

COURSE CODE: FPT 432

FIELD ESTABLISHMENT

Land Preparation Vegetables differ widely from field crops in their requirements for land preparation and cultural practices because of their differences in their morphologies, growth habit, and socio-economic values. In preparing land for vegetable production, the following factors are taken into consideration: ecological location, mode of cropping, season, crop disposition, and the type of vegetables to be grown.

Clearing: It is often necessary to remove the vegetation cover when a piece of land is to be used for vegetable production. The land clearing methods may involve removing the remains of previous crops and undergrowth, cutting back the woody shrubs and trees and burning them. Machete is used for clearing in a small scale production, while heavy machine like bulldozer is used in a commercial production.

Leveling: When the site has been cleared, uneven land may have to be leveled. This facilitates the process of ploughing, harrowing ridging and layout of the site.

Tillage: Tillage is the term used for manual or mechanical manipulation of the soil to prepare it for use in crop production. In vegetable production, the main objectives for tillage are to secure increased growth and yields, to obtain suitable seed bed, to eliminate competition with weeds during early growth, improve the physical condition of the soil and conserve its water and nutrient contents.

Importance of Tillage

1. **Seed bed preparation:** A seed bed provides an environment in which a seed can germinate and grow. It is loose, well drained, deep enough, makes good contact with the seed, retains adequate moisture and is free of weeds.
2. **Level land:** land leveling may be required to make it amenable to a chosen method of irrigation.
3. **Weed Control:** Weeds are menace to crop production. They compete with crops for plant environmental factors. They must be controlled before planting and during growth of the crops by appropriate tillage methods.
4. **Incorporation of Organic matter and soil amendment:** Green manures, crop residues, fertilizers and other chemicals may be added to soil by ploughing them under, or mixing at the time of soil preparation.

5. Improved Physical properties of the soil: Compaction of the fields impede drainage, rooting and crop growth. A hard pan also be caused by traffic may be broken up by tillage method.

Erosion control: The soil surface after tillage may be such that it impedes run off.

Stubble may be incorporated or ridges constructed to curb erosion. Tillage Tools: Hoe, cutlass, Garden fork, Hand fork, disc plough, disc harrow

Conservation measure: Most suitable land for vegetable growing in the humid tropics is usually sloppy. When such site has to be used for growing vegetables, soil conservation measure must be carried to prevent top soil from being washed away. After clearing, ploughing and ridging, the surface of the soil is in a very unstable condition unless efficient conservation measures are adopted. The most frequently used methods include the following:

Terracing: This is the most traditional methods used in the prevention of erosion and is effective on land which has a fairly steep slope. It is obtained by constructing flat areas along the main contours of the land.

Cover Crops: These are planted to prevent exposure of the soil from direct solar radiation and falling rain when any part of the farmland is not used for planting.

The most suitable cover crops are the forage legumes such as *Calopogonium mucunoides*, *Pueraria phaseoloides*, and *Stylosanthes gracilis*, the leaves of which will provide cover over the land. These crops also improve the fertility of the soil.

Strip cropping: The cultivation of different types of crops in narrow strips usually on steep slope or hill side to maintain

Planting

Vegetables can be propagated either by direct sowing and transplanting methods.

Direct sowing: Vegetables are sowed either by broadcasting or by seed drilling methods.

Broadcasting method: In broadcasting, seeds are spread over the prepared land by throwing small quantities of the seeds into the air close to the surface of the prepared land. Broadcasting is the normal practice in sowing seeds of most leafy vegetables such as *Celosia*, *Amaranthus Corchorus*.

Seed drilling method: This is a method for planting small seeded vegetables in rows.

Shallow furrows are made at the spacing recommended for the crop and the seed drilled along the furrows. This method can also be used for some leafy vegetables such as *Celosia*, *Amaranthus*, *Corchorus*.

Transplanting method: Vegetable seedlings are first raised in the nursery for a required period of time before they are transplanted on the field. Seedlings are transplanted in the morning or in the evening to avoid transplanting shock.

Vegetables like tomato, pepper, cabbage, egg plant, garden egg are planted by using transplanting method.

Transplanting Techniques:

- i. Clearing of site
- ii. Removal of trash by burning
- iii. Preparation of bed
- iv. Seedling sowing
- v. Watering
- vi. Erecting of permanent supports for shading.

Routine Operations

Thinning: Thinning of vegetable is done to reduce the number of seedlings per stand when planted in situ. It is also used to obtain regular spacing and plant population when sowing is done in drills by removing the weakest seedlings or those infected by diseases or damaged by insect pests.

Supplying: This is the practice of providing missing stands of vegetables planted by direct sowing as a result of poor emergence or when seedlings are damaged by pests. The essence of seed supply is to maintain correct plant population. Supplying of seeds has to be carried out as early as possible after emergence.

