

Crop Production I and II

Cabbages

Economic Importance

- (i) Leaves are eaten as salads or boiled as vegetables.
- (ii) Leaves can be fed to livestock.

Ecological Requirements

Altitude: Those with small heads: 900-1500m above sea level and those with large heads: 1800-2700m above sea level.

Temperature: Require cool conditions.

Rainfall: 750mm-2000mm per annum, should be well distributed throughout the growing period.

Soils: Deep, fertile and well drained.

Varieties

- (i) Early maturing: Brunswick, Sugar loaf, Early jersey, Copenhagen market, Chinese cabbage, celery cabbage and cafe spits kool.
- (ii) Late maturing: Drumhead, savoy, perfection, Gold Acre and Winningstadt.

Nursery Practices

- (i) The beds should be raised, dimension 1m wide and any convenient length (usually 2-3m in length).
- (ii) Make drills of 15-20cm apart.
- (iii) Sow seeds by drilling and cover to a depth of 1cm.
- (iv) Provide shade or mulch material.

- (v) Apply phosphatic fertilisers and mix thoroughly with soil during planting.
- (vi) Water twice a day.

Seedbed Preparation

- (i) Cultivation should be done during the dry season so that all the weeds are killed.
- (ii) Dig holes at the spacing of 60cmx60cm.
- (iii) Incorporate farm yard manure in the soil.

Transplanting

- (i) Water the seedlings before transplanting.
- (ii) Seedlings are ready for transplanting after one month, i.e. when they are 6-10cm in height.
- (iii) Select healthy and vigorous seedlings and discard the weak and stunted ones.
- (iv) Transplanting is done on a cloudy day or in the evening.
- (v) Transplant the seedlings with balls of soil to prevent root damage.
- (vi) Plant to the same depth as they were in the nursery.

Field Maintenance

- (i) Apply fertilisers during planting and top dress later.
- (ii) Weed to reduce competition.
- (iii) Control pests by spraying insecticides.

Pests

- (i) *Diamond Back Moth*
Damage: Eats the underside of the leaf, making windows or holes in the leaf.
Control: Spray insecticides.
- (ii) *Cut Worms*
Damage: Attacks the stem at the ground level causing the plant to fall.
Control: Spray insecticides.

Diseases

- (i) *Black Rot*
Cause: Bacteria
Symptoms: Leaves turn yellow and rotting of the stem giving an offensive odour.
Control: Closed season, crop rotation, use certified seeds and spray appropriate chemicals.
- (ii) *Black Leg*
Cause: Fungus
Symptoms: Brown to black spots on seedlings and dark canker on the stem.
Control: Crop rotation, destroy infected material.

Tomatoes**Economic Importance**

Fruits are used as salads, cooked as vegetables.

Ecological Requirements

Altitude: 0-2100m above sea level.

Rainfall: 750-1300mm per annum.

Soils: Deep, fertile and well drained.

Varieties

- (i) Fresh market varieties: money maker, marglobe, hundred fold, beef eater, hot set, super marmande and ponderosa.
- (ii) Processing varieties: Kenya beauty, San marzano, Roma, Heinz 1350, primabel and Rutgers hybrid.

Nursery practices

- (i) Choose a site where there has been no solanaceae crop in the last three years.
- (ii) Beds are raised about 15cm above the ground level.
- (iii) Make drills of 20cm apart and 1cm deep.
- (iv) Provide shade or mulch material.
- (v) Water twice a day.
- (vi) Apply phosphatic fertilisers during planting.

Seedbed Preparation

The land should be dug deeply to control all weeds.

Transplanting

Seedlings are ready for transplanting when they are 10-15cm high after about one month.

Spacing: 60cm x 90cm.

- (i) Apply 20gm of DSP in the planting hole.
- (ii) Transplant with a ball of soil around the roots.
- (iii) Apply mulch around each seedling.
- (iv) Transplanting is normally in the evening or on a cloudy day.

Field Maintenance

- (i) Early control of weeds is necessary.
- (ii) Top dressing is done after crop establishes.
- (iii) Pruning and staking is done to train the plant to grow vertically.

Pests

- (i) *American Bollworm*
Nature of damage: Boring of the fruits.
Control: Spraying insecticides.
- (ii) *Tobacco White Fly*
Nature of damage: Suck plant sap from the underside of the leaf, hence may transmit virus diseases.
Control: Destroy infected plants and spray insecticides.

