Planting should be done at the beginning of the main rains 25-28kg are required per ha.

Hand spacing should be 90\*30cm, while machine spacing is 60\*40cm- 3 or 4 seeds should be dibbled per hole.

**Thinning:-** It involves removing excess plants to reduce congestion. It is done after 2 weeks of growth and 2 or 3 seedlings are left per hole.

**Weeding:-** It can be done mechanically using a hand hoe or by herbicides. It’s done twice or thrice before harvesting.

Fertilizer application:- a fertilizer of ammonium sulphate (NH4)S04) can be applied after thinning at a rate of 125-250kg/ ha.

**Harvesting**, drying and storage:- Maize matures with in 4-6months. After ripening and partly drying in the field, it’s harvested and dried further to reduce the moisture content before storage.

Pests and diseases of maize

**Pests**

* 1. **Maize stalk borer (Bussecta fusca):-** This attacks maize in the field.

**Damage:-**

* + Makes holes through leaves.
	+ Eats the grain on the cob.
	+ Destroys soft stem apex resulting in withering of plant tops.

**Control:-**

* + Spray with endosulfan
	+ Practicing crop rotation.
	+ Burning crop residues
	+ Practicing early planting.
	1. **Spotted stalk borer (chillo partellus):-** It is also a field pest.

**Damage:-** Mines the leaves of the funeral and later borers into the stem.

**Control:-**

* + Practice early planting
	+ Crop rotation
	+ Burning crop residues.

Other field pests include the American boll worm, maize tassel beetle and termites.

**Storage pests of maize**

1. **Maize weevil (Sitophilus Zeamais).**

**Damage:-** It borers into the grain and destroys the endosperm.

**Control:-**

* + Dusting with 1% lindane (B. H. C)
	+ Proper drying of grains.
	+ Keeping the stores very clean.
	+ Don’t mix old seeds with new seeds.

Other storage pests include the red flour beetle, grain moth and rodents.

**Diseases of maize**

1. **Maize rust:-**

**Symptoms:-** Forms dark- brown patches on the underside, reducing the photosynthetic area.

**Control:-**

* + Growing resistant varieties.
	+ Practicing crop rotation.
	+ Destruction of plant residues
1. **Maize streak**

**Symptoms:-**

* + Forms yellow or nearly white stripes parallel to the veins.
	+ Stunted growth of the plants.
	+ Reduced yield or complete sterility.

**Control:-**

* + Up rooting and burning affected plants.
	+ Practicing early planting.
	+ Growing resistant varieties.

Another disease is the leaf blight.

1. **Legumes**

These are crops that have got nodules on their roots. They include beans, peas, soya bean and ground nuts.

**Importance of legumes**

1. They are protein substitute in absence of meat, fish, milk and eggs.
2. In pastures, they provide protein for livestock.
3. They add nitrogen to the soil hence increasing on its fertility.
4. They are used in the preparation of green manure.
5. They act as cover crops, protecting the soil against erosion, keeping soil temperature low and preventing excess evaporation.
6. They are used in manufacture of drugs and dyes.

**General characteristics of legumes**

* + Leaves are infoliate and not veined.
	+ They have got nodules that contain nitrogen fixing bacteria.
	+ They bear pods containing seeds.
	+ They have a similar flower structure.

**Beans *(Phaseolus vulgaris)***

**Varieties:-** Classified according to growth habits.

1. **Bush type:-** They are simple bean plants. Examples include banja, k-20 and Canadian wonder.
2. **Semi-climbing type:-** It climbs to a moderate height. Examples are mutiike 4, Mexico 142 and Tanganyika black.
3. **Climbing type:-** These continue growing even after flowering. Examples are lima beans, No -22 harricot (small white seeds)

**Growth conditions**

1. Deep fertile, well drained soils.
2. Enough rain during the early growing stage and a fairly dry spell as they flower to form pods.
3. Moderate temperature of 230c – 250c.
4. An altitude of about 900 – 1200m above sea level.