Staking: This is usually required for vegetables with climbing growth habit such as fluted pumpkin, or those with weak stems such as tomato. Staking is done to provide support for the plant to climb and display the leaves for photosynthesis to take place. The support allows the plant to carry more load without touching the soil thus enhancing the quality of the fruit.. Stake can be made from bamboo or other available wood.

Mulching: A mulch is a layer of plant residue or other materials which is applied to the surface of the soil in order to reduce evaporation, run-off or to prevent weed growth. The purpose of mulching is to conserve soil moisture. Mulching also ensure clean fruit, hasten maturity and increase yields. Most vegetables grown in the humid or semi-arid region, particularly those with fairly long duration such as pepper, egg plant and tomatoes, benefit from mulching.

Watering: One of the most critical inputs to vegetable production in semi-arid areas, dry season farming and nursery establishment is water. During the dry season or off season, the source of water for vegetable growing is from irrigation while in the wet season, rainfall is the source of water. Young vegetable seedlings in the nursery or in the field should be watered in the early morning or in the evening. Watering should be done before transplanting particularly in the evening. Over-watering can be very harmful and can encourage the development of pathogenic diseases and also cause mechanical damage to the seedlings.

Fertilizer application: This is an important variable cost in vegetable production, As all vegetables, particularly the leafy grow quickly, they must be provided with

ample supplies of nutrients such as nitrogen. Application of N fertilizer has been shown to increase yield and to enhance the content of mineral elements such as Ca, P, Na, Zn and Mg. In some tropical leafy vegetables, fertilizers such as FYM and other sources of P and K can be applied as pre-plant basal dressing or after the plants have become established as post planting application.

Weeding: Weed is any plant that grows where it is not wanted. Weed can reduce yield up to 40-60% if not controlled. Weeds can be controlled using cultural, physical, chemical and biological methods. Weed seeds and rhizomes can be killed using physical method during land preparation by burning. Mulching of soil can also be used to smother weeds.

Intercropping of spreading vegetables like melon with some erect and broad leaf crop like okra can provide ecological protection against weed development. Hoeing, pulling and rouging are carried out during the early stages of growth. Chemical weed control is applied in commercially grown vegetable crops.

Pest and diseases Control: Attack by pest and disease is one of the major factors militating against increased vegetable production in the tropics. Insects and disease infestation in vegetable crops bring about heavy losses through yield reduction, lowered quality of produce, increased costs of production and harvests. Control measures include:

- i. planting of high quality, disease-free seed
- ii. use of disease resistant varieties.
- iii. use of vegetables best suited to climate and soil.
- iv. weed control
- v. destroy the remains of annual crop after harvest to prevent pest build-up.

HARVESTING OF VEGETABLES:

- Harvesting is the separation of the portion of need from the mother plant.
- May be carried out once or over time or repeatedly.
- Leafy vegetables may be harvested by total removal or by ratooning.
- The seed and the fruit vegetables may be harvested once, or by topping or digging or lifting.
- Fruit vegetables may be harvested over a period of time by picking.

Maturity Indices:

- Optimum vegetative growth for the leafy vegetables.
- Fruit/ seed maturity, for the fruit vegetables.
- Onset of fruit ripening.

- Harvesting should be done on clear, dry days, for the fruit vegetables.
- Individual, manual harvesting is preferable.
- Readiness for harvesting is affected by the species and climatic factors.

POST – HARVEST CULTURAL PRACTICES:

- These are activities carried out after harvesting till disposal.
- Major activities include: Preservation, Processing; Storage and Marketing.
- affiliated activities include: Transportation and Handling.

PROCESSING:

- Can be partial or total.
- Most leafy vegetables are only partially processed for preservation.
- They can be trimmed, washed, sliced and then dehydrated for preservation.

e.g. Amaranthus, Celosia.

- Some fruit vegetables can also be sliced and dried for preservation. e.g. Pepper, Onion.
- Some leafy vegetables can be blanched in hot water.
- Fruits may be totally processed into paste or slurry in the factories. For canning.
- Vegetable seeds can be threshed, winnowed and dried for preservation.

STORAGE:

- Vegetables, in the fresh state are not usually stored for a long period.
- Storage/Preservation is usually done to keep vegetables for only a short period.
- Vegetables are usually highly perishable in nature, and so, do not store for a long time.
- Short-term storage can be done, using clay pots or padded materials.
- Storage should be done under cool, humid conditions.
- Refrigeration can be used for some vegetables.
- Freeze – storage is usually not appropriate.
- Vegetable seeds may require a storage temperature of about 10 – 15°C.