Diseases**(i) Late Blight****Cause:** Fungus**Symptoms:** Dry patches on the leaves and fruits.**Control:** Use of fungicides, crop rotation and destruction of affected materials.**(ii) Blossom-end Rot****Caused by:**

- too much nitrogen in early stages,
- irregular or infrequent watering,
- calcium deficiency.

Control: Apply calcium ammonium nitrate and correction of the above problems.**Harvesting**

- (i) For canning, fruits should be fully ripe.
- (ii) For fresh market, fruits should be underripe and packed in crates to avoid damage.
- (iii) The fruits should be graded according to size and colour.

Maize**Main growing areas:** Trans-Nzoia, Nakuru, Uasin Gishu districts.**Ecological Requirements****Altitude:** Upto 2000m above sea level.**Temperature:** About 25°C.**Soils:** Freely draining, fertile loam soils.**Rainfall:** 750-1250mm critical at silking and pollination time.**Varieties**

- (i) High altitude areas: Hybrids 611, 613 and 614C.
- (ii) Medium altitude areas: 511, 512, 622 and 632.
- (iii) Marginal rainfall areas: Katumani Composite B.
- (iv) Coast regions: Coast Composite and Katumani Composite B.

Seedbed Preparation

- (i) Ploughing should be deep and done

during the dry season to eradicate weeds.

- (ii) Fine tilth not necessary.
- (iii) Plant spacing 75cm x 30cm.
- (iv) Planting done at the onset of the rains. This also helps to reduce pest attack.
- (v) Dry planting in areas with inadequate rainfall is necessary.

Field Maintenance

- (i) Apply phosphatic fertiliser at planting and nitrogenous fertilisers as a top dress.
- (ii) Control weeds by cultivation or use of herbicide.

Pests**(i) Maize Stalkborer****Nature of damage:** Boring the leaves causing windowing effect, boring the stems and cobs.**Control:** Destruction of previous years crop residues, close season and apply chemicals.**(ii) Maize Weevil**

It is a storage pest.

Damage: Bores holes into the maize grains, eating the contents.**Control:** Proper hygiene and sanitation in the stores. Use of chemicals e.g. Actellic.**Diseases****(i) Rust****Cause:** Fungus.**Symptoms:** Red or brown pustules on the leaves.**Control:** Plant resistant varieties and crop rotation.**(ii) Head Smut****Cause:** Fungus.**Symptoms:** Black sooty mass of spores on maize heads or/ and cobs.**Control:** Crop rotation, growing resistant varieties and destruction of affected plant parts.

Rice

Areas where grown:

- (i) Mwea Tebere Irrigation Scheme.
- (ii) Ahero pilot scheme in Kano Plains.
- (iii) Bunyala in Busia.
- (iv) Bura in Tana River.

Ecological Requirements

Altitude: 0-1200m above sea level.

Temperature: 20-38°C.

Rainfall: 1500-2000mm per annum. Rice is usually grown under irrigation.

Soils: Damp or waterlogged soils of pH 5.5-6.5.

Varieties

Sindano, Basmati 217 and 1R8, 1R22 and 1R257.

Nursery Practices

- (i) Deep ploughing and flooding to a depth of 10cm.
- (ii) Construction of bunds around the nursery.
- (iii) Puddling of fields to obtain fine mud.
- (iv) Plant pregerminated seeds which are over two months old to avoid dormancy.

Planting

- (i) The field should be ploughed to a fine tilth, levelled and puddled.
- (ii) Seedlings are transplanted after one month when they are 15cm in height.
- (iii) Spacing 10cm x 10cm.
- (iv) Broadcast phosphatic fertilisers before transplanting.

Field Maintenance

- (i) Provide fresh water to $\frac{1}{3}$ the height of the crop
- (ii) Control weeds by uprooting and using herbicides.
- (iii) Top-dress with nitrogenous fertiliser in split application, 3-4 weeks after planting.

Pests

- (i) *Rice Hispid*
Nature of damage: Larva bores into

the leaves causing irregular pale brown patches.

Control: Spray insecticides.

- (ii) *Birds (especially the Sudan Dioch.)*
Nature of damage: Feed on ripening seeds.
Control: Scaring, poisoning, trapping and killing.

Diseases

- (i) *Rice Blast*
Cause: Fungus.
Symptoms: Brown spots with grey centres on leaves and "broken neck".
Control: Plant resistant varieties e.g. Basmati 217.
- (ii) *Yellow Mottling*
Cause: Virus
Symptoms: Mottling of the leaves.
Control: Plant resistant varieties and control vectors.

