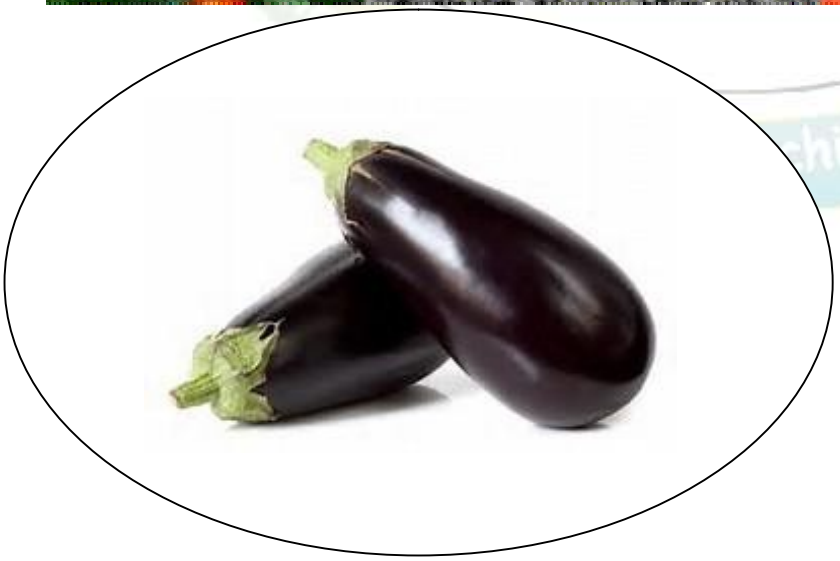
AGRICULTURE NOTES FORM TWO



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1.0: AGRICULTURAL MECHANIZATION

FARM POWER AND MACHINERY

Meaning;

Farm Power: This is the energy used to perform different farm operation; the energies used include heat energy, electric energy, mechanical energy chemical energy etc.

Machinery:

These are devices which use different sources of power, so as to release energy which is used to perform farm operation e.g. planters, harvesters etc.

Sources of power in the Farm

Use of power in the Farm includes:

(a)Human Power: This is a farm power obtained from a healthy human being a healthy human being can produce 0.1kw power.

Advantage: It is an easily available.

Limitation / disadvantage: Human beings can easily tired, hence have different ability to supply poet.

Ration: Human power can perform all farm poet of cultivation, weeding, harvesting, also human being can operate machines e.g. tractor to work the farm; as well as guiding drought animals. To produce power, human beings can produce power by using, all farm tools / equipment e.g. and hoe, axe, rake, hand sprayer etc.

(b) Animal power

This is the power produced by Animals to facilitate work in the farm. The animals used to work in the farm are known as Drought animals.

- Drought animals include; donkeys, oxen, camel, horses
- They may produce 2-4 KW power in a given time
- They work under guidance of human being to pull of crops and inputs. A harness:

This is equipment fastened on the animal body to which farm implements are attached. Process of hitching implements to drought animal is called harnessing. Tools and Implements used for Drought animal

- Ox-cultivator -used for weeding between crops rows

- Ox- Ridgers- used for making ridges.
- Ox- plough- (mould board) – used far tilling / opening up the load
- Toolbar - For attaching different pieces of animal drown implements

  Cart – for transportation of inputs e.g. seeds, manure as well as per carrying crop harvests.

Advantage of adopting animal power it is cheap as no fuel or spares for repair and maintenance will be required.

Disadvantages / limitation of chemical power

Animals cannot survive well in tsetse infested area animals cannot be used effectively in steep – slopes and heavy grass land.

(c) Machine

These include engines which use fuel / oil as source of energy so as to provide driving force (re mechanical energy) e.g. tractor.

Tractor

As a chief source of power; a tractor supplies power through:-

- Pulling implement e.g. ploughs, harrow etc which are hitched and drawn by tractors.
- P.T.O shaft (power take off shaft) to convey power to other implements e.g. rotary mowers, fertilizer distributors etc.
- By attaching a belt to a pulley, in providing power to milling machines.

Operation

Machines can perform different operation e.g. plowing, harrowing, planting, harvesting etc.

Advantage

- It is time serving because it is fast
- It is labour serving

Limitation

- Needs skilled labour to operate, repair, maintenance etc
- Needs large capital in buying, operating, repair and maintenance.

Other sources of power

.They are not so common in farming activities, however they are adapted:-

- Wind power

- Water power
- Solar power
- Biogas
- Charcoal

(e) Wind power

Is power generated by an instrument called windmill, which when wind blows it converts kinetic energy of wind into mechanical energy of the shaft. Operations

- Wind mills, drive water pumps to make water available for irrigation, domestic use and animal drinking.
- Wind mills rotate generators to produce electricity
- Wind mills suns revolving machines e.g. milling machine

Advantage: They require no fuel

Limitation: It is weather sensitive hence / power supplies are unpredictable as it depends on wind presence.

(f) Water power

Water energy can rotate turbine machine to produce electricity (hydro-electricity) Operation

The power rotates turbine to produce electricity which is widely used is different farming activities and industries, water mills are used to grind grains e.g. maize.

Limitations: The power production can fluctuate due to weather changes.

(g) Solar power

The power is delivered from solar energies

Operations

- Solar energy can be converted to heat energy and used for drying of crop harvests. e.g. Solar dries, solar heaters and cooker
- Solar can be directly converted to electricity by photo-voltage cells and stored in solar batteries.
- The electricity produced can be used for different farming activities e.g. water pump

Limitation

- It is not always continuous due to sunshine period storage batteries are expensive and unavailable

(h) Biogas

Is a flammable gas called methane, which is produced through action of bacteria and cellulose present in organic materials

- The process takes place in a stated container called digest or Operations: Biogas can be used as cooking gas, heating lighting homes etc. Advantage: It is cheap to make.

(i) Charcoal

It is used for cooking, ironing clothes and running charcoal refrigerators

Advantage - Its is cheap and readily available

Disadvantage -It encourages deforestation

- Leave soot on cooking utensils

The role of Farm Power and Machinery

- Reduce effects of pests, diseases and weeds if farm machinery are used
- It is time saving
- Encourage human and industrial development through increased profit on mechanized agriculture
- It is labour saving
- Total yield is high as a result of large scale operation

FARM WORKSHOP

Practical application of workshop tools and equipments.

I. Capacity equipment / wood work tools

These include wood saw, wood chisel, rasp file, planes, mallet, hammers, G-Clamp, Drills etc

Application: They are used for making chairs, beds, door, and windows frames.

II. Simple Metal sheets (Metal work tools)

These include hack saw, drills, files, dividers, etc

Application: The tools can be used for making cooking pots, fitting metals, metal joints, dustbins, kerosene burn trays for drying crops, poultry drinkers etc.

III. Simple plumbing work

Tools involved are pipe cutters pipe stocks, pipe fittings etc.

Application: Used in installation of water pipes ad pipe repairs work. Farm workshop management

In order for workshop activities to take place consistently it needs the following management.

(a) Cleanliness

- Keeping the place free of obstacles
- Cleaning by sweeping out all spilled oil material
- Disposing all rubbish into dust bin

(b) Proper arrangement of tools and equipments i.e. equipments should be put in proper spaces e.g. tool box

(c) Protective measures: They involve measures to make sure that the hazards are prevented through regular check up of machines breakdown etc.

(d) Provision of enough light and ventilation in the workshop

2.0: CROP PRODUCTION

CROP PROTECTION

Meaning: This is the process of preventing crop losses due to insects, rodents, weeds, plant nematodes and plant diseases, caused fungi, viruses, bacteria etc.

Objective:

The main objective of crop protection is to provide conditions that will enable crops to grow without their enemies, which reduce crop yields and indirectly reduce food supply and farmers income.

PESTS

It is an organism which damage crops either in the field (Field pest) or in stores (storage pests) The pests include

- Insects
- Mites
- Nematodes
- Birds
- Vermines

The substance or compound used to kill / control pests is known as PESTICIDES

DISEASE AGENTS / PATHOGENS

These are disease causing or transmitting organisms, and they include bacteria, viruses, and fungi.

ECONOMIC IMPORTANCE OF INSECT PESTS

a) They destroy crops, lowering quantity and quality. About 30% of total yield may be affected by insect pest.

b) Some of them are disease vectors e.g. aphids, grasshopper, strainers etc

c) Increase production cost through buying chemicals and equipment to control them.

EFFECTS OF PLANT DISEASES IN CROP PRODUCTION

a) Yield is reduced when crops are attached by diseases

b) The quality of the crop produced is lowered

c) Some crop diseases are poisonous to human beings and animals e.g. Ergot is a wheat disease which cause in poisoning in humans or Fla-toxin which developed from moist stored grains is poisonous to human

d) Increase cost of production due to extra capital to achieved equipments, chemicals and labour.

METHODS OF CONTROLLING INSECT PEST AND DISEASES

These can be divided into 6 major groups:

1) Cultural control measures

2) Biological control measures

3) Chemical control measures

4) Legislative control measures

5) Physical control measures

6) Integrated insect, pest and disease control

I. CULTURAL CONTROL MEASURES

This method involve farming practices employed to alternative the environment making it unfavorable for insect pest and disease pathogens survival hence allowing the crop to escape injury. These measures include;

(a) Timely Planting

Early planted crop, may escape infestation in the field e.g. maize may escape Yellow streak disease stalk borer attack.

(b) Timely harvesting:

Some pests e.g. grain weevil attached the crops while in the field, hence early harvesting will help to reduce the problem.

(c) Tillage

This will expose pests hence killed by sunlight energy or eaten by birds and other predators

(d) Close season

This is a period during which a particular crop is not supposed to be grown so as to eliminate disease and pest build up.

The aim of the practice is to break the life cycle of the pest by stopping growing of a host plant in a certain place for a certain time.

(e) Trap Crop

These are plants planted before or together with the main crop. The pests on the trap crops are then killed by either spraying or uprooting and burning.

(f) Crop Rotation:

Planting of the same crop or crops of the same family, season after season leads to a buildup of insect pests and disease causing micro organisms. Good rotation breaks the life cycles of these parasites

(g) Use of Resistant varieties:

These varieties with stand the effects of pests hence producing a normal harvest e.g. highly tillering sorghum varieties, are planter to overcome sorghum shoot flies attack.

(h) Field Hygiene:

This include rouging, weeding, slashing of field surroundings etc as well as removal of plants which have been affected by pests or diseases, so as to destroy eggs, larvae, pupae and adult through burning.

(i) Destruction of alternative hosts

Some pests attack more than one crop, and some go to the extent of having weeds as their alternate hooks e.g. American boll worm attacks maize, sorghum and even cotton. Hence removal of such hosts reduces pest's infestation.

(j) Use of clean planting materials:

The objective of this practice is to avoid introduction of pests and diseases in the field through treatment of planting materials especially seeds, suckers, cuts etc. e.g.

Fernasan – D and Agrosan – D are used to treat cereal grains like maize stored for planting.

(k) Proper spacing:

Heavy plant population creates humid condition which favour grown of pests and disease causing organisms. Hence optimum population through thinning of excess plants helps to create favorable condition for plant growth

II: BIOLOGICAL CONTROL MEASURES

This involves us of living organism as to reduce pest production the organism could be bacteria viruses or insect.

a) Uses of Insects to control Insects

The insect that can either be predator or parasite e.g.

Predators	**Target Pest**
Ladybird beetle	Aphid
Wasp	Coffee mealy bugs
White scale	Cotton strainers
Majimoto Ants	White scales
Chicken	Cotton strainers
Cat	Rats, mice etc
Dog	Monkey
Chameleon	Most of the insect

b) Uses of viruses: These can be related and used to control insect pest e.g. Viruses uses to control American boll worms.

c) By sterilization process: In this technique, Insects are sterilized by using material which are radioactive e.g. Cobalt radioactive or inducing sterility in insect using chemical sterillants added to baits and sex attractants.

III. CHEMICAL CONTROL MEASURES

Agriculture chemical are in most cases are the best alternatives in eradicating insect

pests, weeds, bacteria, fungi and nematodes. These chemicals are known as-

- Herbicides – for weed eradication
- Insecticides - for insects eradication
- Bactericides - for bacteria eradication
- Fungicides - for fungal eradication
- Nematocides - for Nematode eradication

Chemicals can be grouped basing on its causal agents as follows: -

a) INSECTICIDES:- These are used to kill insects pest

Example:

- Dursban – Leaf eaters e.g. grasshoppers, white scales
- Thiodan – Sucking insect's e.g. cotton strainers, American boll worms.
- Fenitrathion – Basing and Sucking insects.

b) HERBICIDES: - Chemical used to destroy weeds e.g.

Paraquat – Pre-emergence- non selective

2-4-d AMINE – Broad leaves only (post emergence) MCPA

Round up - Pre-emergence- non selective.

c) FUNGICIDES: Chemical used to kill fungi e.g. Chlorothalanil , Coppers ozycloride, Mancozeb Fernasan– D, Agrosan – D

d) NEMATOCIDES: Used to control nematodes e.g.Earbofuram, Fenamiphes

- RODENTCRDES
- Brodifacon
- Bromocolone
- Conmatekchyl
- Zinc compound.

NB: These chemical can be found in different form namely:

- Fumigants
- Wettable powder
- aerosol dust
- Liquid pasties granules
- Emulcifiable Concentrates(EC)
- Emulsions

Advantages of using chemical to control pest and pathogens

I. Chemical control is faster compared to other means

II. Chemical control is more predictable than other methods.

Disadvantages of using chemicals

I. Chemical are expensive to purchase

II. Most of the chemical are non-selective and hence, can kill useful insects e.g. Pollinators

III. Predators as bacteria and viruses used in Biological control measures.

IV. Pest may create resistance to some chemicals hence creating a big problem in controlling them.

V. Most of the chemical are toxic to man and livestock – not intended to be killed

VI. Need skill in handling chemicals.

Precaution to be taken when using Agriculture chemical

I. Read labels and instruction on tins or packets carefully before mixing chemicals e.g. herbicides etc to ensure that right amounts are used.

II. Wear protective clothing e.g. overalls, gloves, rubber boots, eye shields and dust masks.

III. Avoid trouser with twin-ups where granule or dust protection can collect.

IV. Make sure the spray should blow away from you.

V. Do not blow blocked nozzles or hoses with your mouth.

VI. Wash sprayers and other equipments used in dusting and spraying thoroughly.

VII. Wash the protective clothing and hands thoroughly.

VIII. In case of inhalation mistakenly drinking or coming into contact, seek medical help.

IV. PHYSICAL CONTROL MEASURES

This is also knows as Mechanical control involving physical destruction of the paste. It includes the following.

a. Drying of crops: Pests find difficult to penetrate dry grain in the range of 9-13% moisture content (mc), leaving the grain free.

- Hence further drying right after harvesting is very important.

b. Irrigation/flooding: Flooding may kill aerobic organisms living in the soil e.g. nematodes and pest e.g. leap miner, army worms etc.

- Flooding also suppresses weeds and killing them.

c. Physical destruction: Picking and killing pest by using traps e.g. rodent control.

d. Physical barriers: Preventing pests from entering the field by using fences, trenches e.t.c. to control large animal's e.g. wild pigs.

V. LEGISLATIVE METHOD:

These include:-

Plank Quarantine: These are strict prohibition of allowing crops products or planting material to enter in an affected area. This may be around the regions or exercised on country level.

- At the level of the country, quarantine, involves permission of important of only insect pest/disease free planting materials/crop products.

INTEGRATED CONTROL MEASURES:

This is the action of reducing the damage of pests to a level that in below economic threshold by using several method e.g. Biological, cultural and chemical control at a go.

- Methods used should those which complement each other.

CLASSIFICATION OF INSECTICIDES

Agrochemicals can be classified according to the chemical compounds or elements which they are based in the case these are six groups:

a). Organic chlorine group

These are chemical which contain chlorine element

- They are broad spectrum and very persistent
- They kill by contact and stomach poisoning
- They get taken up in food chain very easily and accumulate in the body fat of vertebrates.

Example: BHS (Benzene Hexachloride), Aldrin, Beldrin, Endosulphon, DDT (Dichlorodipheril trinchloro ethane)

b). Organic phosphorus group.

- These chemical contain phosphorus element
- They are effective as systematic and contact mode of action.
- Many are very toxic to mammals and birds and this they have got to be used with great care.

Example: Malathion, Diaz-ion, Dimethoate, Menazon, Sumithion, metasystox, rogor e.t.c.

c). Inorganic (SALTS) Minerals.
Most of them contain carbonate (C03) Groups. Its mode of action in by contact.

Some are systematic (systemic) chemical.

They are broad spectrum.

Examples: carbonyl, carbon furan/faradan, Borax e.g.

d. Plan derivatives.

These are chemical that have been extracted from plant. Example: Pyrethrum dust, Sumicidin, Derris e.g.

e). Fumigants.

- They are highly poisonous
- They are not useful if the target is not visible e.g. insect inside a stalk.

Example: (MB) Phostoxin.

f). Tar. (Organic oils) chemical oils from crude petroleum or coal tar, used against scale insects.

Other classification.

i) Contact i.e. Upon contact of the organism body.

ii) Stomach poisoning i.e. killing when taken in the digestive system

iii) Fumigants i.e. act through inhalation through respiratory system.

iv) Systematic (systemic) i.e. they are absorbed and transported through tissue.

(g). Biological pesticides - This are natural enemies of pest

FORMULATIONS OF INSECTICIDES

- The carrier/diluent should be inert i.e. it should not take past in the reaction.
- The carrier/diluent should help to reduce the toxicity of the active ingredients
- It should also serve as a suffocant i.e. it should be able to stick on the surface to which it is applied.

Groups of formulation:

These are two major of formulations:-

i) Dry or solid formulation

These are chemical formulation in solid form. they include:

a). Granules: they are applied directly.

Granular pesticide formulation.