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COURSE TITLE: : CROP PRODUCTION AND PROTECTION TECHNIQUES

IDENTIFICATION OF MAJOR PESTS AND DISEASES AFFECTING CROP

INSECT PESTS AND NATURE OF DAMAGE ON CROP:

The damage done to the crop can be from three main categories:

BITING AND CHEWING: This category of insects consume plants with the aid of their biting and chewing mouth parts. Grasshoppers, Lepidoptera, caterpillars and beetles all consume the whole plants. The quantity of vegetation consumed can be quite high, e.g a single female locust *Schistocerca* spp. can consume 1.5g of vegetation per day and a swarm of locust covering 10Km² can eat up to 2000 tons of vegetation in one day. Lepidopterans caterpillars are defoliators, they completely eat up the leaves of plants. In addition to stem and leaves, insect pests also eat up the flowers and fruit of crops. Removal of leaves and other vegetative plant tissues interferes with growth and development of crops reducing the photosynthetic surfaces and yield. Damage to flowers and leaves lead to drastic yield reduction of crop.

PIERCING AND SUCKING: Some insect pests belong to Hemiptera and Thysanoptera, having mouth parts which are modified and adapted for piercing and sucking of plant tissue. The Siphonculata and Diptera have mouth parts for piercing and sucking animal tissue.

Piercing and sucking insects do mechanical damage to the tissue they pierce and together with the accompanying loss of plant sap or blood, growth and development of host are seriously affected. In some cases, part of the plant attacked may be distorted and rendered unfit for sale and human consumption. Some sucking insects inject toxic saliva into plant tissue and lead to death of such tissues. When fruits are attacked, it results in blemish, hence reducing the market value of such fruits.

Insects like thrips which pierce and suck cowpea flowers cause flower abortion and reduces fruit formation. The damage caused by insects can create room for secondary attack by bacteria, fungi and virus.

Piercing and sucking insects directly transmit viral diseases of crops. Leaf curl of cotton, cassava mosaic diseases, groundnut rosette virus and cocoa swollen shoot viral disease are all examples of viral diseases of which sucking insects act as vectors.

BORING INSECTS: Some insect pest tunnel into the stem and fruits of crops and remain inside the tissues where they consume large quantities of tissue. Such insect pests have mouth parts adapted for biting and chewing. The larvae of most stored products insects like *Maculatus*, *Tribolium* spp., *Ephestia caultella*, e.t.c. belong to this group. *Maruca testulalis* is a major pest of cowpea, where it bores into the unripe pods, while *Sesemia* spp. is a stem borer of maize and sugarcane.

PESTICIDES

Pesticides are chemical substances used to kill, prevent, expel or control pests. To the growers or farmer, pest include insects and mites that damage crops, weeds that compete with field crops for nutrients and moisture, aquatic plants that clog irrigation and damage ditches. Diseases of plants caused by fungi, bacteria and virus, nematodes, snails and slugs, rodents that feed on grains, birds that eat their weight every day in young plant seedlings and grains from field and feedlots as well as from storage.

To the apartment dweller, pest may include filthy annoying and disease transmitting flies, mosquitos and cockroaches, moths that eat woolen beetles that feed on leather goods and infest packaged foods, slugs, snails, aphids, mites, beetles, caterpillars, and bugs feeding on lawns, gardens and ornamentals, termites that nibble away at wooden buildings, e.t.c.

Pesticide is therefore an umbrella term which includes Acaricides (mites), Algicides (Algae), Avicides (Birds), Bactericides (Bacteria), Fungicides (Fungi), Herbicides (weeds), Insecticide (insect), nematicide (nematode), rodenticide (rodents), Molluscides (snails and slugs), Silvicides (trees and bush), e.t.c

MODE OF ACTION OF CHEMICALS (PESTICIDES)

1. CONTACT PESTICIDES: These pesticides are applied to the infected organisms. The pesticide is absorbed through the body surface when the pest is in contact with the treated surface.
2. SYSTEMIC PESTICIDES: These are chemicals that are applied to the soil or host plant, and are absorbed into the tissue of the host. Thus, rendering the host poisonous to the pest.
3. FUMIGANTS: They are respiratory poison that releases poisonous respiratory gas to the area of application.

PROCEDURES IN CHEMICAL CONTROL OF INSECT PESTS

- Identification of pest
- Choice of chemical and application method
- Determination of rate of application
- Mode of application
- Post application sanitation

PESTICIDE FORMULATION

Pesticide formulation falls into two groups:

1. Solid
2. Liquid

Each product will have a figure indicating the proportion (percent) of toxicants or active ingredients (ai) in the product.

Solid formation usually has an inert material such as clay, fillers, earth (aluminium silicate), dumice, e.t.c. as a carrier or mixer for the toxicant.