Harvesting

- (i) Takes 4-5 months to ripen.
- (ii) Three weeks before harvesting water is drained off the field.
- (iii) Cutting of stems at the base by use of sickles.
- (iv) Threshing to detach the grains from the panickels.
- (v) Drying to a moisture content of 14% and winnowing.
- (vi) Packed and dispatched to the millers.

Bulrush Millet

Areas where grown: Lower areas of Kirinyaga, Embu, Meru, parts of Machakos and Kerio Valley.

Ecological Requirements

Altitude: Does well in areas below 1200m.

Rainfall: 500-600mm per annum.

Soils: Light sandy soils.

Varieties: Serere 2A, 3A, 6A, 17, 16/9, etc.

Seedbed Preparation

- (i) Ploughing of land during the dry season.

- (ii) Soil should be fine since the seeds are small.

Planting

- (i) Done at the onset of the rains.
 (ii) Planted by broadcasting and row planting at a spacing of 60cm x 15cm.

Field Maintenance

- (i) Weeding is done until tillering.
 (ii) Top-dressing is done by use of sulphate of ammonia.

Pests

- (i) *Birds*
Nature of damage: Eats the seeds at milky stage.
Control: Bird-scaring device.

Diseases

- (i) *Ergot*
Cause: Fungus
Symptoms: Heads become sticky.
Control: Use of certified seeds, crop rotation and destruction of affected crop.
- (ii) *Downy Mildew*
Cause: Fungus
Symptoms: Long, whitish lines on the leaves.
Control: Crop rotation and field hygiene.

Harvesting

- (i) Done by cutting off the heads.
 (ii) Drying of the heads.
 (iii) Threshing and winnowing of the grains.
 (iv) Stored under well ventilated dry conditions.

Beans

Grown in all provinces where maize is grown.

Ecological Requirements

Altitude: 1000-2100 metres above sea level.
Rainfall: Average of 625mm per annum.
Soils: Well drained loamy soils rich in organic matter.

Varieties

- (i) Varieties for dry beans: Rose Coco, Mwezi Moja, Canadian Wonder, Wairimu, Haricot, Mwitemanina.
 (ii) Variety for canning: Mexican 142.
 (iii) Varieties for French beans: Primeur, Long Tom, Xaka, Master Piece and Monel.

Seedbed Preparation

- (i) Land should be prepared early.
 (ii) Primary and secondary cultivation done to control perennial weeds.

Seed Selection and Treatment

- (i) Select wholesome seeds free from damage and wrinkles.
 (ii) Seeds are dressed against bean fly.
 (iii) Seeds should be inoculated with appropriate bacteria (none dressed seeds).

Planting

- (i) Planted at the onset of the rains.
 (ii) Spacing 30-45cm x 15cm.
 (iii) Apply phosphatic fertiliser during planting time.
 (iv) Planting is done by drilling of the seeds.

Field Maintenance

- (i) Provide sticks for the climbing varieties.
 (ii) Control of weeds through shallow cultivation.
 (iii) Top-dress with nitrogenous fertilisers e.g. C.A.N.

Pests

- (i) *Bean Fly*
Nature of damage: Feeds on the stems, causing swelling at the roots. This results in wilting and death.
Control: Dressing of seeds, early planting and spraying with insecticides.
- (ii) *Bean Bruchid (Storage Pest)*
Damage: Make dark circular windows on the grains.
Control: Clean stores, fumigation and seed dressing.

Diseases**(i) Bean Anthracnose**

Cause: Fungus

Symptoms: Brown or black lesions on the underside of the leaves, pods and stems.

Control: Growing resistant varieties, crop rotation, destruction of crop residues and spray with fungicides.

(ii) Bean Rust

Cause: Fungus

Symptoms: Red brown pustules on the leaves.

Control: Plant resistant varieties and spray copper fungicides.

Harvesting

- (i) Done during the dry season for dry beans and when the pods are dry.
- (ii) Threshing and winnowing done.
- (iii) Sorting of rotten, off types and damaged ones.
- (iv) Sold to National Cereals and Produce Board when dry.
- (v) For French beans, pick the pods when soft and green.
- (vi) Market immediately to avoid shrivelling.

Garden Peas

Areas where grown: Central Province especially near Nairobi. It is mainly grown for canning.

Ecological Requirements

Altitude: 1500-2100 metres above sea level.

Rainfall: Average of 1000 mm per annum.

Soils: Free draining, fairly fertile loams.