Advantages:

- they are easy to place where needed they are fire less toxic
- No problem of pesticide to be blown by wind
- The chemical is released slowly hence ensure longer protection.

Disadvantages:-

- It can not be applied on foliage oil may damage plant leaves.
- Costly to produce i.e. contains 10% active ingredient and 90%
- Carried material which is expensive to compose and transport.

b) Dust; they are directly applied e.g. DDT. Actellic super.

Advantages.

- They contain smaller particles than granules and pellets; hence increases greater surface are of reaction.
- It is easy to use.

Disadvantage:

- It may cause environmental pollution as it is easily blown out by wind.
- It can easily be washed out of application is shortly followed by rain.

c). Wet table Powder (WP): This is very close to dust but in this form; matter is mixed with water before applying to the pest e.g. De-thane, M45, Endosulphan, Afalon etc.

Undiluted and diluted wet table powder formulation.

Advantage:

- Are conveniently mixed with water hence easily transported.
- They have better surface coverage than dust or granules, because of way small particle

Disadvantage:

- The suspension in the tank may settle at the bottom and form a sludge hence reducing effectiveness of the active ingredient
- If high concentration in used the suspension may cause blockage of nozzles leading to inefficient application and wastage of time.

d). Pellets: They are applied directly as granules

Pellet formulation.

ii) Liquid formulation : Chemical in liquid form include:

a) SOLUTIONS: e.g. Copper sulphate as solution in water, DDT as solution in oil.

Advantage:

- It is useful if the target cannot be easily reached.
- needs skill in application

b). Emulcifiable concentrated (EC) This formulation produces an emulsion when mixed with water e.g. Nogos 50 EC,

Advantage – No problem of spray blockage

- Can be mixed by oil and water and have better coverage than wettable powders.

Disadvantage:

- Use much water.
- The spray could be blown by wind causing environmental pollution.

c). Fumigants: They can either be which e.g. phostoxin or liquid e.g. EDB (Ethyl/ Dibromid) but changes to gas above room temperature.

-They must be kept in sealed container.

Advantage:

- Produces quick and effective action
- Long lasting effect.

Disadvantage:

- Application needs skilled person.
- Highly dangerous it inhaled
- Expensive

WEEDS AND WEED CONTROL

Meaning: A weed is any plant growing where it is not wanted and whose economic disadvantages outweigh the advantages.

Economic importance of weeds

Useful/Advantages of weeds

i. When rotten, weeds provide organic matter and mineral nutrients to the soil

ii. Some weeds are used as vegetable e.g. Pig weed (Amaranth us spp) whose leaves are boiled and eaten

iii. Weeds provide a good surface cover and thereby minimize water evaporation and control soil erosion.

iv. Some weeds are providing food for wild games as well as domesticated animals.

v. Weeds reduce Carbon dioxide in the air, and increases Oxygen in the air through Photosynthesis activity.

vi. Weeds provide medicine for treating various diseases.

Harmful/ Disadvantages of weeds

i. Weeds complete with crops for plant nutrients soil moisture, soil air, light and space.

ii. Some weeds are poisons to man and livestock e.g. Thorn apple (Datura stramonium).

iii. Aquatic weeds like the Nile cabbage, can block water ways, rivers and lakes; making navigation and fishing difficult.

iv. Weeds affect the formation and distribution of roots e.g. in heavily weeds infected plots, crops have relatively less roots.

v. They also lower the quality of farm produce

vi. Weeds reduce crop yields, This is because the plant size and height is reduce exposing small photosynthesis area per plant and hence producing small amount of carbohydrates.

vii. Some weeds are alternate host for some of the most destructive pest of commercial crops e.g. cotton stainer can survive on wild plant related to cotton.

viii. The y reduce the market value of the crops

ix. They lead to extra work, during cultivation and harvesting.

WEEDS CONTROL MEASURES

There are 4 ways of controlling weeds namely:

a) Cultural

b) Chemical

c) Mechanical

d) Biological

a) Cultural means

In this method the main objective is to make the environmental not conducive for weed growth, but giving the crop the best condition that favors its growth these measure include:

i. Crop Rotation

Good rotation program me, includes a resting phase of which the land is planted with grasses/legumes. This will help in suffocating some of the prevailing weeds after the cropping period.

ii. Proper spacing.

One of the main objectives of proper spacing is that crops are able to smother, weeds at an early stage.

The wider the spacing the higher the risk having bigger and more weeds between rows and within rows.

Hence in proper spacing, weeds become weak and easily suppressed by crops.

iii. Time planting

Enable crops to establish themselves and grow early enough, so that by the time, weeds reaches competitive stage, the crops remain unharmed. In the plants become established enough before weed multiplication.

iv. Mulching: This covers the weeds, so that they deprived of light, hence preventing their growth.

v. Cover crop: Use of cover crop has similar effect as mulching. Sometimes knows as smother crop.

vi. User of clean planting material: this involves use of weed free planting materials and hence prevent introduction of weeds in to the farms

b) Mechanical used control.

This involves the use of farm implement and machinery.

Use of hand hoes, slashes, ox-drawn implements and tractor drawn implements during the time of seedbed preparation, help to dissociate the weeds by exposing the roots to the air, also burying deeply (tillage) the weeds and this killing them.

This process employ the following ways:-

i. Uprooting weeds by hand: is mostly done on crops whose spacing is tool close, to allow mechanical cultivation. e.g. rice farms.

ii. Slashing of weeds: Use of slashes to remove top growth of weeds, is very effective in controlling annual weeds.

c) Biological weed control.

In the method insect, ducks, geese, goats and sheep, serve greatly in controlling weeds, as well as user of parasitic insects.

Caterpillars' of various insect species control weeds by eating the foliage and other parts of the plant.

Disadvantage of Biological means:

- The agent introduced might be a parasite of food or cash crop.
- The agent might not be in numbers big enough to control weeds effectively.
- The agent many destroy predators as well.

d) Chemical weed control.

Chemical means of control, involve the use of herbicide (weed killer).

- They can be classified as:-

i. Pre-emergency herbicides.

These are herbicides applied before crop are planted before crop seeds germinate e.g. Atrazine,

ii. Post-emergency herbicides.

The are herbicides applied after crop seed emergence e.g. 2, 4, D.

NB:

Most of pre emergency herbicides are non-selective i.e. they kill all types of plants; which post emergency herbicides are selective i.e. they only kill specified species only e.g. 2 4 D Amine kill broad leaved plants.

Other classification is based on mode of Action:-

i. Contact herbicides.

- These kill only the part of the weed with which they come into contact e.g. gramaxone/paraquat.

ii. Growth regulators/systemic.

- They are absorbed by weeds through, leaves, stem or roots
- They affect plants through systemic action e.g. 2-4-D, M C P A, Dalapon e.t.c.

iii. Soil sterillants

These chemicals are absorbed by roots and prevent plant growth when they are in lethal concentration in the said e.g. linuron, propachlor e.t.c.

Advantages of using herbicides.

i. Herbicides lower cost of production i.e. Time is saved and leas labour in spent per unit area of land cleared of weeds.

ii. High yields are achieved because of efficient weed control.

iii. No tilling of land hence no disturbance of the soil structure, no destruction of plant roots.

iv. Harvesting is relatively easy because less interference with weeds. v. Good quality product can be obtained.

v. Noxious weeds can easily be controlled. vii. Less labour in used.

Disadvantage of using Herbicides.

- If used without care, herbicides can injure or destroy crop especially with non relative chemicals which kills any plant which come into contact with.
- All herbicides are poisonous to human being, hence precautions should be taken during handling then, so that is no dived contact with them.
- Some herbicides have got a long residual effect, thus they can persist in the soil causing injury to crops grown in subsequent reasons e.g. Atrazine.
- Pollution of water bodies and air by herbicides may cause death to birds and fish.

COMMON WEEDS OF EAST AFRICA

BROAD LEAVED WEEDS

COMMON NAME	SCIENTIFIC NAME	FAMILY	CONTROL
Goat weed 	Ageratum conyzoides	composite	2,4,D MCPA, Paraquat e

COMMON NAME	SCIENTIFIC NAME	FAMILY	CONTROL
Witch weeds 	Striga hermontheca	scrophulariaceae	2,4, MCPA Cultural method

COMMON NAME	SCIENTIFIC NAME	FAMILY	CONTROL
Macdonald weed 	Galinsoga parviflora	composite	2,4,D Simazine paraquae

COMMON NAME	SCIENTIFIC NAME	FAMILY	CONTROL
Blackjack 	Bidens pilosa	Compositae	MCPB, 2,4-D

COMMON NAME	SCIENTIFIC NAME	FAMILY	CONTROL
Tick berry 	Lantana camara	Verbe naceae	2,4,D, 2,4,5-T

COMMON NAME	SCIENTIFIC NAME	FAMILY	CONTROL
Thorn apple 	Datura stramonium	Solanaceae	2,4,D, MCPA and2,3,6-TBA

COMMON NAME	SCIENTIFIC NAME	FAMILY	CONTROL
Wandering jew 	Commelina benghalensis	Comelinaceae	2,4-D, MCPA

COMMON NAME	SCIENTIFIC NAME	FAMILY	CONTROL
Sodom apple 	Solanum incunum	Solanaceae	2,4,5-T and 2,3,6- TBa

COMMON NAME	SCIENTIFIC NAME	FAMILY	CONTROL
Black night shade 	Solanumnigrum	Solanaceae	2,4-D, mixture of MCPA and 2,4,5- T

A.GRASS WEEDS

	COMMON NAME	SCIENTIFIC NAME	FAMILY	CONTROL
i.	Couch grass 	Digitaria abyssinica	Gramineae	Use glyphosate and asulam

	COMMON NAME	SCIENTIFIC NAME	FAMILY	CONTROL
ii.	Wild finger millet 	Eleusine indica	Gramineae	Use 2,4-D, Alachlor, Metolachlor, EPTC, Triflurlin.

	COMMON NAME	SCIENTIFIC NAME	FAMILY	CONTROL
iii.	Sword grass 	Imperata cylindrica	Gramineae	Glyphosate

	COMMON NAME	SCIENTIFIC NAME	FAMILY	CONTROL
iv.	Love grass 		Gramineae	

	COMMON NAME	SCIENTIFIC NAME	FAMILY	CONTROL
v.	Star grass 		Gramineae	

	COMMON NAME	SCIENTIFIC NAME	FAMILY	CONTROL
vi.	Elephant grass 		Gramineae	

	COMMON NAME	SCIENTIFIC NAME	FAMILY	CONTROL
vii.	Wild sorghum 		Gramineae	

	COMMON NAME	SCIENTIFIC NAME	FAMILY	CONTROL
viii.	Crown foot 		Graminese	

	COMMON NAME	SCIENTIFIC NAME	FAMILY	CONTROL
ix.	Signal grass 		Gramineae	

	COMMON NAME	SCIENTIFIC NAME	FAMILY	CONTROL
x.	Nut grass 	Cyperus rotundus	Cyperaceae	2,4-D, MCPA and EPTC

	COMMON NAME	SCIENTIFIC NAME	FAMILY	CONTROL
xi.	Lechosa (Mexican fire plant) 	Euphorbia heterophylla	Euphorbiaceae	

Precaution to be taken when using herbicides:-

- Read and follow manufacturer's instruction.
- Use protective gear, e.g. overall, gum boots, gloves, breathing mask.
- Avoid inhaling the chemical.
- Don't spray against the wind.
- Don't eat or smoke while spraying.
- Wash your body thoroughly after spraying chemical
- Containers and papers should be disposed safety.
- Spraying equipments must not be washed in water sources for drinking.

COMMON HERBICIDES USED IN EAST AFRICA

- 2,4,D AMINE (Fernest, Ferminine, phorolteester) they are selective controlling broad leaved weeds, usually applied post emergency
- MCPA (Agrixine, plenary, enephis emploal) function as 2 -4- D
- Dalapon (daipon) translocated selective herbicide.
- Paraquat (Gramaxon) is a non selective herbicide, non-tronslocated and pre-emergence applied.
- Diquant (Regline) functions as paraquat.
- Altrazine (Gesophin, Basagram) applied in pre-emergence or post emergence- very persistent in the soil.
- Suazine – as Atrazine.
- MCPP (Melopueps, methoxine, deovatoxit) it is selective and translocated i.e. 2,4,5,7 (Trioxine, phorties)

HORTICULTURE

Meaning: This is the production of vegetable, fruits, flowers and vines.

NB:

- The art and science of growing vegetable is olericulture.
- The art and science of growing fruits is pomology
- The art and science of growing flower is floriculture
- The art and science of growing vines is viticulture
- A horticultural unit where vegetables are grown is a garden
- A horticultural unit where fruits are grown is an orchard
- A horticultural unit where wines are grown is a vine yard.

Hence horticulture has been divided into 4 groups:-

1. Vegetables: e.g. Tomatoes, cabbage, cauliflower, carrots, lettuce e.t.c.

2. Fruits: e.g. mangoes, orange, bananas, pineapples, pawpaw sect.

3. Flowers: e.g. Hibiscus, cassia, creranium, rinnia e.t.c.

4. Vine production: e.g. grapes.

IMPORTANCE OF HORTICULTURAL INDUSTRY

Human Nutrition: Horticultural products supply nutrient vitamins and mineral to human diet, hence supply good diet for their health.

Source of Income: After selling the product, people earn money which can be used in raising their standard of living.

Foreign exchange Earner: Export of some products e.g. flowers canned fruits or raw fruits earns foreign money.

Source of employment.

LIMITATION OF HORTICULTURE PRODUCTION

These are 6 main factors affecting/influencing horticulture production.

i. Climatic factors:-

a) Rainfall: Some areas receive a lot of rain in which facilitate fungal and nematodes development due to humid condition while other receive low, rainfall which require irrigation of the horticultural units and development of leaf eating and sucking insect.

b) Temperatures: most ports of Tanzania have high temperature throughout the year causing high evapo-transpiration creating high soil water loss.

Also horticultural products are very perishable hence under extreme temperature they rot very easily if storage and transport is poor.

ii. Edaphic factors:

- Also knows as A biotic factor – it is a non-organism factor. It is only describing soils physical and chemical characteristics towards crop grown.
- Most part of Tanzania soil generally experience e.g. poor soil structure, poor water holding capacity etc.
- Soil has low organic matter content due to high temperature as well acidity due excessive leaching during rainy season. Some part has heavy soils which are poorly drained.

iii. Biological factor:

It is also knows as Biotic factor, describing two effect of living organisms, to crop plant growth development. Since Tanzania is a tropical country, the climate is suitable for the development and multiplication of weeds, pest and diseases, as a result this in strong competition between organism with horticulture crops.

iv. Economic problem.

- Risk and uncertainties: Farmers face a lot of risks and uncertainties such as low weather, price fluctuation pasts and disease outbreaks e.t.c.
- Low level of income: Most of the farmer has low income of which they cannot afford to invest in horticulture production, due to lack of capital.

v. Social problem.

- Traditionalism among farmers; generally farmer are slow adopters of new innovations e.g. new skill in producing horticultural crops such as vegetables or flowers.

Hence they continue to practice their traditional ways of farming in producing crop they only used to grow.

- Health of the farmer; Farmer need energy to work in different farm operations. Due to low level of income most of the farmers receive poor nutrition resulting to failure to work effectively in the field.

vi. Relief factor.

This factor describes the effect of elevation in relation to crop growth.

i. The elevation influence temperature of the area and in turn affects the rate of organic matter decomposition, evapo-transpiration and development and multiplication of microorganisms such as pests, diseases and weeds.
ii. Most parts of the country lie in low elevation (low land temperature is high hence accelerating high rate of OM decomposition than its replacement and thus reducing soil moisture content, finally low yields.

PRINCIPLES OF HORTICULTURAL PRODUCTION

These include all activities involve in the production of Horticultural crops they include:-

i. Site selection.

ii. Land preparation.

iii. Crop propagation.

iv. Crop Management (Field)

v. Harvesting

vi. Storage.

a) Site selection.

When selecting a site for horticultural production the following should be observed:- a. Soil characteristics and topography.

i. Select a site with soils which are well drained as vegetable crops do not withstand water logging; and poor mineral element.
ii. Heavy clay soils, and poorly sand soil are not ideals; due to pool drainage and nutrient availability.
iii. The area should be preferably flat or with gentle slope.

b). Climatic condition.

i. Different horticulture crops require/favors different temperatures. Hence the area should have temperature which is suitable, for the kind of vegetable e.t.c you are growing.
ii. Also rainfall of the area should be considered for any irrigation programs if needed.

c). Reliable sources of water.

i. Vegetable require moisture, hence the site should be near permanent water supply e.g. a well, a dam, a stream or river to make irrigation possible.
ii. Irrigation water should be fresh water and not salty water; as crop will become stunted.

d). Market and Transportation

- Vegetable and fruits are perishable i.e. they go bad easily hence they should be sold or eaten within a few hours.
- Hence it is important to select an area which is near a good and reliable market and easily accessible (reached) with reliable transport.

ii. Land preparation.

Involve the following operation.

a). Field clearance:

When opening a horticultural unit with big trees, ring bark all the trees. a considerable period before seedbed or planting holes is prepared.

This is done because in the roots there Are carbohydrates which attract fungus? Known as Armillaria mellea causing root rot.

NB:

- ✓ When you ring back the tree, it is able to transport water from the roots (through the xylem) but fails to transport manufactured food from the leaves (as the phloem has been cut). Hence starving the roots from getting carbohydrates. If you cut the tree without ring backing, the roots accumulate carbohydrate later when you plant your crop will be affected by the fungus.

- After uprooting all the trees, slash the bush and grass; collect and heap.

Direct planted vegetables/fruits e.g. in orchards

i. Marking out planting holes, by use of ropes, tapes and pegs.
ii. The distance of marked holes should be equal to the spacing of the respective vegetable/fruit.
iii. On sloping land mark out rows of holes along the contour in order to minimize soil erosion.

Nursery planted vegetables.