**Seed – bed preparation**

The seed bed should be quite rough and ploughed to a good depth.

**Planting**

Should be done at the beginning of the main rains.

If done by hand, spacing should be 60\*15cm while machine spacing should be 60\*8cm. 2 or 3 seeds are dibbled per hole.

**Weeding:-**

Done twice using a hand hoe.

**Fertilizer application**

It’s generally considered uneconomical to apply fertilizers in a bean fields since beans are self sustaining.

**Harvesting, drying and storage**

* + After ripening and partially drying in the field, beans are harvested and taken for threshing to obtain pure seed.
	+ The seeds are further dried to avoid rotting and weevil attack before they are stored.

**Pests and diseases of beans**

**Pests**

1. **Bean fly (Melanogromyza phaseolic)**

**Damage:-** The larvae enter and eat up the stem, leading to its collapse.

**Control:-**

* + Seed dressing with aldrin and dieldrin.
	+ Early planting
	+ Destruction of volunteer plants
	+ Crop rotation.
1. **Bean aphids (Aphis fabae)**

**Damage:-** They cluster round growing points and suck up the sap, preventing normal plant growth.

**Control:-** Spray with endosulfan, menazon and fenitrozion

**3.Leaf eating beetle and the pollen beetle**.

These can generally be controlled with endosulfan.

**Storage pests**

1. **Bean weevils (Bruchids) (Acanthoscelides obtectus)**

**Damage:-** They enter bean seeds and feed on the pulses 71 (cotyledons), lowering their quality and viability.

**Control:-**

* + Adequate drying of seeds before storage.
	+ Dusting the seeds with 1% lindane. (B. H. C).
	+ Proper cleaning of the store.
	+ Avoid mixing old seeds with new ones.

**Diseases**

1. **Bean anthracnose:-**

**Symptoms:-** brown sunken and water soaked spots appear on pods, making pods and seeds to rot.

**Control:-**

* + Use of resistant varieties.
	+ Destruction of crop residues.
	+ Use of clean seeds.
1. **Bean rust**

**Symptoms:-** dark brown pustules on the underside of the leaves leading to loss of the leaves.

**Control:-**

* + Planting resistant varieties.
	+ Destruction of crop residues.

Other diseases include angular leaf spot, bacterial blight and bean mosaic.

**ROOT CROPS**

These are crops with swollen roots or underground stems in which large quantities of starch are stored. Examples include cassava, sweet potatoes, yams, Irish potatoes etc. they are mainly produced for consumption.

**Advantages of root crops**

* + They accept a variety of soils and give good yields.
	+ They require little labour and attention to produce.
	+ They are easy to propagate.
	+ They are not attacked by many pests and diseases.
	+ They require little processing compared to cereals and legumes.

**Disadvantages of root crops**

* + They are bulky, thus difficult to transport.
	+ They are quick perishing because of their high moisture content.
	+ They need to be supplemented with feeds rich in proteins, vitamins and fats.
	+ The planting material is bulky and quite difficult to obtain.

**CASSAVA (*Manihot esculenta)***

It’s believed to have originated from south America and brought by Portuguese traders.

**Varieties**

1. **Sweet cassava:-** One with light leaves and green veins.
2. **Bitter cassava:-** One with dark green leaves and red veins.

**Growth requirements**

1. Does best in deep fertile well drained soils, though is also tolerant to infertile soils.
2. Requires well distributed rainfall throughout the growth period.
3. Can do well in a wide range of temperature and altitude.

**NOTE:**

Cassava should always come last in the rotation programme because it efficiently uses the least nutrients for its growth.

**Seed bed preparation**

The seed bed should be deeply ploughed to facilitate easy growth and elongation of tubers.

**Planting**

* + Should be done at beginning of main rains, using thick, mosaic free cuttings measuring 30 – 40cm long.
	+ Spacing is 140cm \* 140cm and two pieces should be placed horizontally in each hole.