Varieties: Green Feast, Onward, Alderman, Mator Lincoln and Kelvedon.

Seedbed Preparation

- (i) After primary and secondary cultivation a level clean seedbed is prepared.
- (ii) Early in the rains.
- (iii) Planted in double rows 10cm apart and 60cm between the rows. Depth is 4cm.

- (iv) Apply phosphatic fertilisers at planting time.

Field Maintenance

- (i) Weeding is necessary when they are growing, preferably 2-3 light weeds are sufficient.
- (ii) Staking to support the plant as it grows.
- (iii) Provide netting material to prevent bird's damage.

Pests**(i) American Bollworm**

Damage: Caterpillars feed on flower buds and pods.

Control: Spray insecticides.

(ii) Aphids

Damage: Suck sap causing distortion of young shoots.

Control: Spray dimethoate.

Harvesting

Green pods are picked for home consumption and canning. For dry seeds uproot the whole plant and thresh to remove the seed.

Marketing

Sold in urban centres especially when green.

Cassava

Cassava is used as human food and is fed to livestock especially the tubers and leaves. Tubers are also used for starch extraction.

Areas where grown: Nyanza, Western, Coast provinces and some parts of Eastern Province.

Ecological Requirements

Altitude: Below 1500 metres above sea level.

Temperature: Ranges from 16-35°C.

Rainfall: Lowest amount 500mm per annum.

Soils: Sandy loamy soils.

Varieties: 46106/27, 5543/156 and 4763/13.

Seedbed Preparation and Planting

- (i) Good deep ploughing is essential and then ridged to facilitate harvesting.
- (ii) The seedbed should be free from perennial weeds.
- (iii) Planted during the long or short rains using cuttings.
- (iv) Cuttings of 30-45cm from middle part of the stem and should be 2.5 - 4.0cm thick.
- (v) Planted at a slanting angle of 45° to the ground and about $\frac{1}{2}$ of it buried in the soil.
- (vi) Spacing 1m x 1m.

Field Maintenance

- (i) Weeding is necessary when the crop is young.
- (ii) Inspection of new plants for diseased or dead stem which are then removed.
- (iii) The use of fertilisers is uneconomical.

Pests

- (i) *White Ants*
Damage: Attack cassava tubers.
Control: Spray chemicals e.g. Aldrin or Dieldrin
- (ii) *Moles*
Damage: Eat the tubers causing plant to fall off.
Control: Trapping, killing and use of poison (rodenticide).

Diseases

- (i) *Cassava Mosaic*
Cause: Virus
Symptoms: Leaves become discoloured, deformed and stunted. Reduce yields drastically.
Control
 - Plant resistant varieties.
 - Destroy the affected plants.
 - Plant clean materials.
- (ii) *Brown Sreak Virus*
Cause: Virus
Symptoms: Old leaves have yellow bands along the veins and brown streaks, lesions on the tubers.

Control: Plant healthy material, resistant varieties and destroy affected plants.

Harvesting

- (i) Ready after 9-15 months.
- (ii) Harvest the piecemeal by lifting out the tubers or dig up by use of forked *jembes* or forked stick.
- (iii) Cassava chips are prepared by peeling off the skin and the tubers are chopped into chips which are sun-dried.

Marketing

Sold locally.

Bananas**Economic Importance**

- Eaten fresh as dessert or cooked.
- a flavouring agent.
- Brewing.
- Mulching.
- Feeding livestock.

Areas where grown: Western, Nyanza, Central and Coast provinces.

Ecological Requirements

Altitude: 0-1800m above sea level.

Temperature: Lower limit is 10°C.

Rainfall: Average 1000mm per annum.

Soils: Well drained, fertile with high water holding capacity, pH 5.0-8.0.

Varieties\Cultivars

Some are grown for fresh fruits and others for cooking. Examples: Bokoboko, Gonja, Muraru, Wangae, Kisubi, Nyoro, Shirembe, etc.

Planting Materials

Propagated vegetatively e.g. sword suckers, maiden suckers and bull heads (should be obtained from healthy and high yielding plants).

Seedbed Preparation and Planting

- (i) Ploughing of the land during the dry season to kill all the grass weeds.
- (ii) Planting done at the beginning of the long rains.

- (iii) Spacing: Dwarf varieties 3m x 3m. Tall varieties 4m x 4m.
- (iv) Dig holes 60cm deep and 60cm in diameter.
- (v) Plant the suckers 30cm deep and fill with top soil mixed with organic manures and phosphatic fertilisers.
- (vi) Make a basin around each plant to retain water.