- ✓ Marking out the position of seedbeds in the garden, by use of ropes, and pegs with general measurements of 40cm X120cm; leaving a path of 60cm between beds.

NB:
The length of the seedbed should sun across the slope of land.

- Did the soil on each bed and mix with farm yard manure or composite?
- Break down soil clod and level each seedbed with a rake.

iii. Propagation of Horticultural crops.

Propagation is the process of raising a plant one generation to another either by needs or vegetative means.

a). Propagation by seed (sexual propagation)

In propagation of crops by needs, germinate and form young new plant called seedling) he use of seeds is known as generative or sexual propagation.

- Crops grown through needs are carrot, cabbage, pepper, egg plant, spinach, onions, tomatoes, cauliflower and lettuce.
- Usually the seeds of these vegetables are small in size. For their reasons, they are normally first sawn in small sites called nursery
- In the nursery vegetable, seeds are sown very close together; and late phished in well prepared seed beds. The process of shifting seedling from the nursery to seeds beds is known as Transplanting.

Purpose of Nursery

- Taking care of seedling is made easier
- Some seeds are so small that they cannot be sown directly in the field e.g. carrots, spinach etc.

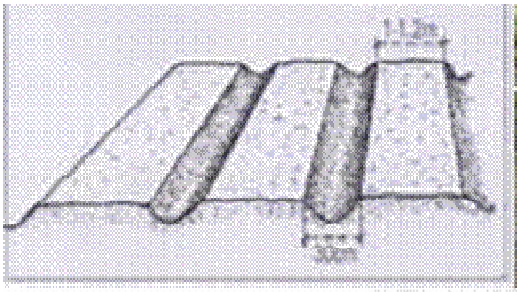
Qualities of a Nursery site.

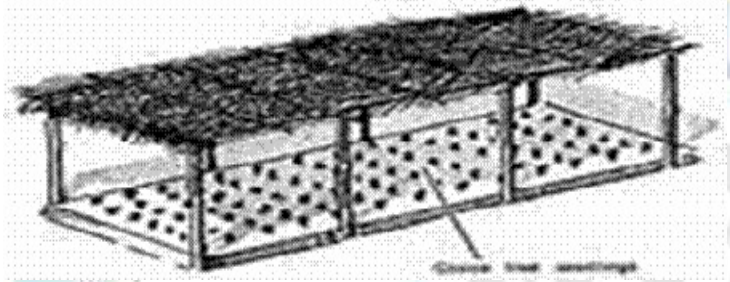
i. The place should be of a deep fertile soil
ii. The place should be near a garden or orchard site.
iii. The place should be near water supply.
iv. The place should be on a gentle slope.

How to raise seedling in a nursery.

1. Seed sowing: after nursery bed preparation sow the vegetable seeds in rows (drills) of about

0.5 – 0.75cm deep, spaced 15cm apart; and cover the seedbed with a thin layer of soil.





2. Mulching: after seed sowing a thin layer of mulches (grass cover) should be applied so as to conserve soil moisture and regulate soil temperature.

3. Watering: water the nursery bed regularly early in the morning and late in the evening. Avoid applying excess water as May because fungal disease called damping off.

4. Removed of mulches: as soon as seedling emerge, remove the mulch and replace by an overland shade build over the seedbed by using poles and grasses.

5. Weeding and thinning any weed growing on the beds should be removed by hand. if seedling is overcrowded trim (thinning) out to help the seedlings to grow healthier and strong.

Age of Transplanting

Seedling of most vegetable crops is ready to be transplanted when they are:

5-6 weeks old or

4-6 leaf stage or

10-15 tall.

2-3 weeks before transplanting, remove the overhead shade; and reduce watering in order to harden off the seedling as to expose them to environmental condition which in relatively the name in the field

The best time of transplanting seedling in the late evening as they will be exposed to low temperature overnight hence reducing water loss.

c) Vegetative Propagation

This is a type of asexual reproduction as some vegetable crops fruits may produce seeds which are not viable e.g. most of the flower.

Method of vegetative Propagation

Planting storing organs e.g. corns, rhizomes, stem tubers, bulb, suckers etc.

- Layering
- Grafting
- Stem cutting
- Budding

Stem cutting: Cutting are usually made from stem or branches of the plant

When making cutting stem and branches are cut into pieces the length of which depends on the type of crop

Example: Cassava, sugarcane, sweet potato etc.

NB: Stem cutting are plant upright and at planting position

If they are laid down they may fail to produce work

Grafting, or 'Budding' Citrus Trees

'Budding' refers to the particular form of grafting best suited for the propagation of citrus trees. In a bud graft, a bud, along with some bark (bud wood), is removed from the variety of tree (scion) the grower is trying to propagate. The bud is then inserted beneath the bark of a host tree (rootstock). As the 'T' budding procedure is the one generally recommended for the inexperienced grower, it is the one we'll describe below.

Step One

Select the variety of tree you wish to cultivate. Look for a tree that is vigorous and healthy. Remember that some states prohibit the importation of bud wood due to disease concerns so check with local authorities if you plan to use imported budwood or even bud wood from quarantined areas of your own state.

Step Two

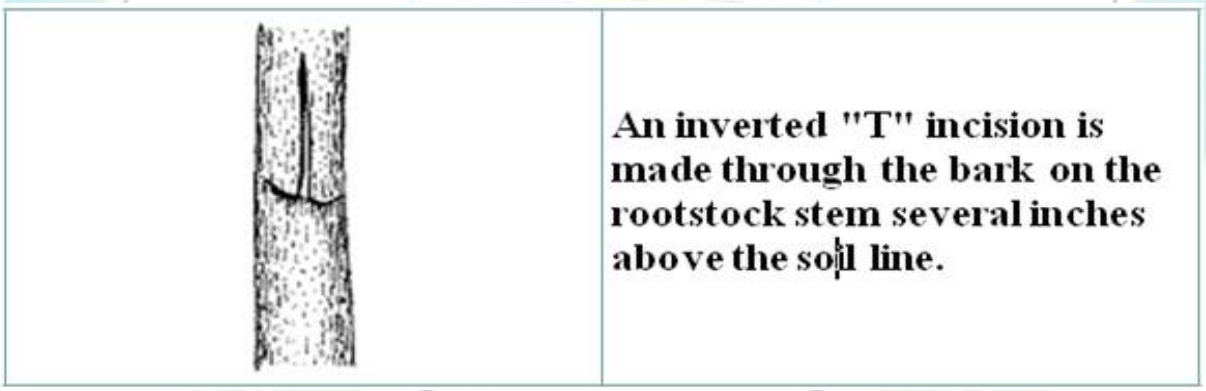
Budwood is usually collected during the growth period between

April and November when the bark can be separated easily from the wood. Carefully collect rounded budded twigs that have begun to harden. Do not use very young buds from the current growth flush. Trim the budwood to 8 or 12 inch lengths. Try to use the collected budwood as soon as possible. If you must store the wood for a period, place it in a sealed polyethylene bag in the vegetable crisper of your refrigerator. Check periodically for moisture build-up or mould. Use the stored buds within 3

months.

Step Three

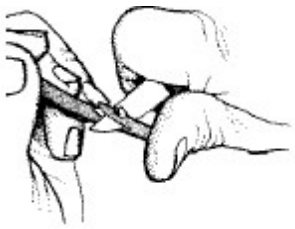
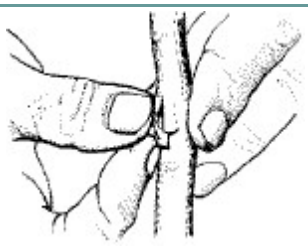
Select the young citrus tree that you wish to use as rootstock. Look for a variety of tree best suited for vigorous growth in your area. With a sharp knife, make a one-inch vertical cut through the bark of a healthy rootstock stem about six inches above the ground. At the bottom of the vertical cut, make a horizontal cut,the two cuts forming an upside down 'T'.



Step Four

Using your knife, remove a bud along with a one-inch sliver of wood and bark from a budded twig. Carefully insert the bud under the flaps of the 'T' cut of the rootstock with the wood of the bud sliver completely enclosed by the 'T' flap. Wrap the graft

with budding tape making two or three rounds below the bud and two or three rounds above. Wraps should be removed not later than 30 days after the graft. A green, healthy looking bud will indicate that the graft has succeeded.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A smooth, continuous cut removes a bud and a thin sliver of wood which is used in T budding. During T budding, the bud is slipped under the bark flaps created by making the "T" incision on the rootstock.

Step Five

In order to stimulate the growth of the union, the bud must be forced into growth. To force growth, cut 2/3 of the way through the rootstock about 1.5 inches above the bud and on the same side as the bud. Then push the rootstock over to lay on the ground. After the bud has grown 3 to 4 inches, the top of the rootstock can then be cut off about one inch above the top of the bud. To prevent competition from rootstock buds, they should be removed as soon as they develop.

Budding: This is a method of vegetative propagation where by closely related plants

(i.e. plants belonging to the same genus)

Are joined together. Such plants are said to be compatible i.e. plants which can form a union when joined together in one way or another

Example: propagation of citrus by bidding

Propagation of citrus by bidding is done in stage as follows:

STAGE I: Preparation of root stock

Select ripe rough lemon fruits from strong lemon trees separation the seeds from the fruits and wash them with clean water.

Sow the needs on well prepared money need bed 2.5cm deep; 2.5cmx15-20cm between needs. Do not allow needling to dry before you sow them.

When seedling are 5.8 months old, transplant them into seedling beds. During up rooting of seedling, prune the stem to 40cm above ground and prune roots leaving of 30cm long. Transplant needling at a spacing of 30cm x 90-120cm.

Leave the needling to grow for 6 month after transplanting

Transplanting at this stage the plant (roots stock) is ready for budding.

STAGE II Budding

Cut bud wood from sweet orange twice, which are healthy and high yielding such twice are called scion trees or mother trees

Remove the weak upper part of the plant shoot and the leaves by sharp knife.

Make a T- shape cut on the root stock stem 20-30cm above ground level a shep knife. by first making a vertical cut 3-5cm long through the book of the shoot. Then make a horizontal cut 3cm long above or below the vertical cut.

Slice the bud with a shield from the scion wood.

Insert the bud under the flaps of the bark at the cut do not turn the bud upside down

Wrap the budded area with polythene tightly to make it water proof. However leave the bud protruding.

After budding watch from day to day it the bud has healed. When the bud heals cut off the root stock just above the bud so as to encourage the new shoot to grow

The budding seedling may be ready for transplanting about 1-11/2 year after budding.

Grafting: This is done by joining a scion onto a root stock. The scion is a small piece of shoot cut from a true of a desirable characteristics e.g. big good fruits, ability to bear many fruits

The root stock is a shoot, containing a roots system with good characters e.g. drought resistance, disease resistance growing well even in poor soils etc. whose top part of this shoot is cut leaving a stump.

Types:

1. Whip and tongue grafting
2. Cleft grafting
3. Approach grafting

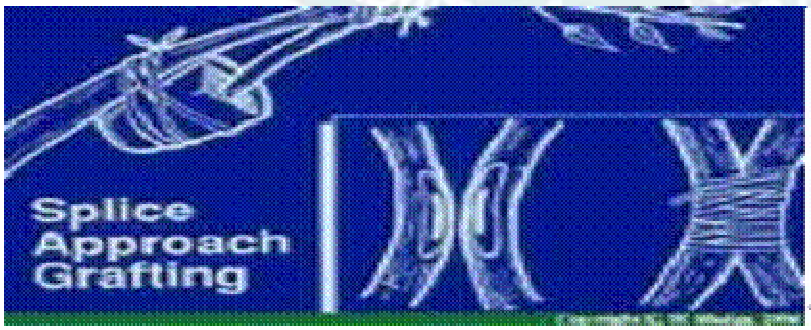
Procedure for whip and Tongue grafting.

i. Select a suitable scion and root stock.
ii. Make a sloping cut on the tip of the root stock.
iii. Make a slopping but matching cut at the base of the scion
iv. Male a V shaped cut on the root stock as well as the bottom part of the scion.
v. Place the scion onto the root stock so that their tongues become inter locked.
vi. Tie the joint firmly with rope, enclosed in a polythene tape so that the place remains moist.
vii. Remove the top after a strong union has formed.

Procedure for cleft grafting.

Clift or top wedge graft

- Select suitable root stock and a scion.
- Cut the stem of a root stock is order to leave a stump
- Split the top 10cm of the stem along the radius.
- Male a wedge on the base of a scion.
- Open the split and insert the scion. Procedure for Approach grafting.



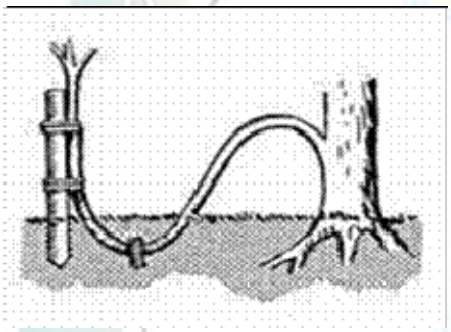
- Select a suitable Branch of a root stock and a suitable branch of a scion.
- Shave off a thin layer of bark on the root stock stem and scion stem.

Layering: This is a method of vegetative propagation which is useful for propagation only a few offspring per planting at a time.

Types:

i. Simple layering
ii. Mound layering
iii. Air layering or marcotting

Procedure for simple layering



This technique is suitable/possible for plant with slender branches which can be bent down ward to the ground without breaking.

- Bend the stem to the ground
- Slice off the bark and phloem from a section of plant

(i) Burry the sliced off portion of the stem into the oil and cover with soil
(ii) and hold in place by hooks peg.

- If it is dry season; continue watering, until roots and shoots appear on the buried portion.
- Plant the rooted shoot at the decide plac

Procedure for Mound layering

- ✓ This technique is used to propagate dicotyledonous plant which produces several side branches or shoots.
- ✓ Select the plant you desire and cut off the shoots 4cm above ground level.
- ✓ Allow the shoots of the plants which you have cut to produce several side branches or shoots.
- ✓ When shoots reach 10cm tall heap or mount oil around their bases. Continue watering until roots are formed.
- ✓ Separate the rooted shoots and plant them in a nursery.

Procedure for Air layering.

- ✓ Air layering can be done on branches which are up to 1.5cm in diameter Wound one point of a branch.
- ✓ Cover the wound with sterilized soil or any other suitable rooting media using polythene or banana sheath and tie with a rope
- ✓ Water the medium regularly until roots emerge.
- ✓ Cut the branch just below the roots and then plant in to form a new plant. IV)

Transplanting planting

- ➢ The best time to lift and transplant seedling is late in the evening as they will be exposed to low temperature during the night.
- ➢ Planting holes on needed should well be prepared whose distance should be equal to the recommend spacing of the vegetable crops you are growing
- ➢ Each planting hole should be big enough to occupy the root system of the seedling.
- ➢ Firm the soil strong avoid the plants as you fill in the hole.
- ➢ Provide temporary shade for seedling.

FIELD MANAGEMENT

a). Watering: Moisture is necessary for vegetable crops if no rain, irrigating water could be supplemented.

- ➢ Do not apply water in the afternoon especially if the sun is shining, as you may cause lens effect and scorch the leaves.

- Apply water early mornings and late evenings.
- Avoid excessive amounts of water as may result to fungal infection (Damping off). b. Weeding: weeds are plants which grow in a place where they are not wanted.
- Remove all weeds as room as they appear to facilitate vigorous growth of seedling.

c). Thinning: When the seeds germinate, the seedling may be overcrowded hence need thinning. This is the removed or pulling out some of the seedlings in order to leave the right numbers per unit area.

d). Mulching: if the weather is rather dry, if may be necessary to apply surface cover (mulch) to reduce

i. Moisture evaporation.
ii. This is done by spreading dry grass on the surface of the soil.
iii. However mulch is possible only if the grown crop planted is wide space.

e). Fertilizer application: Most vegetable crops require a top dressing of nitrogen on fertilizer in order to grown well, by applying nitrogen fertilizer 2-3 weeks after germination or after transplanting the seedling phosphate fertilizer to the soil in the seedbed just before transplanting.

f). Staking: This is the provision of supports for stem of plant, which have weak or climbing stems e.g. tomatoes, cucumber and lina beans.

- Supports which may be used are long stick, stuck upright into the ground near each plant.eg. Pests and Disease control.
- Vegetable crop are sometimes infested by pests when growing in the garden. as well as disease.
- Suitable measures must be done to reduce their effects.

h). Gapping/gap filling: This is sowing where seeds did not germinate or replacing a transplants seedling which has been damaged, diseased or eaten.

The aim is attaining the optimum plant population per unit area.

i). Pruning: This is the removed of unwanted or unproductive parts of the plant, usually done in orchards.

j). Crop rotation: This is the growing of different types of crops in sequence in the same piece land in an organized manner.

Crop rotation of vegetable is the systematic arrangement of growing different vegetable crops in service in the some piece of land. Season after season vegetable crops are divided into 4 groups the purpose of rotation.

I. Main group: cabbage, tomatoes, potatoes and kale.

II. Legumes: peas, beans, Soya, bean.

III. Root crop: carrot, deck and onion.

IV. Optimal group: egg plant, lettuce and capsicum.

- The main crops are grown first in rotation because they are heavy feeder: then followed by legumes which returns the fertility; later followed by root crops.
- Optimal crops can be grown in any order.
- Vegetable rotation is aimed at planting vegetable at different feeding habit; so as to use nutrients at different levels in the soil. Also different families to reduce effect of pests, weeds and disease. Likewise legumes are planted to replenish soil nitrogen.

e.g. of late maturity cabbage

VEGETABLE PRODUCTION

PRODUCTION OF LEAFY VEGETABLE CROPS.

CABBAGE

Scientific name: Brassica oleraceae

Family Cruciferae

Characteristics: This is a leafy vegetable which is eaten raw or cooked.

It is characterized by possessing

4 petals

4 sepals

4 stamens

2 fused carpel

Forming fruit which splits from bottom.