**Weeding**

* + Should be done 3 – 4 times especially in the early stages of growth before harvesting. Slashing can be enough during harvesting.

**Harvesting and processing**

Harvesting is usually done by uprooting tubers using hand hoes. Harvested tubers can be peeled and consumed when still fresh or may be sliced , dried and grinded into flour depending on intended use.

**Pests and diseases of cassava.**

1. **Wild pigs, rodents and monkeys**

**Damage:-** These up root and eat up tubers

**Control:-**

* + Hunting
	+ Poisoning
	+ Trapping
	+ Destruction of habitat
1. **Termites**

**Damage:-** These eat up stem cuttings before germination

**Control:-**

* + Early planting
	+ Digging out antihills
	+ Use of dieldrin on anti-hills.

Other cassava pests include the elegant grasshoppers and the green cassava mite.

**Diseases**

1. **Cassava mosaic:-** Serious and caused by a virus, transmitted by whitefly.

**Symptoms**

* + Moulting of leaves
	+ Stunted growth
	+ Poor formation and growth of tubers

**Control**

* + Up rooting and destroying affected plants
	+ Planting resistant varieties
	+ Planting mosaic free cuttings

Other diseases that attack cassava include the brown streak, leaf spot and cassava wilt.

**VEGETABLES**

These are crops normally grown to supplement meals. They include tomatoes, cabbage, Irish, eggplants etc.

**Advantages of vegetable growing**

1. They fetch high income for farmers.
2. They are produced on small plots of land.
3. They are highly marketable.
4. They are highly nutritious with vitamins A, B1, B2, B5, B6 and B12, C, E together with minerals.
5. They are quite easy to look after.
6. They are quick maturing.

**Problems associated with vegetable growing**

1. They are highly perishable and this lead to great losses.
2. They require special skills in care and management.
3. Their market is resistant to urbanized areas.
4. They require a lot of investment in terms of capital
5. Their market price largely depends on quality and size of the products.

**Establishment of a nursery bed**

A nursery bed is a unit where seedlings are first raised before they are transplanted to the main garden.

**Procedure**

1. Select a flat, well drained fertile part of land.
2. Measure a width of 1m and any length of the bed.
3. Clear the site of all the vegetation.
4. Plough the soil to a very fine tilth and remove all the tree roots and stumps.
5. The soil level should be raised about 15cm above the ground.
6. Apply some amount of compost fertilizer in the bed.
7. Make rows 20 – 30cm apart throughout the whole of the bed.
8. Some potassium and phosphatic fertilizers should also be applied.
9. Make ditches or drills using a dibber or sharp stick and plant the seeds in the rows.
10. The seeds should be covered in a depth about 3 times their diameter.
11. Mulch the bed with a suitable mulching material.

**Management of seedlings in a mulching bed**

1. Remove the mulch as soon as seedlings emerge from the soil.
2. Provide shade for seedlings by covering an erected sheltering with suitable vegetative roofing.
3. Seedlings should be regularly watered, about 2 -3 times a day during their growth period.
4. Weeding should be carefully done using a garden fork.
5. Where there’s congestion, prick out or thin the seedlings by either eliminating them or transferring to any available space.
6. Apply suitable pesticide to control pests in the bed.
7. Apply suitable fungicides to control fungal infection.
8. Fence off the bed to ensure protection and security against stray animals and tress passers.
9. Frequently check on the nursery bed to ensure the proper growth conditions of the seedlings.
10. Harden-off the seedlings by gradually exposing them to sunlight and direct rain 7 to 10 days before transplanting. Hardening off is done to enable seedlings withstand field conditions when transplanted.

**Transplanting of seedlings**

This should be done when the seedlings have reached a reasonable stage of development.

Transplanting should be done earlier in the rainy season and preferably in the evening to enable plants benefit from the cool night.

