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Principles of Crop Production

Land Preparation

Land is prepared to make it ready to receive planting materials. The prepared land is known as a seedbed.

Reasons for Preparing a Seedbed

(i) To enable water to infiltrate and assist in the conservation of moisture in the soil.
(ii) To kill weeds.
(iii) To improve soil aeration.
(iv) To destroy pests and disease agents.
(v) To incorporate organic matter in the soil.
(vi) To facilitate root penetration in the soil.

Procedure

(a) Clearing the land
- (i) Cutting down trees.
- (ii) Removing roots and stumps.
- (iii) Slashing undergrowth bushes.
- (iv) Removing or arranging the trash.
- (v) Implements used are *panga,* axe, slasher, bulldozers.

(b) Primary cultivation
- (i) Breaking the land for the first time.
- (ii) Done during the dry season or before the rains.
- (iii) Implements used are *jembe,* fork *jembe,* ox-plough, disc plough, mouldboard plough, rotary cultivators, sub-soilers, chisel plough.

(c) Secondary Cultivation
- (i) To break soil clods into finer particles and kill more weeds.
- (ii) Implements used are *panga,* fork *jembe,* ordinary *jembe,* ox-plough, harrows, cultivators.

(d) Miscellaneous Operations
- (i) Depends on the type of crop planted and physical condition of the soil.
- (ii) Includes rolling, ridging, levelling and making of cambered beds.
- (iii) Implements used are rollers, ridgers, etc.

(e) Minimum Tillage
- (i) A method involving reduction of tillage operations.
- (ii) Use of mulch, slashing, cover crops and application of herbicides to prevent weed growth.
- (iii) Advantages: saves time, cost and labour, conserves moisture and reduces disturbance of soil structure.
- (iv) Disadvantages: Leads to incomplete decomposition of organic matter. Weeds with underground structure are not killed.

Crop Propagation

This is the multiplication of crops by reproducing new individuals. It can be done by means of seeds or vegetative materials.

(a) Seed
It is the result of fertilisation of the ovule by a pollen grain.

Advantages
(i) Cheaper than vegetative propagation.
(ii) Easy to handle and transport.
(iii) Can be stored for longer period.
(iv) Easy to plant using machines.
(v) Control of pests and diseases before storage is easy.

Disadvantages
(i) Cannot breed true to type.
(ii) Are delicate.
(iii) Can spread undesirable genes quickly.

(b) Vegetative Propagation
Uses parts of plants other than seeds.

Advantages
(i) Genetically uniform (breeds true to type).
(ii) Early maturing.
(iii) Useful in plants which do not produce seeds.
(iv) Combines good qualities of the scion and the stock.
(v) Does not have dormancy period as in seeds.

Disadvantages
(i) Bulky and difficult to store or transport.
(ii) Perishable and cannot be stored for long.
(iii) In case of disease outbreak, it is passed from one generation to another.
(iv) Requires a lot of skilled labour.
(v) It is not possible to develop new varieties using vegetative materials.

Methods of Vegetative Propagation
(i) Cutting (stems, leaves or roots).
(ii) Layering (serpentine, aerial and stool).
(iii) Grafting (whip or tongue, side, cleft and bud).
(iv) Use of food storage organs (bulbs, tubers and rhizomes).

Planting

Selection and Treatment of Planting Materials.
Qualities of good planting materials include the following:
(i) Uniform in shape, colour and size.
(ii) Wholesome not broken and with no physical defects.
(iii) Free from pests and diseases.
(iv) Of high germination percentage.
(v) Purity (with no foreign materials).
(vi) Suitable to local environment.

In caring and treatment of planting materials, the following should be observed:
(i) Seeds should be of proper moisture content (e.g 12% for cereals).
(ii) Seeds are dressed with appropriate chemicals against pests.
(iii) Avoid storing seeds for too long.
(iv) Avoid dampness in the store.
(v) Legumes require seed inoculation with Rhizobium bacteria.
(vi) Stem cuttings should be treated e.g. sugar-cane cuttings treated with hot water, etc.

Methods of Planting

(i) Broadcasting
- Scattering seeds and covering them.
Advantages: quick, gives good ground cover and suitable method for small seeds.
Disadvantages: wasteful, lack of uniformity, uneven germination and difficult to mechanise.

(ii) Row Planting
- Planting crops in definite measurements.
Advantages: easy to mechanise, uniform spacing, uniform germination, little wastage of seeds and ease of weeding, spraying and fertiliser application.

Disadvantages: requires more skilled labour than broadcasting and not suitable in slopy areas.

Row planting methods are:
(i) Drilling, for small seeds.
(ii) Dibbling, for small plots.

Depth of Planting
Appropriate depth in planting is necessary. Shallow planting exposes seeds to the sun and pests. Very deep planting impedes germination. Factors determining depth of planting:
(i) Type of soil.
(ii) Size of planting materials (depth should be 3-5 times seed diameter).
(iii) Moisture content in the soil.