VARIETIES

i. Late maturing and large varieties include price drum head; early jersey; wake field
ii. Usually taken 31/2 months from sowing to harvesting.

Early maturing and small varieties include sugar load usually taken 21/2 months to maturity.

Nutritional importance: Leaves contains iron calcium, phosphorus and potassium; as well as rich in vitamins A and c.

Production areas: Cabbage prefers moist condition and elevation of 760m above sea level. Therefore the vegetable is commonly found in temperate climatic of Tanzania.

Ecological requirement.

Cabbage grow well in cool or warm climate with fertile, moist, well drained soil with ph 6.5

PROPAGATION

Nursery: They are propagated by needs. Since the seeds are too small they have to be stated in the nursery.

- Make raised seedbeds and apply manure, later drill rows 20cm apart. Put seeds in the drill cover, put shade on the bed and continue watering. (The seed in a drill should be 2-3 cm apart).

Transplanting.

- After one month seedling are ready for transplanting.
- Suitable spacing per large varieties is 60cm x 60cm and for small varieties is 45cm x 45cm.

Cultural Practices

Weeding weed regularly to keep off weeds unit the cabbage beans cover the ground.

Manure and fertilizer application.

- Add 1-2 handfuls of manure or compost in every planting hole at transplanting time.
- if manure or compost is not available; add one table spoon of Dsp to each planting hole.
- When seedling reaches 20cm tall; top dream with one table spoon of CAN (Calcium ammonium nitrate) per plant.
- urea 1 tea spoonful per hole of DSP (DOUBLE SUPPER PHOSPHATE)

Pest and Disease control.

Cabbage is very susceptible to past and Disease attacks

- Major inserts include:-Diamond back moth
- susceptible Aphids(cabbage aphid) Cabbage saw-fly

Cut worms (during transplanting)

Flea beetles.

Control: Spraying insecticides e.g. Malathion Cyper methrin and Diazinon etc.

Common diseases of cabbage include, Black rot, Dark leaf sport, Downy mildew and White rust

Control:

i). Black rot, Dark leaf spot and white rust cannot be controlled by chemical spraying.

Hence effective method is

- ✓ Crop rotation
- ✓ Use of certified used

ii). Downy mildew: Use Benomyl fungicide spray.

Harvesting: Cabbage is harvested when the heads become firm.

i. Yield is 40 tones/hectare
ii. The time to rich maturity varies from 60-170 days.

LETTUCE

Scientific name: lactuca sativa

Family: Compositae

Characteristics: The vegetable has numerous tiny flowers which form I disc-like flower head with 2 florets, central Disc florets and marginal ray florists.

VARIETIES Include

- Great lakes
- Webbs wonderful
- New York

Ecological Requirement

- Rainfall: Adequate rainfall-2500mm/per annum.
- Temperature: Cool/low temperature
- Soil: Well drained sandy 10am to clay 10am soil and moist all the time to avoid it to become bitter if the soil is dry.

PROPAGATION

Nursery: Sow seeds inn nursery bed in drills (rows) space 10cm a part and 1cm deep; then cover the soil with a layer of mulches using dry leaves; or over head shade.

Transplanting: Seedlings are ready for transplanting 2-3 who after nursery sowing; or 7cm fall.

- During transplanting, choose sting seedlings and plant them in row space 30-45m; and 30cm between plants i.e. 30cm-45cmx30cm as spacing.

CULTURAL PRACTICES

Weeding: Regular weeding should be done. Avoid splashing soil into the lettuce leaves as may lower the quality of the leaves.

Manure and fertilizer.

A few day before transplanting, apply sufficient manure 5-6 tones/hectare on the transplant beds and mix through with soil 3wks later apply CAN AL the rate of 100kg/hect.

Pest and Disease control.

Lettuce plant sometimes suffers from a growth disease known as Heart rot; where by the crop become rotten inside.

Control: No control except in subsequent plantings increases space.

Nematodes: This is a most important group off past they cause student growth and damage roots.

Control:

- ✓ crop Rotation
- ✓ Use of nematocide before transplanting
- ✓ Avoid excessive watering

Harvesting: The vegetable is ready for harvesting 6-12 weeks after transplanting. Cut the lettuce when the hearts are fully development.

Yield is 10 tones/hect

PRODUCTION OF LEGUMINOUS SEED VEGETABLES

BEAN PRODUCTION

Scientific name: Phaseolus vulgaris

Family: Leguminaceae

Characteristic: Beans are rich in protein ranging from 17- 31% with an average of 25%>

VARIETIES:

i. Canadian wonder Bean (CWB)
ii. Selian wonder Beans (CEB)
iii. Kabanima
iv. SUA 90

ECOLOGY: In Tanzania beans are found in temperature climate with an attitude 600m – 27m above sea level.

- ✓ Rainfall should be high during vegetation growth undesirable during the late stage (i.e. flowering) of growth.
- ✓ Soil should free disease.

PROPAGATION

- ✓ Is done by seeds which are directly own in the field. Can also be intercropped with main crop like maize.
- ✓ For pure stand a spacing of 0.45-0.6 x 150cm(i.e. 45 – 60cm x 150cm)

CULTURAL PRACTICES:

Weeding: should be done regularly at during the operation earthing up is necessary i.e. pilling soil around the stem of the plant.

Manure Fertilizer.

As it container nitrogen fixing bacterial, nitrogen fertilizer are not necessary. If needed insulation (i.e. coating seeds with innoculum i.e. artificial bacterial) to stimulate formation of nodules in the roots.

Pest and Disease Control.

Bean fly: (Melanogromyza spp). The insert feed on stem tissue, causing the stem to be swollen and cracked.

Control: Use dieldrin chemical.

American bollworm (Heliothis amigera). Cause damage to flowers and pods. Control: Early application of insecticides e.g. selecron.

Bean Rust: Is a fungal disease caused by fungi uromyces spp. causing brown sport on leaves.

Anthracnose: is a fungal disease caused by a fungi celletotricum spp.

Hallo blight. is a bacterial disease caused by a bacterium Pseudomonus Spp.

Control: Use of cultural measuring e.g. crop rotation and timely planting.

Harvesting: Is ready 60-120 day after planting depending on the variety is done by uprooting the whole plant and biting to split the pods.

• Yield various between 25kg – 2000kg/heat for improved verities.

PRODUCTION OF FRUIT VEGETABLES.

The fruit vegetables include Tomatoes, egg plant sweet pepper and okra.

TOMATOES (Origin- South American)

Scientific name: Lycopersicon esculentum

Family: Solanacea

Nutritional importance: The crop is grown for its fruit which can be cooked as vegetables, eaten raw in salad or used in chutneys.

• The fruit is rich in vitamin and mineral 750 – 1300mm Ecological requirement warm climate with medium temperature moderate rainfall

• VARIETIES: 10cm soil attitude 0-2100m a.s.l

a. Elongated fruit types or plum tomatoes; usually grown for caning: Rome VF – Cal j

Henz 1350 and roma nova

b. Round fruit types usually grown for the fresh produce market

• Money maker

• Easy Beauty

• Marglobe

PROPAGATION.

- Propagation is done by seeds planted in a nursery whose site should be in areas where potatoes peppers tobacco or egg plant were not previously planted were not previously planted; to reduce risk of disease. Never user organic manure.
- Drill seeds 20cm apart and 1cm deep; thin only to leave optimum population. (Over with mulch and then overhead shed thin seedling at least to be 7cm apart.

Transplanting.

Prepare beds for transplanting; and seedling are ready when they are 10-15cm tall; usually one month after nursery sowing; at a spacing of 90cmX60cm.

CULTURAL PRACTICES.

Wedding: If mulching is applied it will help to suppress the weeds; otherwise weed regularly to reduce weed competition and pest and disease.

Manure and Fertilizer

When seedling reach 25cm tall top dress with CAN by applying one table spoon for every 4 plant i.e. 100kg/hact and later after 4wk apply one tablespoon for every 2 plant i.e. 200kg/hack.

Mulching: Cover the soil with chopped mulch so as to retain soil moisture, regulating soil temperature and suppressing weeds

- If there is strong winds, shelter tomatoes by planting
- High growing plant.

Watering: Shout be done regularly especially in dry weather. Avoid splashing water on the leaves to reduce diseases especially Tomatoes Blight.

Pruning: Should be done very week to leave only one main stem after removing side stems.

Staking: Erect varieties need staking, by pushing a 2m stick (stake) firmly into the ground next to each plant, and tie the stem loosely with string to the stick.

Pest and Diseases

American bollworm (heliothis amigera)

- The caterpillar bore into the fruit and feeds on the inner parts resulting to rotting.
- Control: use permethrin or cypermethrin insecticides

Tobacco whitefly (Bemisia tabaci) there are flies found under the leaf sucking the sap and transmitting virus causing diseases case tobacco mosic i.e. stunted growth.

Control: By spraying fenitrothion or Diazinon.

Any plant showing signs of viral infection (curled, street or motted leaves) should be uprooted and burnt before spraying.

Late blight. This is a fungal disease caused by a fungi phytophthora infestans; symptomized by

- Wilting and drying of leaves
- Browning and rotting of the fruits

Early blight: fungal diseases by a fungal Alternaria solani, symptomized by

i. Brown sport on the leaves
ii. Dropping off of fruits

Control: Both late and early blight care be controlled by spraying mancozeb soon after seedling

emergency every 2wks in dry weather and once after every 4-7 days in wet weather.

Bacterial wilt: Caused by a bacterium knows as Pseudomonas solanacearum. symptomized by wilting of the plant even in moist soil.

Control: No chemical control, just uproots and burn affected plants, and practice crop rotation.

Blossom end-rot physiological disease caused by

i. Too much nitrogen in the early stage
ii. Irregular watering/too much watering
iii. Calcium deficiency in the young fruit

Control: Regular watering Control calcium defficience

Viral Diseases symptomized by

i. Mottled leaves
ii. streak or curled leaves
iii. death of plants

They are spread by aphids and whitefly.

Control: No chemical control only a uproot and hum

i. If you smoke, wash hand before touching
ii. Spray against Aphids
iii. Use resistant varieties
iv. Disinfest hands and pruning knife before starting pruning.

Other pests

i. Red spider miters
ii. Tomato russet mites
iii. Nematodes
iv. Aphids

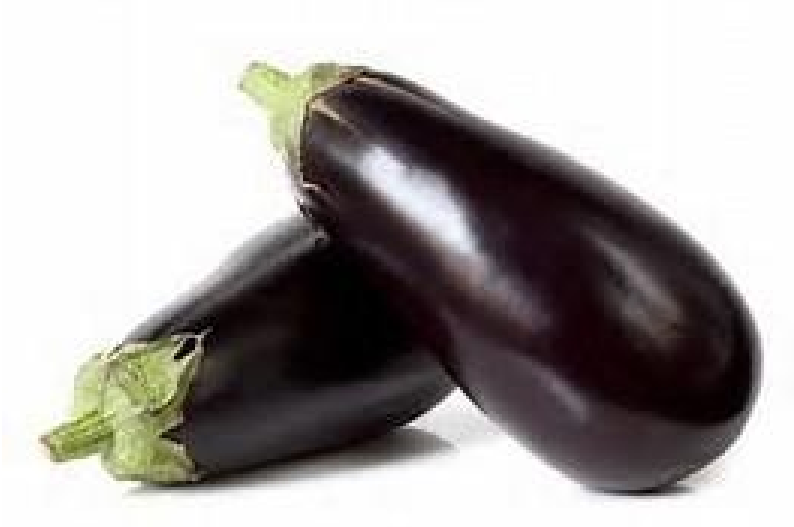
Other Diseases

i. Bacterial canker
ii. Leaf spot
iii. Leaf mould.

Harvesting

i. For fresh market pick when just starting ripening.
ii. For caning pick when fully ripe
iii. Yield 75 tone/hact.

EGG PLANT



Scientific name: Solonum melongena

Family: Solananceae

Nutritional importance: Also known as bringals or brinjals are grown for their fruit which in eaten cooked in stew. Contains vitamins and minerals.

Ecological requirement. Ground well in altitudes earning from sea level to 1500m above sea level.

VARIETIES:

Black beauty – has a long strong life

Early long purple – high yielding variety with long fruit.

Early round purple: has a round fruit.

PROPAGATION.

Nursery Prepare nursery beds and mix soil with manure or compost.

Sow needs closely in drills 30cm apart and cover with dry grass mulch and water regularly

Transplanting: Select strong seedling with 4 true leaves at a spacing of 90cm x 60cm.

During the operation, one table spoon of double super phosphate (DSP) in each planting hole, when seedling reach 25cm tall Top dress with CAN around each plant.

Mulching: Mulching is important, apart from conserving soil moisture regulating soil temperature, but also keeps the fruits clean after rain or irrigation.

Weeding: Mulching can help to keep off weeds, otherwise regular weeding is necessary, until egg

plant leaves cover the soil.

Pest Disease

Epilachna beetle (epilachna spp) the beetles eat the leaves in patches.

Control: spray malathion or fenitrothion.

Stripped blister battle (epicauta albovitata) these are black and white stripped battles which eat irregular holes in the leaves.

Control: spray parathion methyl.

Gall midge (asphondylia spp) the larva feeds inside the fruit and shoots. Control: spray Malathion or fenitrothion.

Bacterial will (preudomonas solanancearum)

Plants wilt and die.

Leaf sport (alternania solani)

i. crop rotation
ii. use of clean certified seeds.

Harvesting: Harvest fruit, when they have attained maturity they turn yellow Handle carefully and avoid bruising.

FRUIT PRODUCTION

Orhard fruit crops include Orange. Tanganyika pineapple/ pawpaw, apples, mangoes and bananas.

Classification of fruits grown in Tanzania.

Basing on climate requirements, fruits grown in Tanzania have been categories into:-

i. High Altitude fruit crops: e.g. Apples

ii. Medium Altitude fruit crops e.g. banana

iii. Low altitude fruit crops e.g. orange, tangerine, pawpaw and pineapples.

SWEET ORANGE

Scientific name: citrus sinensis

Family citruceae or rutaceae

Nutritional importance: oranges are rich in vitamin C

VARIETIES

i. Valencia
ii. Jaffa
iii. Pineapple
iv. Hamlin
v. Washington navel
vi. Matombo sweet.

ECOLOGY

Altitude: Tropical region ranging from 900m-1200m a.s.l

The growth of orange tree is greatly reduced when the temperature falls below 120c and are damaged it atmospheric temperature fall below 30c.

CULTURA PROCTIES

i. Transplanting: 1-11/2 year seedling is ready for transplanting.
ii. Prepare planting holes ready in advance just before the rainy season.
iii. The spacing of the buddled seedlings depends on the size of the full grown true.
iv. Small tree size variation 6.5m x 6.5m
v. Medium free size 7.0m x 7.0m
vi. Large tree size variation – 9.0 m x 9.0
vii. Make a basin during dry weather.

Watering: Never allow the young trees to show any sign of witting, by regular watering and providing mulch.

Manure and fertilize

i. Apply one 20 litter tin of compost or manure in each tree
ii. Cultivate the soil within the irrigation basin to make it loose for easy water percolation.
iii. Fertilized can be applied at yearly interval from 250gm three in the first year to 1.5kg/three

4th year and after of N.P.K fertilized (2:3:4)

Weeding: The area around the young tree should be repeat weed free by planting cover crops like beans, cow peas groundnuts etc between the rows of young citrus trees

Pest and Disease.

Frequent occurring pest are: Citrus Aphid (Taxopter citricidus)

i. Red scale (Aonideth aurantil
ii. Green scale (cocus viridian)
iii. Orange dog (papilio democium

Control: Spray Diazimon, Malathion, Feritrothion

Disease: Citrus scab (Elsinol fawcetti) fungal leaf spot (Altenaria citrii) diseases

Control: Use of copper Fungicides or Gummosis Tristenza – No can (just uproot $ Burn the affected crop)

Pruning

Remove all suckers or side shoots growing from the root stock and the main three trunks at ground level to 1m above ground

Remove des and broken branches as well as sick tree

Cut off excess growth to ensure balances and well space frame work in each tree.

NB:

Regular pruning; disease and pest control

Regular watering and fertilizer and manure applications are continuous operation to be done for the bearing trees.

Harvesting

Starts about 3rd year after planting. by picking the fruits when they are full mature and have uniform colour.

Avoid bruising (hiting) the fruit since it can post it quality

PINEAPPLES PRODUCTION

Scientific name: Amanas comosus National importance: provides Vitamin C

VARIETIES

- Smooth cayenne
- Natal Queen
- Ripley Queen
- Sugar leaf

ECOLOGY

Altitude 0 -2100m a.s.l

Rainfall: 1000mm per annual well distributed

PROPAGATION

Pineapples are propagated using three types of vegetative material

(i) crowns: There are obtained from the tops of the fruit

(ii) Suckers: There are leaves shoots arising below the fruit level but may originate from bellow

above soil surface

(iii) Slip: leaf shoots arising from the base of the fruits

- Grown take longer (24 month); Sucks take 18 months and grow more uniform and slip nature 20-22 month. most farmers use suckers and they have to be spread out 1-2 weeks before planting

i. planting is done in double rows at the following spacing:
ii. Between plant in rows :30cm
iii. Between rows in bed:45-50cm
iv. Between beds :90cm

CULTURAL PRACTISES

Weeding/Mulching: can be controlled by a combination of cultivation, mulching and herbicides however mulching using a layer of dried gases is best.

Stripping: This is the removal of all slips and unwanted suckers so as to leave only one sucker to prepare the plant for ratoon crop (i.e. subsequent fruits after first harvest).

Pest and Diseases

Insects: mealy bug (dysmicoccus brevipes) carries virus causing red or yellow colour to the leaves resulting to stunting growth.

Control: Difficult to control; but dip planting material in a solution of chlordane or heptachlor.

Nematode: Attacks the roots causing root knots and distorted growth.