**Effects of too much shade on seedlings**

1. Seedling stems become exceptionally long.
2. The leaves are turned pale yellow.
3. There is a reduction in size of the leaves.
4. Seedlings are very weak when transplanted.
5. Seedlings normally have long internodes.

**Tomatoes (*Lycopersicon Lycopersicum)***

They belong to the family solanacae

**Varieties**

These include money maker, marglobe and Bonny Best.

**Growth conditions**

1. Moderate rainfall of 900 – 1500mm 1 year and a dry spell during flowering and fruiting.
2. Temperatures should be warm for optimum growth.
3. Does best in deep, fertile, loamy, non – acidic soils.
4. Thrives in a wide range of altitude.

**Seed bed preparation and transplanting**

* + Seed – bed should be finely prepared.
	+ Transplanting is done when seedlings have 4 – 6 leaves spacing should be 90 \* 45cm.

**Mulching**

This is done with a suitable vegetative material as to reduce moisture loss and encourage water infiltration.

**Staking**

Plants are staked by supporting them on sticks. Staking avoids fruit contact with soil, gives adequate exposure to air, light and also avoids fungal infection.

**Pruning and spraying**

* + Pruning is done by removing side shoots, leaving 2 or 3 shoots to grow. This improves on quality and fruits.
	+ Spraying should be done using DDT and copper fungicides effective pest and disease control.

**Harvesting**

Maturing is attained with in 10 – 14 weeks from time of transplanting depending on variety. Maturity of the fruits is shown by change of colour around base of the fruit.

**Pests and diseases of tomatoes**

**Pests**

1. **Nematodes**

**Damage:-** They feed on young roots, reducing growth and considerably.

**Control:-**

* + Crop rotation
	+ Use of nematicides such as nemagon
1. **American boll worm (*heliothis armigera)***

**Damage:-** Attack and eat up fruits at any stage of growth

**Control:-**

* + Spray with DDT

**Diseases**

1. **Tomato blight:-**Caused by fungus phytopthora infestans. Affects young seedlings, flowering tomato plants and those at harvest stage.

**Symptoms:-** Dark brown sunken lesions on leaves, stem and fruits.

**Control:-** spray with copper fungicides such as ridom and Dithane M45

1. **Bacterial wilt**:- A soil borne disease, very difficult to control.

**Symptoms:-** Wilting and death of growing points and the leaves.

**Control:-**

* + Up rooting and burning affected plants.
	+ Crop rotation.
	+ Planting resistant varieties.
1. **Tomato mosaic:-** It causes mottling and curling of leaves, reducing photosynthetic area. It can be transmitted from tobacco shreds or smoker’s hand.

**Control:-** Planting resistant varieties, burning affected plants, planting clean material. Smokers should wash hands before touching plants.

**CULTIVATION OF COFFEE**

Coffee is a perennial crop purposely grown to make beverage because of its 1 – 1.5% caffeine content.

**Varieties**

1. Arabic coffee (Coffea Arabica)
2. Robusta coffee (Cofea canephora)

**Growth requirements (conditions)**

1. Does best in deep, fertile, well drained, slightly acidic volcanic soils (PH between 4.2 and 6.2)
2. An annual rainfall of between 1500 and 2300mm, well distributed through the year. A dry spell of 2-3 months to stimulate flowering and fruiting.
3. An optimum temperature of between 180c and 280c. higher temperatures cause excess vegetative growth while low temperature cause stunted growth.
4. Does best at an altitude of between 1400m – 1900m.

**Propagation of coffee**

Coffee can be propagated by;

* + 1. Seeds
		2. Vegetatively (using cuttings)
1. **Seeds:-** These are planted in a nursery bed and seedlings are later transplanted to the main field.

**Advantages of propagation by seed**

1. It’s quite cheaper.
2. It minimized chances of transferring parent diseases to off springs.
3. Seeds are easier to store and to take care of.
4. The plantation raised from seeds lasts longer.