Field Maintenance

- (i) Top-dressed with nitrogenous fertilisers at the start of the rains.
- (ii) Shallow cultivation to control weeds and use of mulching material.
- (iii) Pruning to leave 3-4 plants per stool at different stages of growth i.e. one bearing, one half grown and sword sucker.
- (iv) Staking or propping to support the heavy ripening bunch by use of forked poles.

Pests

- (i) *Banana Weevil*
Damage: Feeds on young shoots and makes tunnels into the pseudo-stem.
Control: Plant clean materials, dip the planting materials in Dieldrin solution and around each stool with Dieldrin dust.
- (ii) *Nematodes*
Damage: Attack the roots making them to rot and become swollen.
Control: Trim roots before planting and dip them in chemicals. Practice crop rotation.

Diseases

- (i) *Panama*
Cause: Fungus
Symptoms: Yellowing of lower leaves which eventually drop off and discolouration of vascular tissues.
Control: Use clean planting materials. Uproot and destroy the affected plants and plant resistant varieties.

- (ii) *Cigar-End Rot*
Cause: Fungus
Symptoms: Tips of infected fruit looks like ash of cigar.
Control: Remove the floral parts from the ends of the fruits and discard them.

Harvesting

- (i) Ready for harvesting between 9-18 months after planting.
- (ii) Cut the pseudo-stem when the fruit is light-green and shiny in appearance.
- (iii) Wrap bunches in grass or banana leaves to prevent bruising.

Sweet Potatoes

Economic Importance

- Tubers are used as human food.
 - Leaves and vines are used as fodder crops.
 - Tubers used in manufacture of alcohol.
 - Young leaves are fed to fish.
- Areas where grown: Central, Eastern, Western and Coast provinces.

Ecological Requirements

- Altitude:* 0-2100m above sea level.
Rainfall: Optimum 750mm per annum.
Soils: Deep fertile loam soils.
Varieties: Musinya, Muibai, KSP/11 and KSP/20, Namunjuna, Gikanda, Gaciri, Kukunungu and Omito.

Seedbed Preparation and Planting

- (i) Deep ploughing done during the dry season.
- (ii) Ridging is done to facilitate formation of large tubers, spaced at 0.9-1.5m apart and the vines planted at 30-60cm apart along the ridges.
- (iii) Vines are used as planting materials of 30-60cm long and are buried in the ground upto $\frac{2}{3}$ of their length.

Field Maintenance

- (i) Fertiliser application - nitrogenous fertilisers are applied if the crop is grown for vine production only.
- (ii) Initial weeding is necessary in the early stage.

Pests**(i) Sweet Potato Weevil**

Damage: Larva bores the tubers causing discolouration making the tubers bitter.

Control: Crop rotation, destruction of infected materials, plant clean materials and spray chemicals e.g. Dieldrin.

(ii) Moles

Damage: Eat the tubers, vines and leaves.

Control: Trapping, killing and poisoning.

Diseases**Sweet Potato Virus B**

Cause: Virus

Symptoms: Stunting, excessive branching, yellowing of the vines and corky appearance on the tubers.

Control: Plant resistant varieties, crop rotation and control of vectors by use of insecticides.

Harvesting

- (i) Ready for harvesting in 4-5 months.
- (ii) Signs of ripeness is cracking of the ground as the tubers enlarge.
- (iii) Method of harvesting include lifting and digging up with a sharpened stick or fork.
- (iv) Harvested piecemeal and can be chipped, dried and stored for future use or eaten fresh.

Marketing

For local consumption.

WORK TO DO

1. (a) Name the parts that are harvested from a cabbage crop.
(b) Describe the harvesting of cabbages.
2. State the economic importance of the following crops:
(a) Carrots (b) Spinach
(c) Onions (d) Capsicums
3. (a) Write short notes on the harvesting and storage of maize.
(b) Describe the methods of controlling maize stalkborer.
4. (a) Describe the seedbed preparation in rice production.
(b) What do you understand by the term "parboiling in rice"?
5. What are the benefits of pruning a banana plant?
6. Write short notes on the following:
(a) Control of moles in sweet potatoes.
(b) Control of cassava diseases.
7. Describe the field establishment of bananas.
8. State the advantages of planting sweet potatoes on ridges.
9. State the importance of each of the following in tomato production:
(i) Staking
(ii) Pruning
(iii) Packing of tomatoes in crates.
10. What are the problems encountered in the marketing of vegetables?