Control: spray nematocides e.g. carbofuran (furadan) others: scale, mikes fruit flies e.t.c.

Diseases: Heat rot: caused by fungus phytophthora cinamomi: result to rotting of the fruit from the centre outwards.

Control: Soak planting material in difolatan fungicide and reapply 2-4 months after planting.

Harvesting

Pick pineapples when ripe, when the small leaves in the centre of the grown can be pulled out easily.

HANDLING AND PROCESSING OF CROP PRODUCTS.

Processing: This refers to any alteration on the proportion of agriculture products by physical/chemical/Biological measure; so as to be stored or consumed. It involves the presentation or manufacturing of agriculture products.

Handling: This refers to all care which is undertaken in processing agriculture products.

OBJECTIVES OF PROCESSING AGRICULTURE PRODUCES.

i. To preserve agriculture products for safe transport from producers to consumers.
ii. To facilitate storage during time of surplus and therefore stabilizes supply of agriculture produce throughout the years.
iii. To convert agricultural products into a form which is suitable for consumers to use since most of the product when harvested are raw product e.g. milk, cereals legumes etc.

CATEGORIES OF PROCESSING

i. Primary processing

ii. Secondary processing.

PRIMARY PROCESSING

This refers to processing activities which involve a slight charge of agricultural raw product. It includes:-

Cleaning: This is the removing of foreign material by winnowing e.g. maize.

Grading: This is the classifying of crop products by its size, quality, and shape, colour, small etc. e.g. Tobacco, Tea, coffee.

Crushing: This is a process of milling the product e.g. cereals the removal of outer cover e.g. cassava.

Peeling: The removal of outer covers e.g. cassava.

Winnowing: The process of separating grain from chaff and foreign matter e.g. removing husks from rice

Dehusking: The removal of husks e.g maize.

Drying: The act of reducing moisture control of grains.

Trashing: The separation of grain from cobs, pods, panicles etc e.g. maize, sorghums, legumes.

Curing: The process of drying leafy crop e.g. Tobacco, vegetables etc. Decortications: The separation of fibres from leaf covers e.g. sisal. Shelling: Removal of outmost cover from crop e.g. maize or legumes. PRIMARY

PROCESSING EQUIPMENT/MACHINE

- Coffee pulper sisal decorticators
- Groundnut Sheller sugar cane crushers
- Maize Sheller pyrethrum drier
- Burr mill hummer mill
- Sorghum threshers
- Secondary processing: baking, frying, cooking, extruding, blending, and fermenting, roasting;
- Packaging, marketing;

CROP STORAGE STRUCTURES

Storage concept: Consumption of food grains is regular is regular while production is seasonal; hence there is a need of storing food grain so as to have continuous supply of grains, thus reducing piece fluctuation.

These are various ways of grain storage by using different storage structures.

SILO-Is a very high narrow building on the earth surface or partially underground used for storing grains

Types:

Above ground silo

Underground silo (godown)

Construction material needs:

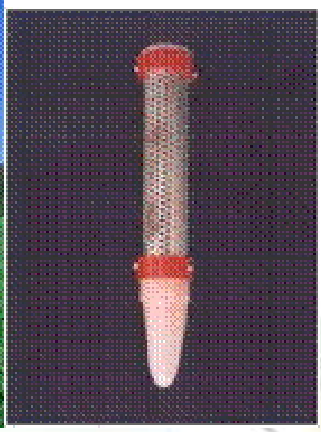
i. Concrete materials
ii. Brick materials
iii. Wooden materials
iv. Metal materials

ADVANTAGE

i. Can store grain for a long time
ii. Can store large quantities of grain
iii. No need of packing grains into containers as the grain is kept loose.

DISADVANTAGE

i. Needs high skills in construction
ii. It is costly (in construction)
iii. It is difficult to control pests and disease when there is an attack.
iv. In case of fire outbreak, large quantities of harvest are lost resulting to total loses.



STORAGE BINS

TNAU INSECT PROBE TRAP

These are short and broad large container with lead covers on its top side. They may be partially or wholly underground. Construction material used:

i. Metal (commonly used in large form

ii. Mud bin

iii. Brick bins (burnt or cement bricks)

iv. Wire mash bins

ADVANTAGE

i. Does not need skill and high cost during construction.

ii. Easy to control pest and disease outbreak due to easy applying.

iii. Grains are stored loosely and no need of containers.

DISADVANTAGE

i. They store small quantity of crop

ii. Storage is for short time

iii. In case of mud bin, it is difficult to control insert fungi and rodents as the structure cannot effectively be fumigated.

STORAGE WAREHOUSE

These are normal storage building constructed on the ground. They are market oriented usually organized by the government/cooperative societies.

ADVANTAGE

i. Can store different types of crop.

ii. Can store large quantities of products

iii. Easy to control pests and diseases

DISADVANTAGE

i. Disease spread is easy

ii. Stores crop for a short time 3-12 month only

iii. Needs containers e.g. suck or gunny bags as they cannot be stored loosely.

Granaries

- These are usually traditional stores to which crop are put fruit after harvest
- They may be circular (diagram) or rectangular shaped and have forked wood supporting post levating above ground level.
- The size of granaries varies according to the quantity of produce to be stored. Construction material used.
- Post for building floor and walls
- Thatch grass for roofing the granaries
- Used to store loose grains in a woven basket, however un threshed products can also be tightly packed in granaries.

CRIBS -I s a constructed unit which is capable of drying grain while in cobs and thus reducing moisture content from 30% - 13% without explosive to the sun. The wall of the cribs has about 50% opening efficiency ventilation.

They crop harvest are kept in the crib for 2-3 months to dry before shelling and later shelled, winnowed, and seed dressed by chemical and packed in containers e.g. Gunny bags for longer storing.

3.0: LIVESTOCK PRODUCTION

POULTRY FARMING; Poultry farming means 'raising various types of domestic birds commercially for the purpose of meat, eggs and feather production'. The most common and widely raised poultry birds are chicken.

About 5k million chickens are being raised every year as a source of food (both meat and eggs of chicken). The chickens which are raised for eggs are called layer chicken, and the chickens which are raised for their meat production are called broiler chickens. The UK and USA consume more meat and eggs of chicken than other Countries of the world. On an average the UK alone consumes more than 29 million chicken eggs every day. However, in a word commercial poultry farming is very necessary to meet up the demand of animal nutrition (eggs and meat). Commercial poultry farming is also very profitable. And commercial poultry farming business is one of the traditional business ventures. Here we are describing more about the advantages of poultry farming business and the steps for running this business.

Benefits of Poultry Farming

Poultry farming business has numerous benefits. As a result many farmers prefer to invest in this business. People generally establish poultry farm for the purpose of producing eggs, meat and generating high revenue from these products. Billions of chickens are being raised throughout the world as a good source of food from their eggs and meat. However, here I am shortly describing the main benefits of poultry farming.

- The main benefit of poultry farming is, it doesn't require high capital for starting. You need just basic capital to start raising poultry. And most of the poultry birds are not costly enough to start rising.
- Poultry farming doesn't require a big space unless you are going to start commercially. You can easily raise some birds on your own backyard with one or numerous coops or cages. So, if you are interested in poultry farming, then you can easily do it on your own backyard with several birds.
- Commercial poultry farming business also ensure high return of investment within a very short period. Some poultry birds like broiler chickens take shorter duration of time to mature and generating profit.
- Poultry farm structures do not require high maintenance. You can minimize diseases and illness in poultry by following proper hygiene and care. Diseases are less in some poultry birds like quails, turkeys etc.
- In most cases, you don't need any licensed. Because almost all types of poultry birds are domestic. Although, if you need licensed from the relevant authority it is also easy for poultry.

o Poultry provides fresh and nutritious food and has a huge global demand. Global consumers of poultry products prefer them due to their nutrients and freshness. Poultry products are not much expensive and most of the people can afford those.

- Marketing poultry products is very easy. There is an established market for poultry products in almost all places of the world. So, you don't have to think about marketing your products. You can easily sell the products in your nearest local market.
- Poultry farming creates income and employment opportunities for the people. Unemployed educated youth can easily create a great income and employment opportunity for them by raising poultry commercially. Women and students can also do this business along with their daily activities.
- Almost all banks approve loans for these types of business venture. So, if you want to start this business commercially, then you can apply for loans to your local banks.
- There are many more benefits of poultry farming along with the above mentioned benefits. Start raising and you will gradually learn everything.

Various Methods of Poultry Farming

World watch institute described that, â€•about 74% of total poultry meat and 68% of total poultry eggs produced from intensive poultry farming method. Free range farming is the other alternative method of intensive poultry farming. Free range farming method is used for large number of poultry birds with high stocking density. There are some basic differences between intensive and free range poultry farming. Intensive poultry farming method is a highly efficient system which saves, land, feed, labor and other resources and increases production. In this system the poultry farming environment is fully controlled by the farmer. So, it ensures continuous production throughout the year in any environment and seasons. Intensive poultry farming has some disadvantages too. Some people says intensive system creates health risks, abuse the animals and harmful for environment. On the other hand free range poultry farming method requires a large place from raising the birds and the production is about the same as intensive method. However, in the case of both intensive and free range poultry farming method the producers must have to use nationally approved medications like antibiotics regularly to keep the poultry birds free from diseases

POULTRY BREEDS (EXOTIC BREEDS)

These are breeds which are brought from other country.

These are two main groups of exotic chicken breeds

i). Pure breeds.

These are pure for one bread and are further divided into

a). Heavy Breeds: These are chicken breeds which have heavy body weight they include:- Rhode /island red-Origin American

Characteristic: Brownish used feathers

Some have black wing and tail

Females are good/layer

Black Australop – Origin Australia

Characteristics male birds have bright red feathers around the neck, on the tail and wings. Females are fairly good layers

Orpington –Origin from England

Characteristics

- ✓ Birds have black feather with white bars
- ✓ They are quite heavy in weight.
- ✓ Some of the distinguished varieties are black variety.

Barred Plymouth Rock:

- ✓ origin America

Characteristics:

- ✓ birds have black feather with white bars
- ✓ Birds have got long bodies and are hardy.
- ✓ Females do not easily stop lying.

Light breeds: These are chicken breeds with an average light body weight.

Majority are suitable for egg foundation. They include:-\

Leghorns: Origin Mediterranean countries. Some distinguished varieties of these breeds are

- ✓ White leghorn
- ✓ Black leghorn\Brown leghorn.

Other light breeds include:-

- ✓ Minorca
- ✓ Andalusia
- ✓ Ancona

ii). HYBRIDS.

These are types of bread which result from crossing two or more breeds of poultry

- Some are suitable for egg production and other are suitable for meet i.e. Broilers
- Broilers grow and increase in weight very fast while Hybrid layer produce more eggs than their crossed parents.

Examples of Hybrids are

i. Shavers
ii. Hornber
iii. Haco
iv. Sterlin

POULTRY MANAGEMENT

This involves the following operation:-

i. Egg incubation
ii. Rearing of chicks
iii. Feeding of CHICKS
iv. Administration of drugs
v. Prevention of vices
vi. Disease and parasite control.

I. INCUBATION OF EGGS

Meaning: This is the treatment of fertile eggs in order they develop into chick:-

This is achieved only when they are subjected to environment with suitable temperature, humidity and ventilation.

- Temperature – 300c – 350
- Humidity 60%-70% NB:

The time taken from fertilization and full maturity of an egg to produce a chick i.e. know as **INCUBATION PERIOD.**

Incubation periods for different birds are:-

i. Chicken 21 days
ii. Ducks 28 days
iii. Turkeys 28 days
iv. Goose 30 days

Incubation process can be achieved by two methods

- Natural process (Natural incubation)
- Artificial process(artificial incubation)

A). NATURAL INCUBATION

Terminologies:

I. **Brooding**: Is a process of supplying heat either naturally or artificial to an egg (fertilized) to facilitate hatching.

II. **Broody hen**: A hen that site on fertilizer eggs so as to supply heat.

Natural incubation is done by allowing a broody hen to sit on the egg until they hatch.

- ✓ Usually a hen site for 21 days until they hatch.
- ✓ This is very common to love breed whereby they make nests and lay eggs. After laying a number of eggs, the hen site on the eggs, whereby its body provides heat and humidity to the egg; until they hatch.
- ✓ The hen usually turns the eggs over to allow the developing embryo not to settle to one side.
- ✓ The hen should be supplied with water, feed and a good shelter.
- ✓ The capacity of the brooding hen is 10-15eggs.

Best way:

i. Prepare the broody hen by dusting i.e. with insecticide powder e.g. Gamatox to full lice and other external parasite in its feathers.
ii. Prepare the nesting place; preferably a box measuring 40cm x 35cm x 35cm is sufficient; as well a basket of reasonable size.
iii. Part soft material or clean dry sand on the floor of the box on top of which maize husk, paddy husks or wood shavings can be put.
iv. Put 10-15 eggs in the box and allow the hen to site on the egg noting down the dates.
v. Put drinking water and feed containers.
vi. After 21 days check for hatched eggs.

B. ARTIFICIAL INCUBATION.

This is achieved by placing eggs in special equipment called an INCUBATOR.

Types of incubators

i. small incubators
ii. flat type
iii. still air
iv. table incubators
v. Large incubators
vi. cabinet incubators
vii. walk in incubators

NB:

Small incubator holds 50-300 eggs at a time.

Large incubator holds thousands of egg at a tome which large ones are heated by electricity.

Procedure.

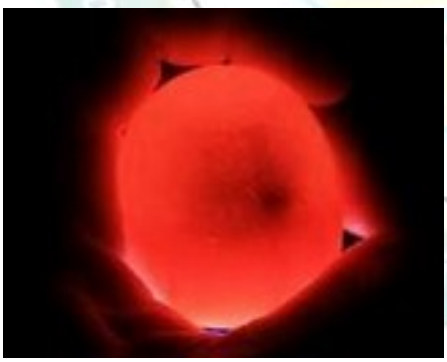
1. Collect fertilizer eggs of medium size 56gm 63gm with thick shells.

2. Conduct egg testing to check for cracker or only in the yolk. This is done by candling method clean and disinfects the incubator 7 days before starting incubation.
3. Switch on the source of heat 3 days before.
4. Put water into the water pan as well as egg in the egg tray (each egg should be placed in such a way the large end facing upwards), and place the tray in the incubator.
5. Keep the temperature in the incubator at 37^0c 39^0c and humidity at 60%.
6. Turn egg 3-5 a day in the first 18 days to facilitate equal distribution of heat wound the egg so that the embryo may not stick to the shell.
7. After 4-7 days repeat egg candling and also on the 14^{th} days do the same.
8. On the 15^{th} day shift the eggs to the hatching compartment in the incubator; and raise humidity 70% and lower temperature 5^{th} 36^0c – 37^0c.
9. Let the eggs to stay until they hated.

Precaution

1. The incubator should be well ventilated and place in a well ventilated place.
2. Avoid direct sunlight falling on to the incubator through windows
3. Clean and disinfect incubator after ever hatch.
4. Operate the incubator 3 days before setting in the eggs so as to be sure if it is working
5. When the eggs hatch do not remove the chicks from the incubator on the first day
6. The hatchery room and incubator must be cleaned regularly
7. Wear protective clothing and wash them regularly
8. Always place a â€•foot bathâ€– with disinfectant at the entrance to avoid risk of disease transmission.

Egg testing process by candling.



i. Candling is done by using a small box or container with a hole on top; with an electric lamp or hurricane lamp on it.
ii. The egg is put in the hole and the light is switched on; and egg observation is done.
iii. A fertile egg has a round small disc inside the yolk; and the yolk is dark in colour.
iv. If it is fertile, a dark spot will be seen inside the egg near the middle of the egg.

Importance

- Is to identify defected eggs which have to be removed from the incubator. They include:-

  i. Thin shelled eggs
  ii. Cracked shelled eggs
  iii. Defects in the yolk.

FORMS OF POULTRY PRODUCTION IN TANZANIA

There are 3 forms of keeping poultry in Tanzania.

a. Multipurpose poultry production.
b. Commercial meat production.
c. Commercial egg production.

I. Multipurpose poultry production.

This taken account of keeping local poultry breeds usually in small scale production. The main products from this form are egg and meat.

II. Commercial meat production.

Brolers are chicken which are kept for meat production. Their feature include

i. To obtain high mature weight
ii. Good ability convert feed into meat (High feed conversion efficiency) e.g. Heavy breed; Red island red.

III. Commercial egg production.

i. Pullets which are kept for egg production are celled layers.
ii. The quality of a good layers include:-
iii. Should have an ability to lay much egg up to 200 eggs during the whole laying period.
iv. Have the ability to convert feeds into eggs efficiently e.g. all types of light breeds.

SYSTEMS OF POULTRY REARING

Poultry rearing: This refers to the rearing or locking after poultry birds.

These are 3 main system of rearing poultry mainly:-

i. Free range

ii. semi – intensive

iii. intensive

Capital: Intensive system required high investment than the other system hence if you have less capital use semi intensive or free rang

Purpose of keeping poultry:

- The suitable system also depends on whether you are keeping layers, broilers or dual purpose birds.
- Most of the layers and broilers are kept by intensive system, which dual purpose poultry are kept under free range system.

Numbers of birds to be kept.

- Few birds can be raises using free range system while many birds prefer intensive system. Space available.
- If space is not available and you have capital use intensive systems.
- If there is plenty of space you use semi intensive or free range stem.

Environmental factors.

- This needs consideration on weather factors
- Presence of predators
- Presence of thieves
- If the place has thieves, predators and too cold the birds need protection hence use intensive system.

(i). FREE RANGE SYSTEM (EXTENSIVE SYSTEM)

This is a system whereby poultry birds are locked in the house during the night and allowed to go out to find their own feed and water during the daytime. Sometime it is called (EXENSIVE SYSTEM)

It is particularly suitable for local/ indigenous breeds which are hardy and can without adverse weather e.g. cold, rainfall e.t.c. and able to find their own food.