While liquid formulation usually has organic liquid as solvents. These solvent are mostly water immiscible. Since most formulation will eventually be applied as aqueous solutions, an agent which help the pesticide to stick to the surface of it's target is added at about 1-2% concentrations.

TYPES OF SOLID FORMULATION

1. Granules (G): Coarse grained solids suitable especially for incorporation in the soil where it may act as a fumigant or it may enter ground water in order to be taken up by the roots of plants into the sap where toxicant acts on pests.
2. Dust: Powder-like formulation suitable for application on the aerial parts of plants. They control pest by contact.
3. Wettable Powder (WP): Fine-grained solids with which the aid of the added surfactant into the stable suspension in water and therefore applied to the aerial parts of plants in high volume spray.
4. Soluble Powder: It is dissolved in water and is applied as solid dissolved in water.
5. Sticky Strips: This is a case in which grease or other sticky materials is applied to a strip of paper, plastic, e.t.c which is impregnated with pesticide.
6. Tablets: They are often used where low vapour pressure solid pesticides are to be used for killing pest by fumigation. Constituents of pellet may react with atmospheric moisture to produce toxic gas.
7. Capsules (especially slow release capsule): A pellet is coated with a colloidal type material which absorbs moisture when placed in the soil and slowly releases the toxicant into the soil.
8. Smokes: In which finely divided solid particles of pesticides are carried on a stream of hot air and other gases, enabling the pesticide to go far in conditions such as the canopies of orchard, trees or into ceiling of warehouses.

LIQUID FORMULATIONS

1. Emulsifiable Concentrates (EC): A toxicant dissolved in an oily or organic solvent which is not miscible with water. To this is added detergent or spreader which turns the formulation into an emulsion which can be readily diluted with water for application.
2. Miscible Liquid (MC): The toxicant is dissolved in a water miscible organic solvent and this is soluble in water at a suitable dilution for application.
3. Small Volume Formulation: Including Ultra Low Volume (ULV), Controlled Droplet Application (CDA) and New Electro-dyne

Technique (NET). In this formulation, a concentrated formulation based on an oily solvent is applied in a very small quantity without further dilution by that user. The droplets are very small.

SEED DRESSING: This is an important method of using pesticides to protect seeds and other planted materials. Usually a mixture of an insecticide and a fungicide (both being either liquid or solid) is applied to the planting material before placement in the soil to prevent damage caused by pest and thus ensure satisfactory germination and subsequently an adequate crop stand.

APPLICATION METHODS AND EQUIPMENTS

The immediate objective of pesticide application is to ensure a contact as intimate as possible between the pesticide and the target pest so that the ultimate aim of killing the pest may be achieved. Thus the choice of appropriate method and equipment is based on some knowledge and understanding of pest's biology and behavior. The characteristics of the overall climate and the immediate environment (temperature, air, humidity, wind speed and direction, solar radiation, e.tc.) are also important points to consider in deciding the choice of method and equipment.

SPRAYING

Usually water is the diluent for pesticides which may be formulated as any one of the following; emulsifiable concentrates, wettable powder, soluble powder and miscible liquid. Appropriate equipment is used to for the liquid through a variety of nozzles thus increasing the surface area of the liquid may fold. Depending on the amount of liquid spray applied per unit area of crop, spraying may be high in volume (600-1200/ha) or ultra-low volume in which 51L/ha or less are used.

- a. Low-volume spraying is the commonest conventional spraying practice to be found in Nigeria. The sprayer may be motorized or mist blower-type sprayer in which the motor drives a fan which provides a stream of air that both breaks up the liquid pesticides into smaller particles or droplet and propels it to its target, or it

may be hydraulic sprayer in which high air pressure is achieved with a piston at the top of the sprayer tank or a trombone-type slide continuously operated by the spray operator and propels the liquid spray through a nozzle into one or more rapidly spinning discs which break up the pesticides into droplet size about 70microns.

- b. Ultra-Low Volume Spraying: This is based on forcing the concentrate as “solid” stream through a nozzle onto one or more rapidly spinning discs which break up the pesticides into droplet size about 70microns.

Controlled Droplet Application: It is an advance ULV method. It aims to restrict the range of droplets size within the spray so that the behavior of the spray with respect to target is more predictable or direct.

The Electro-dyne Sprayer: It continues the idea of minimum pesticide use by electrostatically charging the pesticide droplet so that they are attracted to and adhere to the target positively and therefore less likely to be loss in drift. It is powered by battery.

Granular Pesticide Application: This seldom requires specialized equipment. Equipment such as seeders, and fertilizer applicators, e.t.c are quite suitable and placement of granular pesticides into the soil may be combined with seed planting or fertilizer application.

Application by Aircraft: This is used when large area has to be covered quickly especially for weed control in plantation crop such as sugarcane, or control of mobile pest such as Locust and weaver birds.