**Disadvantages**

1. It takes long for the plant to mature.
2. It increases on the chances of transferring seed borne diseases.
3. A lot of labour is involved in raising seedlings in the nursery bed.
4. There is danger of loosing quality of parent plants.

1. **Vegetative propagation:-** Involves obtaining cuttings with nodes and planting them in soil/ manure field tins to facilitate vegeneration. They are transplanted after 10 weeks to the main field.

**Advantages of vegetative propagation**

1. There is transfer of the original parent qualities to the off springs.
2. There are higher chances of regeneration.
3. Vegetative propagation ensures fast growth and early maturity.
4. Risks of seedling diseases are eliminated.
5. No nursery bed preparation is necessary.
6. They at times tend to give high yields.

**Disadvantages of vegetative propagation of coffee**

1. The cuttings can transfer the parent diseases to the off springs.
2. It’s very expensive to raise the material to the stage of transplanting.
3. Vegetatively propagated coffee plants mature and die earlier than those propagated by seeds.
4. The planting material is quite bulky.

**Nursery bed practice**

The site should be fertile, deeply ploughed and near a water source.

Healthy, viable high quality ripe berries are dried and planted in the bed (spacing should be 15 \* 15cm) and covered 2.5cm into the soil. The bed is then mulched

Germination takes place after 6 months. Shades should be erected over germinated seedlings and the mulch removed.

**Note:**

1. There should be frequent watering of the seedlings especially in the stages of growth.
2. Watering should be gradually with drawn to make the seedlings adapted to field conditions.

This is called hardening off.

It takes 7 – 10weeks for the seedlings to get ready for transplanting.

**Raising seedlings without nursery bed**

Alternatively, coffee seedlings can be raised in polythene sleeves filled with potting mixture of topsoil, organic manure, phosphatic fertilizer and sand. The seedlings are not disturbed at transplanting.

**Seed bed preparation and transplanting**

* + The field for coffee should be prepared 6 months in advance by deep ploughing to allow for soil restructuring.
	+ Holes for planting (60cm deep and wide) should be dug 3 months before transplanting. They are then filled with manure and topsoil 3 weeks before transplanting.
	+ Transplanting should be done at the beginning of the main rains. Spacing between plants should be 2.7 \* 2.7m

**Field management**

* + 1. **Shade trees**

Trees such as Albizzia spp and cordial Abyssinica can be planted in the field (spacing 16 \* 16m) to provide shade in the field.

**Importance of shade trees in the coffee field.**

1. Moderates the field temperature by reducing the sunlight intensity.
2. Reduces transpiration rate from coffee trees.
3. Reduces soil erosion.
4. Protects coffee trees from wind and hail storms.
5. Reduces evaporation from the soil.
6. Provides conducive working environment for laborers.

**Disadvantages of shade trees**

1. Reduces the number of flower buds on coffee trees.
2. Reduces rate of photosynthesis leading to decline in yields.
3. There is competition for nutrients between shade trees and coffee trees.
4. Shade trees increase the incidence of some pests such as leaf miners.
	* 1. **Mulching**

Can be done using materials like coffee husks, elephant grass, maize and wheat straw. Mulching promotes growth of feeder roots in topsoil, conserves soil moisture, reduces erosion and moderates soil temperature.

* + 1. **Weeding**

Weeds should be effectively controlled since they are a big effect on the yield. Herbicides, mechanical or cultural methods can be used.

* + 1. **Fertilizer application**

Organic fertilizers and phosphates only give good response when applied at planting. In the field, Nitrogen can give good results. They can be applied at 45 – 120.

* + 1. **Pruning**

It’s the cutting or removal of excess vegetative nodes (branches and leaves) from coffee plants. In coffee, pruning is done just after harvesting before flowering begins.