ADVANTAGES:

i. These are no feed cost as the births find their own food and no supplementary food is given to them.
ii. The birds get balanced diet as they eat a variety of foods e.g. grass, insect, grain ex.
iii. Initial cost is very low as a small cheap house is all that is needed.
iv. Very low cases of vice e.g. egg eating, cannibalism father packing etc.
v. Eggs and meat produce under this system are palatable and nutrition.
vi. Birds get a lot of exercise due to free movement.

DISADVANTAGES:

i. The system required a lot of space.
ii. The birds may destroy people properties e.g. crop while looking for food.
iii. Low security to the birds as they may be eaten by predators or stolen by thieves or killed by vehicles.
iv. It is difficult to collect eggs as they may lay eggs in awkward places and hence difficult to keep records.
v. The system is not suitable for keeping hybrid broiler and layers.
vii. Birds are subjected to advance weather e.g. rain cold.
viii. Disease infection and spreading is high and difficult to control.

iii). SEMI – INTENSIVE SYSTEM

This is a system where by birds are provided with a form of a housing, surrounded by an area which is enclosed in a fence whereby in the night the birds sleep in the house; while during the day the birds walk within the area

Types

House and run system

- In this system birds are provided with small houses surrounded by an area called a Run; whereby drinking water (waters) and feeds (feeders) are provide.
- Resting places (perches) and laying boxes are also kept
- During the day the birds are allowed to well freely and enclosed them inside the house during the night.

a). Fold unit system.

The system is similar to the house and run system as it consist of a house and run but the housing unit is mobile called folds/arks with a sold roof covered by wire netting.

- A fold unit of 7mx3mx3m is enough for 20-30 birds.

Advantages of semi intensive system.

i. The movement of fold unit and the alternating use of run is easen the control of parasites and disease
ii. Simple and cheap poultry houses can be used.
iii. Spread of manure in the runs is made possible as the birds drop their feaces in the runs.
iv. Easy to called egg if layer are kept under their system.
v. Easy to observe an attend birds in case of infection.

Disadvantages of semi intensive system.

i. Fold units can easily get broken if material used is not durable.
ii. It is not easy to keep many birds under this system thus not suitable for commercial production of chicken.
iii. Somehow expensive and capital is needed in purchasing fences, food drugs etc.

iv). INTENSIVE SYSTEM

This is a system where by many birds are confirmed in a small place/building where feeding and during water is supplied.

Types:

Deep litter system-This is a system whereby birds are kept in a house or pen in which litter is spread on the floor of the rouse or pen.

The litter could be either of:-

- Timber shavings
- Sawdust
- Paddy husk
- Maize grain husks filed to a uniform depth of 10-15cm

The litter shout be changed every time when a new flock is put.

NB: Avoid making the litter damp (by spilling water) as may cause disease and parasites of infection.

- Repair roots to avoid leakage during rain seen.

NB:

- The bottom 60cm of each wall should be solid made of cement; the rest should be wire netting.
- In case of wind cover the wire netting. with sacks on the side which wind blows
- Do not keep many birds in one house. Allow 2-3 birds/m2 of floor space.
- Provide birds with –

  - Water through

  - Feed through

  - Laying boxes for layers

  - perches (Roosters)

Advantages of deep litter system

i. Suitable for commercial production as many birds can be kept in a small area

ii. Birds are protected from basic weather, predators and thieves.

iii. Egg collection in easier if layer are kept

iv. Keeping of record is made possible,

v. Litter from the house is a good source of manure.

Disadvantages of deep litter system

i. Encourages vices e.g. cannibalism and eating habit

ii. If litter becomes damp; spread of coccidiosis disease can be high.

iii. Sometimes birds become broody

iv. High initial cost of building poultry house

v. High feed cost

vi. High labour requirement

Battery Cages-This is a system where by bird are kept in cages of 1-2 birds where food and water through are within in the front point of the cage.

- The floor of cages is made up of wire netting
- When the eggs are laid they slide to the front of the cage and can be collection
- Suitable for eggs production birds but not broilers.

NB

Clean the metal sheet under the cage where feaces are collected. One row of a cage in known as a tier.

Advantage of Battery cage systemic

i. Large number of birds can be kept in small area

ii. Egg recording is made possible

iii. Food and water cannot be made dirty

iv. Egg eating and breaking is not possible

v. Clean eggs are collected

vi. Vices are minimize e.g. cannibalism

vii. Easy to identify disease birds.

viii. Hen cannot be broody if the floor is cold.

ix. Birds cannot be infected by intestinal worm and disease.

x. Easy provision of water and feeds.

Disadvantage of Battery cage systemic

i. Highly expensive so as to buy cages.

ii. High skill is required to operate the system.

iii. Is feed for layers only.

II. CHICK REARING BROODING

Definition: This is a period of growth during which supplementary heat is provided for the young chicks. Young chick must be provided with heat, light, fresh air good food and water.

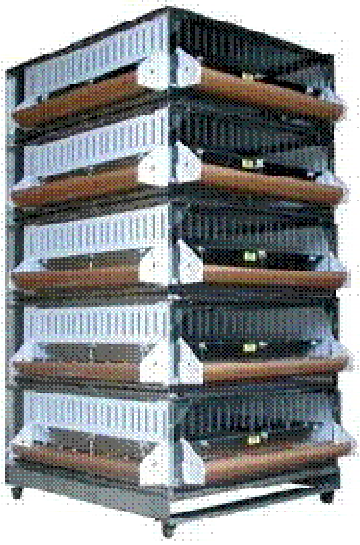
Methods:

a). Natural: By using a Brooding hen which looks after its own chicks.

It provides the chicks with warmth by sheltering them from cold and wetness. It also scares enemies to protect the chicks.

Types of Brooders

i. Hoover brooder



ii. Battery brooders

iii. Homemade brooder

iv. Heated Tin brooder

v. Kerosene lantern brooder

vi. Fire less brooder

Preparation of Brooder House and Brooding area

Before buying chicks the brooder house should be prepared

- Clean the Brooder house wall floors and disinfect it thorough and leave it to dry
- Prepared the enclosure and floor of the brooder house by using cardboard's' with a height of 45-60cm.
- Spread litter on the floor uniformly in the enclosure.
- Install the source of heat e.g. bulb or hurricane lamp 40cm above the floor.
- Light the source of heat 12hrs before the arrival of the chicks and ensure a temperature of 32- 350c always.
- Put fresh water for drinking in shallow containers.
- Provide enough chick mash (contain 20-22% protein.

NB: The brooding house should be well ventilated.

SEXING CHICKEN.

- The action of identifying the sex of each chick which facilitate the separation of male chicks from female chicks.
- This is usually done by expects using special instrument.
- Sometimes the experts rood may make mistake therefore it is advisable that this operation be done when chicks reach the age of 8 weeks. At this age the cockerels (male birds) must be separated from the pullets (female birds). Usually cockerels have larger combs and wattles than pullets.

REARING OF DAY OLD CHICKS UP TO 8th WEEK.

1st WEEK:

1st DAY:

- Once you bring the chicks remove them from the boxes and put them in the brooder.
- Let them drink a lot of water and food; and change to fresh feed several times a day. Feed them into CHICK MASH
- Maintain temperature in the brooder between 320c – 350c 2nd Day -3rd Day.
- Replace feed and water at least twice per day.
- Check temperatures in the brooders

i. Overcrowding – low temperature
ii. Away from heat source high temperature
iii. Evenly distributed throughout the floor –right temperature.

- Stir up the litter on the floor once per day.
- Replace any damp litter with a fresh one 4th -7th day
- Expand the brooder by making the area enclosed by the cardboard wall much large by joining another piece of cardboard into the wall.
- Observe temperatures; supply feed and drinking water.
- Remove any dead chick.
- Stir up the litter regularly and put fresh if it is damp.

2nd WEEK ONWARDS

- Reduce temperature in the brooder as the chicks will be bigger and bearing more and more feathers.
- This is by lifting the heat source much higher from the surface of the floor or turn down the wick of the hurricane lamp
- Re move heat source when chick are at 4-5wk stage.
- provide light during the night so that the chick can eat and drinking to facilitate fast growth
- Make sure the litter is dry all the time as well as fresh feed and clean fresh water.
- Add more water and feed troughs as the chicks grow bigger.

- provide adequate floor space and adequate space on feed troughs in the brooder and be well distributed (i.e. 1000cm2/bird as floor space)

➢ NB: at weeks old they are called growers of which they are cared differently.

- Broiler growers may be shifted or reared in the same house.
- Layer growers are normally shifted from the brooder to another house.

Common Poultry Diseases

Respiratory Diseases

There are many common and important diseases which can affect the respiratory system (air passages, lungs, air sacs) of poultry (see Table 1). Poultry refers to birds that people keep for their use and generally includes the chicken, turkey, duck, goose, quail, pheasant, pigeon, guinea fowl, pea fowl, ostrich, emus, and rhea. Due to modern systems of management, usually with high poultry densities, these diseases are able to readily spread.

Fowl Pox

Synonyms: chicken pox (not to be confused with chicken pox in humans; the human disease does not affect poultry and vice versa), sore head, avian diphtheria, bird pox

Species affected: Most poultry—chickens; turkeys, pheasants, quail, ducks, psittacosis, and ratites—of all ages are susceptible.

Clinical signs: There are two forms of fowl pox. The dry form is characterized by raised, wart - like lesions on unfeathered areas (head, legs, vent, etc.). The lesions heal in about 2 weeks. If the scab is removed before healing is complete, the surface beneath is raw and bleeding. Unthriftiness and retarded growth are typical symptoms of fowl pox. In laying hens, infection results in a transient decline in egg production.

Transmission: Fowl pox is transmitted by direct contact between infected and susceptible birds or by mosquito. Virus-containing scabs also can be sloughed from affected birds and serve as a source of infection. The virus can enter the blood stream through the eye, skin wounds, or respiratory tract. Mosquito become infected from feeding on birds with fowl pox in their blood

stream. There is some evidence that the mosquito remains infective for life. Mosquito are the primary reservoir and spreaders of fowl pox on poultry ranges. Several species of mosquito can transmit fowl pox. Often mosquito winter-over in poultry houses so, outbreaks can occur during winter and early spring.

Treatment: No treatment is available. However, fowl pox is relatively slow-spreading. Thus, it is possible to vaccinate to stop an outbreak. The wing-web vaccination method is used for chickens and the thigh-stick method for turkeys older than 8 weeks.

Prevention: Fowl pox outbreaks in poultry confined to houses can be controlled by spraying to kill mosquito. However, if fowl pox is endemic in the area, vaccination is recommended. Do not vaccinate unless the disease becomes a problem on a farm or in the area. Refer to the publication PS-36 (Vaccination of Small Poultry Flocks) for more information on fowl pox vaccinations.

Newcastle Disease

Synonyms: pneumoencephalitis

The highly contagious and lethal form of Newcastle disease is known as viscerotropic (attacks the internal organs) velogenic Newcastle disease, VVND, exotic Newcastle disease, or Asiatic Newcastle disease. VVND is not present in the United States poultry industry at this time.

Species affected: Newcastle disease affects all birds of all ages. Humans and other mammals are also susceptible to Newcastle. In such species, it causes a mild conjunctivitis.

Clinical signs: There are three forms of Newcastle disease—mildly pathogenic (lentogenic), moderately pathogenic (mesogenic) and highly pathogenic (velogenic). Newcastle disease is characterized by a sudden onset of clinical signs which include hoarse chirps (in chicks), watery discharge from nostrils, labored breathing (gasping), facial swelling, and paralysis, trembling, and twisting of the neck (sign of central nervous system involvement). Mortality ranges from 10 to 80 percent depending on t he pathogenicity. In adult laying birds, symptoms can include decreased feed and water consumption and a dramatic drop in egg production (see Table 1).

Transmission: The Newcastle virus can be transmitted short distances by the airborne route or introduced on contaminated shoes, caretakers, feed deliverers, visitors, tires, dirty equipment, feed sacks, crates, and wild birds. Newcastle virus can be passed in the egg, but Newcastle-infected embryos die before hatching. In live birds, the virus is shed in body fluids, secretions, excreta, and breath.

Treatment: There is no specific treatment for Newcastle disease. Antibiotics can be given for 3–5 days to prevent secondary bacterial infections (particularly E. COLI). For chicks, increasing the brooding temperature 5°F may help reduce losses.

Prevention: Prevention programs should include vaccination (see publication PS-36, Vaccination of Small

Poultry Flocks), good sanitation, and implementation of a comprehensive biosecurity program.

Infectious Bronchitis

Synonyms: IB, bronchitis, cold

Species affected: Infectious bronchitis is a disease of chickens only. A similar disease occurs in bobwhite quail (quail bronchitis), but it is caused by a different virus.

Clinical signs: The severity of infectious bronchitis infection is influenced by the age and immune status of the flock, by environmental conditions, and by the presence of other diseases. Feed and water consumption declines. Affected chickens will be chirping, with a watery discharge from the eyes and nostrils, and labored breathing with some gasping in young chickens. Breathing noises are more noticeable at night while the birds rest. Egg production drops dramatically. Production will recover in 5 or 6 weeks, but at a lower rate. The infectious bronchitis virus infects many tissues of the body, including the reproductive tract. Eggshells become rough and the egg white becomes watery.

Transmission: Infectious bronchitis is a very contagious poultry disease. It is spread by air, feed bags, infected dead birds, infected houses, and rodents. The virus can be egg-transmitted, however, affected embryos usually will not hatch.

Treatment: There is no specific treatment for infectious bronchitis. Antibiotics for 3–5 days may aid in combating secondary bacterial infections. Raise the room temperature 5°F for brooding-age chickens until symptoms subside. Baby chicks can be encouraged to eat by using a warm, moist mash.

Prevention: Establish and enforce a biosecurity program. Vaccinations are available.

Avian Influenza

Synonyms: AI, flu, influenza, fowl plague

Species affected: Avian influenza can occur in most, if not all, species of birds.

Clinical signs: Avian influenza is categorized as mild or highly pathogenic. The mild form produces listlessness, loss of appetite, respiratory distress, diarrhea, transient drops in egg production, and low mortality. The highly pathogenic form produces facial swelling, blue comb and wattles, and dehydration with respiratory distress. Dark red/white spots develop in the legs and combs o f chickens. There can be blood-tinged discharge from the nostrils. Mortality can range from low to near 100 percent. Sudden exertion adds to the total mortality. Egg production and hatchability decreases. There can be an increase in production of soft-shelled and shell-less eggs.

Transmission: The avian influenza virus can remain viable for long periods of time at moderate temperatures and can live indefinitely in frozen material. As a result, the disease can be spread through improper disposal of infected carcasses and manure. Avian influenza can be spread by contaminated shoes, clothing, crates, and other equipment. Insects and rodents may mechanically carry the virus from infected to susceptible poultry.

Treatment: There is no effective treatment for avian influenza. With the mild form of the disease, good husbandry, proper nutrition, and broad spectrum antibiotics may reduce losses from secondary infections. Recovered flocks continue to shed the virus. Vaccines may only be used with special permit.

Prevention: A vaccination program used in conjunction with a strict quarantine has been used to control mild forms of the disease. With the more lethal forms, strict quarantine and rapid

destruction of all infected flocks remains the only effective method of stopping an avian influenza outbreak. If you suspect you may have Avian Influenza in your flock, even the mild form, you must report it to the state veterinarian's office. A proper diagnosis of avian influenza is essential. Aggressive action is recommended even for milder infections as this virus has the ability to readily mutate to a more pathogenic form.

For more information on avian influenza, refer to publication PS-38 (Avian Influenza in Poultry Species).

Infectious Coryza

Synonyms: roup, cold, coryza

Species affected: chickens, pheasants, and guinea fowl. Common in game chicken flocks.

Clinical signs: Swelling around the face, foul smelling, thick, sticky discharge from the nostrils and eyes, labored breathing, and rales (rattles—an abnormal breathing sound) are common clinical signs. The eyelids are irritated and may stick together. The birds may have diarrhea and growing birds may become stunted (see Table 1).

Mortality from coryza is usually low, but infections can decrease egg production and increase the incidence and/or severity of other diseases. Mortality can be as high as 50 percent, but is usually no more than 20 percent. The clinical disease can last from a few days to 2–3 months, depending on the virulence of the pathogen and the existence of other infections such as mycoplasmosis.

Transmission: Coryza is primarily transmitted by direct bird-to-bird contact. This can be from infected birds brought into the flock as well as from birds which recover from the disease which remain carriers of the organism and may shed intermittently throughout their lives. Birds risk exposure at poultry shows, bird swaps, and live-bird sales. Inapparent infected adult birds added into a flock are a common source for outbreaks. Within a flock, inhalation of airborne respiratory droplets, and contamination of feed and/or water are common modes of spread.

Treatment: Water soluble antibiotics or antibacterials can be used. Sulfadimethoxine (Albon), Di- Methox™) is the preferred treatment. If it is not available, or not effective, sulfamethazine

(Sulfa-Max), SulfaSure), erythromycin (gallimycin, or tetracycline (Aureomycin) can be used as alternative treatments.

Sulfa drugs are not FDA approved for pullets older than 14 weeks of age or for commercial layer hens. While antibiotics can be effective in reducing clinical disease, they do not eliminate carrier birds.

Prevention: Good management and sanitation are the best ways to avoid infectious coryza. Most outbreaks occur as a result of mixing flocks. All replacement birds on "coryza-endemic" farms should be vaccinated. The vaccine (Coryza-Vac) is administered subcutaneously (under the skin) on the back of the neck. Each chicken should be vaccinated four times, starting at 5 weeks of age with at least 4 weeks between injections. Vaccinate again at 10 months of age and twice yearly thereafter.

Swollen Head Syndrome

Synonyms: Facial cellulitis, thick head, Dikkop, SHS

Species affected: Chickens and turkeys are the known natural hosts. Experimentally, guinea fowl and pheasants are susceptible but pigeons, ducks, and geese are resistant to the infection. SHS does not presently occur in the United States, but is present in most countries of the world.