Spacing
It aims at obtaining maximum plant population per hectare that gives maximum yields. Factors determining the spacing of crops:
(i) Fertility status of the soil.
(ii) Types of machines to be used for various operations.
(iii) Purpose of the crop.
(iv) Growth habits of the crops.
(v) Moisture content of the soil.

Weeds and their Control

A weed is a plant whose economic disadvantages to the farmer are more than the advantages, hence considered undesirable.

Economic Disadvantages of Weeds
(i) Some are poisonous to man and livestock.
(ii) They compete with desired crops for growth factors hence reduce crop yield.
(iii) They reduce the market value of farm produce.
(iv) They make the control of pests and diseases difficult.
(v) They increase the cost of production.
(vi) They interfere with navigation and fish farming.
(vii) They lower the quality of pasture.
(viii) They reduce efficiency of farm workers e.g. thorny weeds cause irritation.

Factors Contributing to Competitive Ability of Weeds.
(i) They produce many viable seeds.
(ii) They remain viable for a long time.
(iii) They have effective seed dispersal mechanism.
(iv) Some propagate by means of underground food storage structures.
(v) Most of them are efficient in utilising little moisture, nutrients and sunlight.
(vi) Some are gross feeders and aggressive.

Classification of Weeds
Classification of weeds is based on:
(i) life cycle e.g. annuals, biennials and perennials,
(ii) morphology e.g leaf formation such as size, shape and venation,
(iii) ecology e.g. some are terrestrial others aquatic.

Methods of Control
(i) Cultural methods - Involves farming practices such as mulching, cover cropping, crop rotation, early planting, etc.
(ii) Mechanical - Involves use of farm implements and machinery e.g. slashing, mowing and cultivation.
(iii) Biological - Use of a biological agent to control weeds e.g. use of chicken and goats.
(iv) Chemical - Involves the use of chemical weed killers known as herbicides.

There are two main ways of classifying herbicides.
(a) According to time of application e.g. pre-planting, pre-emergence and post-emergence.
(b) According to mode of action e.g. contact and translocation.

Field Practices

(a) Thinning

(i) Removal of excess, weak, damaged or diseased seedlings.
(ii) Allows the remaining seedlings to get enough nutrients and moisture.
(iii) It is aimed at obtaining optimum plant population.

(b) Gapping

(i) Filling the gaps so as to maintain proper plant population.
(ii) Gaps occur as a result of failure of seeds to germinate or dying of seedlings.

(c) Pruning

Removal of extra or unwanted parts of the plant. Reasons for pruning are:

(i) To remove old, unproductive or diseased, damaged parts of the plant.
(ii) To train plants to take a desirable shape e.g. formative pruning in tea.
(iii) To control crop leaf ratio hence avoid overbearing.
(iv) To control diseases and pests e.g. antestia bug in coffee.
(v) To facilitate other operations such as spraying, picking, weeding, etc.
(vi) To reduce wastage of chemicals applied on the crop.
(vii) To remove branches that interfere with traffic, telephone lines and view.
(viii) Open up the plant to allow free air circulation and exposure of leaves to sunlight.

Tools used are secateur, pruning saw and pruning knife.

(d) Crop Rotation

This is the growing of different crops in the same farm in an orderly sequence.

Importance of Crop Rotation

(i) Maximises use of nutrients and moisture.
(ii) Breaks the life cycle of pests and disease agents.
(iii) Maintains good soil structure.
(iv) Reduces soil erosion due to adequate soil cover.
(v) Controls weeds that are specific to certain crops e.g striga on cereals.
(vi) Improves soil fertility when legumes are included in soil rotation.

Factors Influencing Rotational Programme

(i) Growth habits and nutrient requirements.
(ii) Liability of soil to erosion.
(iii) Crops attacked by the same pests and diseases should not follow one another in the programme.
(iv) Availability of capital and market e.g. beans or peas in legumes.

Crops in the rotation programme should be in the order as follows:

(i) Main crop e.g. maize, sorghum.
(ii) Legume e.g. beans, peas.
(iii) Root crop e.g. Irish potato, cassava.
(iv) Optional crop e.g. spinach, pepper, water melon.

(e) Harvesting

It is the gathering or picking of the farm produce after maturity. Time of harvesting depends on:

(i) Stage of maturity of the crop.
(ii) Use of the crop.
(iii) Tastes and preferences of consumers.
(iv) Weather conditions, hence liability to spoilage.
(v) Moisture content of the crop.