**Importance of pruning coffee**

1. It improves on the quality of coffee berries.
2. It increases the coffee yield.
3. Avoids over –bearing and die –back
4. Reduces incidence of some pests such as the nutebeg.
5. Reduces transpiration in plants.
6. Reduces infection and transmission of diseases.
7. Facilitates easy spraying and weeding in the field.
8. Keeps plants healthy and vigorous.
9. Facilitates easier and faster harvesting.
10. It reduces unnecessary congestion in the field.
11. Avoids mineral and plant food wastage in un productive branches.
12. Reduces weight and therefore plant susceptibility to wind and hail storms.
13. Material after pruning can be used as firewood and mulches.

**Disadvantages of pruning coffee.**

1. Retards growth of coffee plants.
2. Poor pruning can lead to permanent damage.
3. Pruning is very tiresome and laborious.
4. Can expose the soil to erosion and moisture loss..
5. Requires special skills for its success.

**Methods of pruning.**

1. **Single stem pruning**

It involves cutting down others and leaving only one stem to bear fruits. The remaining stem is cut at the tip 1.5m above ground to stimulate the growth of branches. The more the branches, the higher the yield.

1. **Multiple stem pruning**

Two or three stems are left to bear fruits. The simple stem is cut at a height of 0.45m. 2 or 3 shoots will emerge. These are also cut at 1.5m to stimulate lateral branch growth.

**Note:**

Coffee stems should be trained (bending them) to facilitate easy picking during harvest of the berries.

**Harvesting**

Ricking is done when berries (cherries) are mature and ripe and when colour has changed from green to yellowish – orange and finally red. Only ripe berries should be picked.

**Processing**

1. **Dry method:-** Harvested cherries are sun dried and then taken to the milling factory (Hullery) where skin and parchment (husks) are removed.
2. **Wet method**:- Main stages involved are ;
3. Inspection:- berries are first inspected to remove under ripe, over- ripe, yellowish or diseased berries.
4. Pulping:- coffee beans are squeezed out of their skins with a pulper.
5. Pre-washing:- parchment coffee (coffee beans) is in channels to remove all pieces of skin and any old floating and foreign objects.
6. Fermentation:- the parchment coffee is placed in fermentation boxes for 2-4 days to facilitate the breakdown of the inner slippery jelly- like layer (mucilage) off the coffee beans. It’s done by enzymes micro-organisms.
7. Washing:- the beans are then washed to remove broken down mucilage.
8. Drying:- it involves a 48hours adequate sun drying heeping it on a floor and frequently turning it to allow for proper air drying before it’s sold off.

**Pests and diseases of coffee**

**Pests:-**

1. Antestia bugs:- these are dark brown insects with white speckles.

**Damage:-** Feeds on berries, flowers and growing parts of the plants, lowering quality and yield of berries.

**Control:-**

* + Adequate pruning
	+ Spraying with fenitrothion and parallion.

1. **Leaf miners**:- These are small white nocturnal moths.

**Damage:-** Larvae feed on leaf tissue reducing rate of photosynthesis.

**Control:-** Spray with fenitrothion and parathion.

1. **Coffee – berry borer:-**

**Damage:-** Bore into berries and feed on the contents.

**Control:-**

* + Regular picking of berries.
	+ Proper pruning.

Another pest is the mealy bug.

**Diseases.**

1. **Leaf rust:-** Caused by a fungus and spread by rain splash.

**Symptoms:**- Round – orange patches on the underside of the leaves, reducing photosynthesis.

**Control:-**

* + Open pruning.
	+ Adequate weeding
	+ Timely use of Dithane M -45
1. **Coffee berry disease:-** Caused by fungus and spread by rain splash.

**Symptoms:-** Small sunken patches on flowers, ripe berries and also on leaf veins.

**Control:-**

* + Use of resistant cultivars e.g ruins II.
	+ Use of copper fungicides like perenox, benlate and captafol.
	+ Proper pruning.

Another disease is coffee die back and is controlled by proper pruning.