Clinical signs: In chicks and poults, there is initial sneezing, followed by reddening and swelling of the tear ducts and eye tissue. Facial swelling will extend over the head and down the jaw and wattles. Adult chickens have mild respiratory disease followed by a few birds having swollen heads. Other signs include disorientation, twisting of the neck, and a significant drop in egg production .

Transmission: The infection spreads by direct contact with infected birds or indirectly by exposure to infectious material.

Treatment: There is no proven medication for swollen head syndrome. The disease is caused by a virus classified as a pneumovirus. A disease closely mimicking SHS is caused by a mixed infection of respiratory viruses and specific bacteria. Antibiotic therapy may be helpful against the bacterial component.

Prevention: A commercial vaccine is available. Swollen head syndrome is considered an exotic disease and a live vaccine is not approved for use in the United States.

Mycoplasma synoviae

Synonyms: MS, infectious synovitis, synovitis, silent air sac

Species affected: chickens and turkeys.

Clinical signs: Birds infected with the synovitis form show lameness, followed by lethargy, reluctance to move, swollen joints, stilted gait, loss of weight, and formation of breast blisters. Birds infected with the respiratory form exhibit respiratory distress. Greenish diarrhea is common in dying birds (see Table Clinically, the disease in indistinguishable from MG.

Transmission: MS is transmitted from infected breeder to progeny via the egg. Within a flock, MS is spread by direct contact with infected birds as well as through airborne particles over short distances.

Treatment: Recovery is slow for both respiratory and synovitis forms. Several antibiotics are variably effective. The most effective are tylosin, erthromycin, spectinomycin, lincomycin, and chlorotectracycline. These antibiotics can be given by injection while some can be administered in the feed or drinking water. These treatments are most effective when the antibiotics are injected.

Prevention: Eradication is the best and only sure control. Do not use breeder replacements from flocks that have had MS. The National Poultry Improvement Plan monitors for MS.

Mycoplasma meleagridis

Synonyms: MM, N strain, H strain

Species affected: MM affects turkeys of all ages, although poults are affected more severely than mature turkeys. Recently, MM has been shown to infect pigeon, quail and peafowl.

Clinical signs: A drop-off in production and hatchability can be expected in breeder flocks. There can be very high mortality in young poults. Unthriftiness, respiratory distress, stunting,

crooked neck with deformity of cervical vertebrae, and leg deformation are common in young birds (see Table 1).

Transmission: Egg transmission is low in the early breeding period, but rises as the the age of the flock increases. Infections can be introduced into a flock by contaminated equipment, shoes, and clothing of workers and visitors.

Treatment: Several antibiotics have been effective including tylosin, erythromycin, spectinomycin, and linco-spectinomycin.

Prevention: The best preventive measure is to keep MM-free breeders. The MM-free status of breeders can be confirmed by periodic blood tests through the National Poultry Improvement Plan.

Aspergillosis

Synonyms: brooder pneumonia, mycotic pneumonia, fungal pneumonia, ASPERGILLUS. When the source of the disease is the hatchery, the disease is called brooder pneumonia. In older birds, the disease is called aspergillosis.

Species affected: All birds (domestic poultry, pigeons, and canary and zoo bird species), animals, humans, and plants are susceptible.

Clinical signs: Aspergillosis occurs as an acute disease of young birds and a chronic disease in mature birds. Young birds have trouble breathing and gasp for air. Characteristically, there are no rales or respiratory sounds associated with aspergillosis. Feed consumption decreases. Occasionally there is paralysis or convulsions caused by the fungal toxin. Mortality in young birds averages 5–20 percent, but may be as high as 50 percent. Mature birds also have respiratory distress, reduced feed consumption, and may have a bluish and dark color of the skin (cyanosis). Nervous disorders, such as twisted necks, may occur in a few birds. Mortality in mature birds is usually less than 5 percent.

Transmission: Aspergillosis is caused by a fungus. The fungus grows well at room temperature and higher. All litter and nest materials (peat moss, peanut hulls, sawdust, peat, and bark, straw)

have been known to have been contaminated with aspergillus. Feed and water should be suspect when attempting to identify the source of contamination.

Treatment: There is no cure for infected birds. The spread can be controlled by improving ventilation, eliminating the source of the infection, and adding a fungistat (mycostatin, mold curb, sodium or calcium propionate, or gentian violet) to the feed and/or copper sulfate or acidified copper in the drinking water for 3 days. The litter can be sprayed lightly with an oil-base germicide to control dust and air movement of fungal spores.

Prevention: It is important to thoroughly clean and disinfect the brooding area between broods. Use only clean litter, preferably soft wood shavings. Do not use sawdust, litter high in bark content, or shavings that have been wet.

Viral Diseases (nonrespiratory) Marek's Disease

Synonyms: acute leukosis, neural leukosis, range paralysis, gray eye (when eye affected)

Species affected: Chickens between 12 to 25 weeks of age are most commonly clinically affected. Occasionally pheasants, quail, game fowl and turkeys can be infected.

Clinical signs: Marek's disease is a type of avian cancer. Tumors in nerves cause lameness and paralysis. Tumors can occur in the eyes and cause irregularly shaped pupils and blindness. Tumors of the liver, kidney, spleen, gonads, pancreas, proventriculus, lungs, muscles, and skin can cause in coordination, unthriftiness, paleness, weak labored breathing, and enlarged feather follicles. In terminal stages, the birds are emaciated with pale, scaly combs and greenish diarrhea (see Table 2).

Marek's disease is very similar to Lymphoid Leukosis, but Marek's usually occurs in chickens 12 to 25 weeks of age and Lymphoid Leukosis usually starts at 16 weeks of age.

Transmission: The Marek's virus is transmitted by air within the poultry house. It is in the feather dander, chicken house dust, feces and saliva. Infected birds carry the virus in their blood for life and are a source of infection for susceptible birds.

Treatment: none

Prevention: Chicks can be vaccinated at the hatchery. While the vaccination prevents tumor formation, it does not prevent infection by the virus.

Lymphoid Leukosis

Synonyms: visceral leukosis, leukosis, big liver, LL

Species affected: Although primarily a disease of chickens, lymphoid leukosis can infect turkeys, guinea fowl, pheasants, and doves, but not on a large scale.

Clinical signs: The virus involved has a long incubation period (4 months or longer). As a result, clinical signs are not noticeable until the birds are 16 weeks or older. Affected birds become progressively weaker and emaciated. There is regression of the comb. The abdomen becomes enlarged. Greenish diarrhea develops in terminal stages.

Transmission: The virus is transmitted through the egg to offspring. Within a flock, it is spread by bird-to- bird contact and by contact with contaminated environments. The virus is not spread by air. Infected chicken are carriers for life.

Treatment: none

Prevention: The virus is present in the yolk and egg white of eggs from infected hens. Most national and international layer breeders have eradicated lymphoid leukosis from their flocks. Most commercial chicks are lymphoid-leukosis negative because they are hatched from LL-free breeders. The disease is still common in broiler breeder flocks.

Infectious Bursal Disease

Synonyms: Gumboro, IBD, infectious bursitis, infectious avian nephrosis

Species affected: chickens

Clinical signs: In affected chickens greater than 3 weeks of age, there is usually a rapid onset of the disease with a sudden drop in feed and water consumption, watery droppings leading to soiling of feathers around the vent, and vent pecking. Feathers appear ruffled. Chicks are listless

and sit in a hunched position. Chickens infected when less than 3 weeks of age do not develop clinical disease, but become severely and permanently immunosuppressed.

Transmission: The virus is spread by bird-to-bird contact, as well as by contact with contaminated people and equipment. The virus is shed in the bird droppings and can be spread by air on dust particles. Dead birds are a source of the virus and should be incinerated.

Treatment: There is no specific treatment. Antibiotics, sulfonamides, and nitrofurans have little or no effect. Vitamin-electrolyte therapy is helpful. High levels of tetracyclines are contraindicated because they tie up calcium, thereby producing rickets. Surviving chicks remain unthrifty and more susceptible to secondary infections because of immunosuppression.

Prevention: A vaccine is commercially available.

Equine Encephalitis

Synonyms: EE, EEE, WEE

Note: This disease should not be confused with St. Louis Encephalits (SLE). Chickens are used as sentinels (test animals) in SLE suspect areas, such as southern Florida. While SLE is also carried by mosquitos, that is where the similarities between the two encephalitis diseases end. Chickens do not get SLE. Refer to

Factsheet VM71 (St. Louis Encephalitis—The Role of Chickens) for more information on SLE.

Species affected: Equine encephalitis is a contagious disease of birds (especially pheasants), mammals (especially horses), and people. Birds are the major source of the virus.

Clinical signs: Two forms affect birds: eastern equine encephalitis (EEE) and western equine encephalitis (WEE). The clinical signs are identical and include reduced feed consumption, staggering, and paralysis. Surviving birds may be blind, have muscle paralysis, and have difficulty holding their head up. Damage to the bird's nervous system varies with species. In pheasants, there is pronounced leg paralysis, twisting of the neck, and tremors. Mortality is high. Chukar partridges and turkeys show drowsiness, paralysis, weakness, and death.

Transmission: Infected mosquitoes are the primary source of the virus. The CULISETA MELANURIA mosquito is the primary transmitter of the virus to poultry. Other mosquito species transmit the disease too, but feed mostly on other animals. Cannibalism of sick or dead birds by penmates is a major source of transmission within pens.

Treatment: none

Prevention: Remove the source of infection by establishing mosquito control: keep weeds mowed in a 50- foot strip around bird pens. This removes cover and resting areas for mosquitos. Eliminate mosquito breeding areas. Fog areas with Malathion.

It is possible to immunize birds, especially pheasants, with the vaccine prepared for horses. The recommended dose is one-tenth of a horse dose per bird.

Egg Drop Syndrome

Synonyms: egg drop, egg drop syndrome 76, EDS-76

Species affected: The natural hosts for EDS virus are ducks and geese, but EDS has become a major cause of reduced egg production in chickens in many parts of the world. No illness has been observed in ducks or geese. Chickens of all ages and breeds are susceptible. The disease is most severe in broiler-breeders and brown-egg layer strains.

Clinical signs: There are no reliable signs other than the effects on egg production and egg quality. Healthy- appearing hens start laying thin-shelled and shell-less eggs. Once established, the condition results in a failure to achieve egg production targets. Transient diarrhea and dullness occur prior to egg shell changes. Fertility and hatchability are not affected (see Table 2).

Transmission: It is believed that the syndrome was first introduced into chickens from contaminated vaccine. Vertical transmission occurs from infected breeders to chicks. Newly hatched chicks excrete the virus in the feces.

Treatment: There is no successful treatment. Induced molting will restore egg production.

Prevention: Prevention involves a good biosecurity program.

Infectious Tenosynovitis

Synonyms: viral arthritis, tenosynovitis, teno, reovirus enteritis, reovirus septicemia, malabsorption syndrome, helicopter disease

Species affected: turkeys and chickens

Clinical signs: Several serotypes of the reovirus have been identified. Some localize in the joints

(tenosynovitis) while others target respiratory or intestinal tissues (septicemic form) .

The principal sign of tenosynovitis is lameness with swelling of the tendon sheaths of the shank and area extending above the hock (see Table 2). Affected birds are lame, sit on their hocks, and are reluctant to move. Rupture of the tendon can occur in older roaster birds, resulting in permanent lameness of the affected leg. If more than two joints are affected, the entire carcass will be condemned.

Infection can also play a part in broiler stunting, the result of malabsorption syndrome. In chicks, malabsorption due to viral enteritis is called "helicopter disease" because feathering is affected. Wing feathers protrude at various angles. A reovirus is believed to play only a secondary role in this syndrome.

In commercial layer flocks, increased mortality may be the first sign of t he septicemia form. Egg production will decrease by about two to three times the mortality rate. For example, a mortality rate of 5 percent will be accompanied by a 10–15 percent drop in egg production. In the septicemic form, joint involvement is present but less pronounced. Affected birds beco me cyanotic (blue) and dehydrated. The tips of the comb turn purplish. The entire comb darkens as the disease progresses.

Transmission: The infection spreads rapidly through broiler flocks, but less rapidly in caged layers. Spread is by respiratory and digestive tract routes. The virus is shed in the feces.

Treatment: There is no satisfactory treatment available. With hens, tetracycline, molasses, and oyster shell therapy is helpful.

Prevention: A vaccine is available for use in endemic areas or on endemic farms.

Nonrespiratory Bacterial Diseases

Fowl Cholera

Synonyms: avian pasteurellosis, cholera, avian hemorrhagic septicemia

Species affected: Domestic fowl of all species (primarily turkeys and chickens), game birds (especially pheasants and ducks), cage birds, wild birds, and birds in zoological collections and aviaries are susceptible.

Clinical signs: Fowl cholera usually strikes birds older than 6 weeks of age. In acute outbreaks, dead birds may be the first sign. Fever, reduced feed consumption, mucoid discharge from the mouth, ruffled feathers, diarrhea, and labored breathing may be seen. As the disease progresses birds lose weight, become lame from joint infections, and develop rattling noises from exudate in air passages. As fowl cholera becomes c hronic, chickens develop abscessed wattles and swollen joints and foot pads. Caseous exudate may form in the sinuses around the eyes. Turkeys may have twisted necks.

Transmission: Multiple means of transmission have been demonstrated. Flock additions, free-flying birds, infected premises, predators, and rodents are all possibilities.

Treatment: A flock can be medicated with a sulfa drug (sulfonamides, especially sulfadimethoxine, sulfaquinonxalene, sulfamethazine, and sulfaquinoxalene) or vaccinated, or both, to stop mortality associated with an outbreak. It must be noted, however, that sulfa drugs are not FDA approved for use in pullets older than 14 weeks or for commercial laying hens. Sulfa drugs leave residues in meat and eggs. Antibiotics can be used, but require higher levels and long term medication to stop the outbreak.

Prevention: On fowl cholera endemic farms, vaccination is advisable. Do not vaccinate for fowl cholera unless you have a problem on the farm. Rodent control is essential to prevent future outbreaks.

Pullorum

Synonyms: bacillary white diarrhea, BWD

Species affected: Chickens and turkeys are most susceptible, although other species of birds can become infected. Pullorum has never been a problem in commercially grown game birds such as pheasant, chukar partridge, and quail. Infection in mammals is rare.

Clinical signs: Death of infected chicks or poults begins at 5–7 days of age and peaks in another 4–5 days. Clinical signs including huddling, droopiness, diarrhea, weakness, pasted vent, gasping, and chalk-white feces, sometimes stained with green bile. Affected birds are unthrifty and stunted because they do not eat. Survivors become asymptomatic carriers with localized infection in the ovary.

Transmission: Pullorum is spread primarily through the egg, from hen to chick. It can spread further by contaminated incubators, hatchers, chick boxes, houses, equipment, poultry by-product feedstuffs, and carrier birds.

Treatment: Treatment is for flock salvage only. Several sulfonamides, antibiotics, and antibacterials are effective in reducing mortality, but none eradicates the disease from the flock. Pullorum eradication is required by law. Eradication requires destroying the entire flock.

Prevention: Pullorum outbreaks are handled, on an eradication basis, by state/federal regulatory agencies. As part of the National Poultry Improvement Program, breeder replacement flocks are tested before onset of production to assure pullorum-free status. This mandatory law includes chickens, turkeys, show birds, waterfowl, game birds, and guinea fowl. In Florida, a negative pullorum test or certification that the bird originated from a pullorum-free flock is required for admission for exhibit at shows and fairs. Such requirements have been beneficial in locating pullorum-infected flocks of hobby chickens.

Necrotic Enteritis

Synonyms: enterotoxemia, rot gut

Species affected: Rapidly growing young birds, especially chickens and turkeys 2-12 weeks of age, are most susceptible. Necrotic enteritis is a disease associated with domestication and is unlikely to threaten wild bird populations. Necrotic enteritis is primarily a disease of broilers, roasters and turkeys. Ulcerative enteritis, on the other hand, commonly affects pullets and quail.

Clinical signs: Initially there is a reduction in feed consumption as well as dark, often blood-stained, feces. Infected chickens will have diarrhea. Chronically affected birds become emaciated. The bird, intestines, and feces emit a fetid odor

Transmission: Necrotic enteritis does not spread directly from bird to bird. Bacteria are ingested along with infected soil, feces, or other infected materials. The bacteria then grow in the intestinal tract. Infection commonly occurs in crowded flocks, immuno-suppressed flocks, and flocks maintained in poor sanitary conditions.

Treatment: The clostridia bacteria involved in necrotic enteritis is sensitive to the antibiotics bacitracin, neomycin, and tetracycline. However, antibiotics such as penicillin, streptomycin, and novobiocin are also effective. Bacitracin is the most commonly used drug for control of necrotic enteritis. As with all drugs, legality and withdrawal time requirements must be observed.

Prevention: Prevention should be directed toward sanitation, husbandry, and management.

Ulcerative Enteritis

Synonyms: quail disease

Species affected: Captive quail are extremely susceptible and must be maintained on wire-bottom pens or on preventive medications. Chickens, turkeys, partridges, grouse, and other species are occasionally clinically affected.

Clinical signs: In quail, the disease is acute with high mortality. In chickens, signs are less dramatic. Acute signs are extreme depression and reduction in feed consumption. Affected birds

sit humped with eyes closed. Other signs included emaciation, watery droppings streaked with urates, and dull ruffled feathers. Accumulated mortality will reach 50 percent if the flock is not treated.

Transmission: Birds become infected by direct contact with carrier birds, infected droppings or contaminated pens, feed and water. Bacteria are passed in the droppings of sick and carrier birds. Infection can be spread mechanically on shoes, feed bags, equipment, and from contamination by rodents and pets.