Method of harvesting is determined by:

(i) Scale of farming e.g. large scale farming machines are used.
(ii) Type of crop e.g. pyrethrum is harvested by hand.
(iii) Uniformity in ripening of the crop e.g. wheat is harvested by use of

combine harvester while coffee is harvested by hand.
(iv) Uniformity in height of the crop and size of seeds, fruits and flowers.
(v) Financial status of the farmer.
(vi) Part of the plant to be harvested.

(f) Storage

Purpose of storage is to prevent spoilage and to make the produce available for future use. Requirements for a proper store are:
(i) It should be clean, well aerated and dry.
(ii) It should be vermin-proof.
(iii) It should be secure from theft.
(iv) It should be treated against pests such as weevils.
(v) The crop should be whole, free from pests and diseases, pure and of proper moisture content.
(vi) The crop should be treated with proper chemicals.

(g) Sorting and Grading

This is classifying farm produce into different grades based on cleanliness, freshness, moisture content, wholesomeness, consumer tastes (colour, size and shape) and extent of damage by pests or diseases.

(h) Processing

Purpose
(i) Convert farm produce into a utilisable form.
(ii) To prevent spoilage of farm produce.
(iii) To increase market value.
(iv) To reduce bulkiness hence make it easy to handle and transport.
(v) To pack or package.
(vi) To standardise the produce.

WORK TO DO

1. (a) What do you understand by the term seedbed?
   (b) State five reasons why it is necessary to prepare a seedbed.
   (c) State major operations carried out during seedbed preparation, mentioning tools used in each operation.
2. Describe the advantages of minimum tillage in farming.
3. (a) Define the word "propagation" as relates to crop production.
   (b) List the advantages of vegetative propagation over use of seeds.
4. What factors must one consider when selecting planting materials?
5. Explain the importance of the following in the establishment of crops:
   (a) Timely planting
   (b) Thinning
   (c) Gapping
6. For what reasons should pruning be carried out on coffee?
7. (a) What is crop rotation?
   (b) List the factors that must be considered in a crop rotation system.
8. Name the methods that are commonly used in harvesting crops.
9. State the conditions that must be fulfilled in stores to achieve a safe storage of crop produce.
10. State reasons for processing farm produce.
11. What is the seed rate per hectare for maize planted at a spacing of 105 cm x 37.5 cm, if 320 seeds weigh 114 gm? (1ha = 10,000 m^2).
12. Explain the meaning of integrated weed control.

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Crop Pests and Diseases

Pests

A crop pest is an organism that destroys crops and their products.

Harmful Effects of Pests

(i) They exterminate the crop by feeding on it.
(ii) They lower the quality and quantity of farm produce.
(iii) They increase the cost of production.
(iv) They transmit diseases to crops.
(v) Chemicals used to control the pests cause pollution of the environment.

Classification of Pests

Pests can be classified according to:

(a) where they are found e.g. field and storage pests,
(b) nature of damage e.g. defoliation, boring and transmission of diseases through sucking,
(c) part of the plant damaged e.g. leaves, stems, roots and fruits.

Examples of Common Pests

(i) Insects e.g. weevils, armyworms, termites, locusts, larval forms of butterflies and moths.
(ii) Mites e.g. red spider mite, yellow spider mite, etc.
(iii) Nematodes e.g. root knot nematode.
(iv) Rodents e.g. rats, field mice, moles, squirrels and porcupines.
(v) Birds e.g. sudan dioch, weaver bird and mouse bird.
(vi) Other mammals e.g. wild pigs, monkeys and antelopes.
(vii) Molluscs e.g. garden slugs.
(viii) Micro-organisms e.g. viruses, bacteria and fungi.

Methods of Pest Control

(a) Cultural method - early planting, use of clean planting materials and field hygiene.
(b) Physical method - trapping and killing, use of scare crows and physical barriers.
(c) Chemical method i.e. use of pesticides, rodenticides and fumigants.

Crop Diseases

A disease is any alteration in the normal functioning of the plant.

Effects of Diseases on Crops

(i) Reduce yields.
(ii) Lower quality.
(iii) Cause poisoning in man and livestock.
(iv) Increase cost of crop production.

Classification of Crop Diseases

Plant diseases can be classified according to the agents causing the disease:

(i) Fungi cause rust, smuts, armillaria, root rot and late blight.
(ii) Viruses cause cassava mosaic, groundnut rosette and greening disease.
(iii) Bacteria cause bacterial wilt, black arm, black rot.

Methods of Control

(a) Cultural method e.g. use of healthy planting materials, planting resistant varieties and proper pruning.

(b) Chemical method, e.g. use of fungicides, etc.

WORK TO DO

1. (a) What is a pest?
   (b) Give two main categories of pests.
2. State the economic importance of crop pests.
3. Pests are the largest in number among all the animals kingdom. Explain why pests are more successful.
4. Give three ways of controlling rats in the store.
5. How would you define the term disease?
6. Name four ways in which crop diseases are of economic importance to farmers.
7. How are crop diseases classified?