Treatment: Bacitracin and neomycin can be used singly or in combination. Other antibiotics and drugs such as tetracyclines, penicillin, Lincomycin, and Virginomycin are also effective. Consult a veterinarian for dose, route, and duration of treatment.

Prevention: Ulcerative enteritis is difficult to prevent in quail. When quail have access to their own droppings, this disease commonly occurs. To eradicate, depopulate stock, thoroughly clean and disinfect, and start over with young, clean stock.

Botulism

Synonyms: limberneck, bulbar paralysis, western duck sickness, alkali disease

Species affected: All fowl of any age, humans, and other animals are highly susceptible. The turkey vulture is the only animal host known to be resistant to the disease.

Clinical signs: Botulism is a poisoning causing by eating spoiled food containing a neurotoxin produced by the bacterium CLOSTRIDIUM BOTULINUM. Paralysis, the most common clinical sign, occurs within a few hours after poisoned food is eaten. Pheasants with botulism remain alert, but paralyzed. Legs and wings become paralyzed, and then the neck becomes limp. Neck feathers become loose in the follicle and can be pulled easily.

If the amount eaten is lethal, prostration and death follow in 12 to 24 hours. Death is a result of paralysis of respiratory muscles. Fowl affected by sublethal doses become dull and sleepy.

Transmission: Botulism is common in wild ducks and is a frequent killer of waterfowl because the organisms multiply in dead fish and decaying vegetation along shorelines.

Decaying bird carcasses on poultry ranges, wet litter or other organic matter, and fly maggots from decaying substances may harbor botulism. There is no spread from bird to bird.

Treatment: Remove spoiled feed or decaying matter. Flush the flock with Epsom salts (1 lb/1000 hens) in water or in wet mash. It has been reported that potassium permanganate (1:3000) in the drinking water is helpful. Affected birds can be treated with botulism antitoxin injections.

Prevention: Incinerate or bury dead birds promptly. Do not feed spoiled canned vegetables. Control flies. Replace suspected feed.

Staphylococcus

Synonyms: staph infection, staph septicemia, staph arthritis, bumblefoot

Species affected: All fowl, especially turkeys, chickens, game birds, and waterfowl, are susceptible.

Clinical signs: Staphylococcal infections appear in three forms—septicemia (acute), arthritic (chronic), and bumblefoot. The septicemia form appears similar to fowl cholera in that the birds are listless, without appetite, feverish, and show pain during movement. Black rot may show up in eggs (the organism is passed in the egg). Infected birds pass fetid watery diarrhea. Many will have swollen joints (arthritis) a nd production drops.

The arthritic form follows the acute form. Birds show symptoms of lameness and breast blisters, as well as painful movement. Birds are reluctant to walk, preferring to sit rather than stand.

Bumblefoot is a localized chronic staph infection of the foot, thought to be caused by puncture injuries. The bird becomes lame from swollen foot pads.

Transmission: STAPHYLOCOCCUS AUREUS is soil-borne and outbreaks in flocks often occur after storms when birds on range drink from stagnant rain pools

Treatment: Novobiocin (350 g/ton) can be given in the feed for 5–7 days. Erythromycin and penicillin can be administered in the water for 3-5 days or in the feed (200 g/ton) for 5 days. Other antibiotics and drugs are only occasionally effective.

Prevention: Remove objects that cause injury. Isolate chronically affected birds. Provide nutritionally balanced feed

FEEDING THE CHICKS

First 4 weeks

During the first 4 weeks: Chicks for layers are fed on Chick mash whereby for Broilers are fed on Broiler mash

Both of them are well compounded feeds and contain a mixture of Food substances and antibiotics

Feeding Growers

When chicks reach 5 weeks old they are called growers and are fed on Growers Mash for Layers and Broiler Mash for Broilers.

Broilers:

They are fed on Broiler Mash until they are ready for slaughtering

The food should be of the right quality and quantity to make them heavy enough for slaughter during 7 – 8 weeks.

Poor quality feeds of low quantity makes the birds to take longer time to become big enough for slaughter.

Layers:

They are fed on Growers Mash until 5 months old where the feed is changed to Layers complete

Meal (Layers Meal) gradually.

Start with a mixture of Growers Mash and Layers Mash

As days pass reduce the proportion of Growers Mash and increase Layers Mash

After 1 week feed the birds with Layers Complete Meal only

Supplementary Feeds

Broilers and Layers should be provided with supplementary feeds such as:

Green Vegetables or Green leaves of Legumes e.g. beans, Lucerne etc to provide protein (legumes) and Vitamin A (green leaves)

The feeding is done by tieing the leaves with ropes and hangs them in the poultry shed

IV. POULTRY DISEASES AND PARASITES

Ill health: Is a condition in which birds are unwell? Ill health in Poultry can be detected through visible signs such as appearance: Birds become abnormal, appetite and Feeding; A sick bird is reactant to feed and swallow with difficult.

Defecation; Diarrhea / water, blood stained faces or contaminated with worms segment indicating diseases.

Mucous discharge; Due to respiratory and digestive system problems the birds would discharge mucous through nose or mouth

DISEASES;This is a condition in which an individual's physical and psychological state shows diversion from a normal state

CAUSES OF DISEASES

Diseases may be caused through the following causes:- Nutritional causes

Excess feed to birds may cause rapture of stomach, diarrhea and constipation while under feeding in the other hand results into starvation and nutritional.

Living organisms

These are of two groups

Infectious diseases

These are caused by micro organisms e.g. bacteria, virus, fungus etc Parasitic diseases: This group include External parasites (Ectoparasites)

These live outside the body of a bird e.g. flies, lice mites etc

Internal parasites: (Endo parasites)

These are found inside the body of the bird such as alimentary canal e.g. tape worms

MISCELLANEOUS DISEASES

VICES

These are undesirable habits of poultry.

Types:

i. Cannibalism
ii. Egg eating
iii. Toe Pecking
iv. Feather pecking

CAUSES

i. Overcrowding of birds because fighting/cannibalism
ii. High temperature and lack of Ventilation
iii. High light intensity
iv. Low protein level
v. Insufficient salts and other essential minerals in the food. Starvation

CONTROL

i. Keep the correct number of birds in the house to reduce fighting for food and water
ii. Supply green feeds to the birds by hanging them in the poultry house to reduce mineral deficiency
iii. De- beak the birds when and weeks old
iv. Supply feed with enough minerals and protein
v. Reduce light intensity in the poultry house
vi. Provide enough waiters and feeders to reduce scrabbling and fighting.

NUTRITIONAL DISORDERS

VITAMIN A:

Deficiency causes Nutritional rupee condition in which the birds have yellow- white pustules in the mouth

VITAMIN D:

Calcium (Ca) and Phosphorus deficiency causes sickest.

PARASITES IN POULTRY

i. Internal or ectoparasites
ii. External end parasites

- Generally external parasites bites the chicken on the body surface and suck blood causing the birds to scratch themselves by beak and toes. Examples, lice mites fly etc.
- Internal parasites suck blood in the alimentary system resulting to loss of blood, pale combs and wattles and diarrhea examples tape worm, Roundworm, caecum worm, thread worm

LIVESTOCK FEEDS AND FEEDING

Concepts of feeds and feeding

Feeds : There are materials given to animals so as supply nutrients

Feeding : This is a process of supplying animals with feeds

Feed stuff : These are materials which are included in the diet of farm animals

Balanced diet: These are feed supply having the right proportion of nutrients

Compounding of feeds: This is a process of mixing several feed stuffs to make up a balanced diet.

Feed nutrients which are required by livestock Livestock require six types of feed nutrients mainly: Carbohydrates

Animal body require energy in order to maintain body temperature warm as well as conducting body activities and assist in production e.g. milk and eggs.

Grains, root tubers are rich in starch while grasses are rich in fibers. Starches and fibers are good source of Carbohydrates

Fats; Oils and Fats are a good source of energy

Fats are important also in facilitating the intake of vitamin A, D, E and K Proteins:

- Is important for growth and repair of worn out tissues
- Is important in making livestock products e.g. eggs, wool, milk, meat etc
- Is important in the formation of antibodies and enzymes, hormones, skin, hairs, feathers.

Vitamins; they are essential for health and growth of animals

Act as a catalyst for many processes in the body, Promote growth, Formation of bones, Important in protection against diseases, Assist in blood clotting, Help in muscular activities Minerals: include

Calcium - Chlorine

Sodium - Iron

Sulphur - Copper

Zinc - Manganese

Potassium - Phosphorus

They are essential in health, growth, reproduction and development

Water:

i. For transportation of digested food
ii. For keeping the body cool
iii. For removing waste materials from the body

Classification of Feeds in Livestock

Basing in their nutritive value and moisture content, feeds in animals can be classified as follows:

- Concentrate Roughage's Succulents Concentrates Feeds
- They are highly nutritive as they are rich in Carbohydrates and protein
- They contain little indigestible fiber and dry

Protein concentrates

Include Fish meal, bone meal, bone meal, sunflower cake, cotton seeds cake, Lucerne etc

Energy concentrates: Include sorghum, maize, oats, wheat etc

Specific concentrates:

These are concentrates which contain vitamin and minerals mixed together Sometimes called vitamin and mineral premises or supplements.

Roughage's:

- These are high fiber content feeds – 18% C.F
- These include pasture grasses, straws and hay are good examples
- These are main feeds for ruminant animals.

Succulents

- These are high moisture content feeds; most of them are plant origin
- They include, green plants, such as elephant grass, fresh cassava tubers, fresh potato etc
- They have very low nutrient content, but high water content

Livestock feed Rationing

Ration: This is a combination of feed stuff which is fed to a particular animal in order to meet its daily nutritional requirement e.g. draught animal's egg production, meat production etc

Balanced ration:

This is a ration that supply nutrients needed for maintenance and production in correct amount and proportion.

It contains is made up of various feed stuffs. Maintenance ration:

This is the amount of ration required by an animal per day in order to live

Production ration:

This is a ration fed in addition to maintenance ration in order to supply nutrients needed for production of e.g. wool, eggs, milk etc

Factors to consider when making balanced ration

(i) Age of an animal

Young animals Grower animal Mature animal

(ii) Production of animal products; Eggs, Wool, Meat, Fatty etc

(iii) Types of animals

a) Ruminants
b) Non – ruminants (iv) Body size Light breeds Heavy breeds

(v) Breeding

Parent stocks

(vi) Energy producing animals

Drought animals

Mixing Rations in the Farm

There are several methods that can be used in ration formulation such as

(i) Person's square method

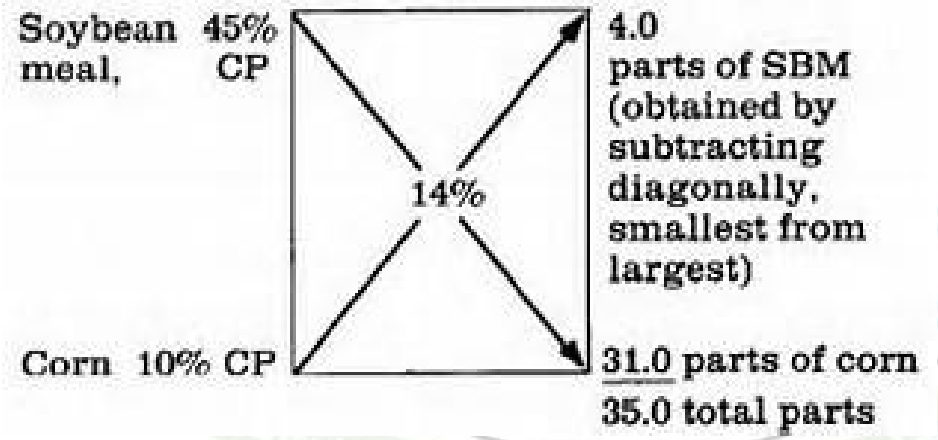
(ii) Simultaneous equation method

(iii) Simple variable method

Pearson's square method

Procedure

(i) Draw a square as shown below;



ii. Determine the protein percentage of the ration which you want to prepare. Place this protein % in the Centre of the square e.g. 14%
iii. Place the % percentage of protein in the protein supplement on the upper left hand corner of the square e.g. 45% (see diagram)
iv. Place the % percentage of protein, present in the grain on the lower left hand corner of the square e.g. 10% (see diagram)
v. Subtract the figures along the diagonal NB Subtract the small number from the large number (Do not mind about negative or positive sign)
vi. The number you obtain represents the pasts of each food stuff.

a. Supplement and

b. Protein stuff 45-14=31 parts 45-14=4 parts

In termed of 4/35x100=11.4kg and 31/35x100=88.5kg Weight (kg) in 100kg ration.

On the other hand if percentage by weight is required in this case for example 80% protein and 20% other materials e.g. Vitamins and Minerals, then

8/18X80% =36% and 10/18x80%=44% Protein supplement

FODDER CONSERVATION

Facture: This is a crap consisting of grass and legumes sown and used for feeding animals e.g. guinea grass Kikuyu Grass, wholes grass, star grass, tegument etc.

During wet season grass and their heritage plans grow well in pastures. On the other hand in the dry season plants do not grow well because of drought. Hence there is a necessity of preserving pastures which is in excess so no to be fed in dry season i.e. Fodder conservation.

4:0 FARMING BUSINESS ECONOMICS AND AGRICULTURAL EXTENSION

PRICE AND ITS DETERMINANTS (PRICE THEORY)

This is a form in economics which describes the relationship supply, Demand and price of goods and services,

DEMAND.

This refers to the quantity of goods and services that consumers are willing to buy at a particular price and go on buying in a given/particular period.

PRESENTATION/REPRESENTATION

Demand Schedule.

This refers to the list of the quantities of a commodity (good) or service that re bought at different prices.

Such a schedule must show clearly the situation it refers i.e. should state the people whom it refers time, place and any other conditions which will help to distinguish it from any other demand schedule.

Example DEMAND SCHEDULE FOR GREEN MAIZE AT MIKUMI MARKETING 2004

PRICE THS/COB	QUANTITY PURCHASED(OF COBS)
AT5.00	8000
6.00	7000
7.00	6000
8.00	5000

9.00	4000
10.00	3000
11.00	2000
14.00	500

Demand curve; this refers to graphical presentation of the demand schedule after plotting the data above, one gets a demand curve.

The price- demand quantity demanded relationship

The law of Demand; States that, as price of a commodity or service rises, always is followed by a seduction in quantity demanded, and a fall in price, always is followed by an increase in quantity demanded while other factors/conditions of demand remain constant i,

Usually this law is proved by the down ward sloping of the demand curve.

Change in Demand; when there is a change in demand it means that at each price, a different quantity is purchased then was previously done. This can be an increase or decrease in demand. In this case, when there is an increase in demand the whole curve shifts to the right and when there is a decrease in demand the whole curve shift to the left.

Example: Demand Schedule for oranges at Kisanga Market in March June and December 2004.

Price Tsh/orange	QUANTITY BOUGHT		
	MARCH(D1)	JUNE(D2)	DECEMBER(D3)
1.00	8000	10,000	6000
1.50	7000	9000	5000
2.00	6000	8000	4000
2.50	5000	7000	3000
3.00	4000	6000	2000
3.50	3000	5000	1000
4.00	2000	4000	500

Demand curves for oranges at Kisanga Market in March June and December 2004

FACTORS WHICH CAUSE CHANGES IN DEMAND

i. Changes in tastes and habits of consumers

When tastes and habits of consumers change in favor of a curtain commodity, the demand for that commodity increases when the opposite occurs, the demand for a given commodity diseases

ii Changes in consumer's income

When the income of consumers rise, the demand for a particular product may either rise of fall and vice versa.

For some products, an increase in consumer's incomes leads to rise in demand while other products such cases may lead to decrease in demand.

iii. Changes in the price of goods in question

Generally when the price of a certain good rises, the demand for such a good decreases and vice versa

iv. Changes in the price of other goods (Complementary goods.)

When the price of other goods rises, consumers tend to buy more quantities of a good which has a relatively lower price, especially for complementary goods e.g. Maize flour and Rice.

v. Changes in population

An increase in population may lead to an increase in demand for agricultural products e.g. food.
Elasticity of Demand (Ed)

This is a measure of how the quantity of a good or service demanded, changes when the price of that commodity or service changes.

It is expressed as:-

Ed = %change in Quantity of a good

% change in price

Categories of Elasticity of demand (Ed)

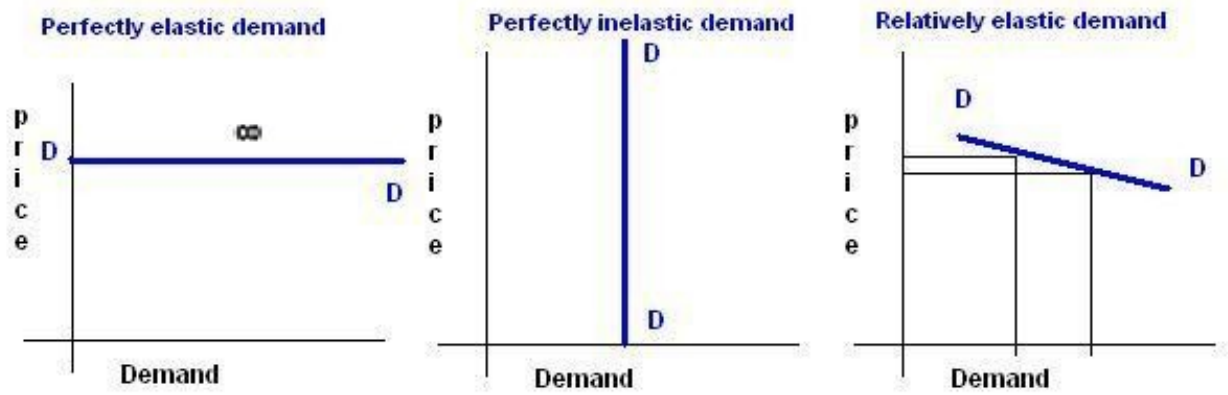
a) Elastic demand Is achieved when Ed is greater than one I.e. >1

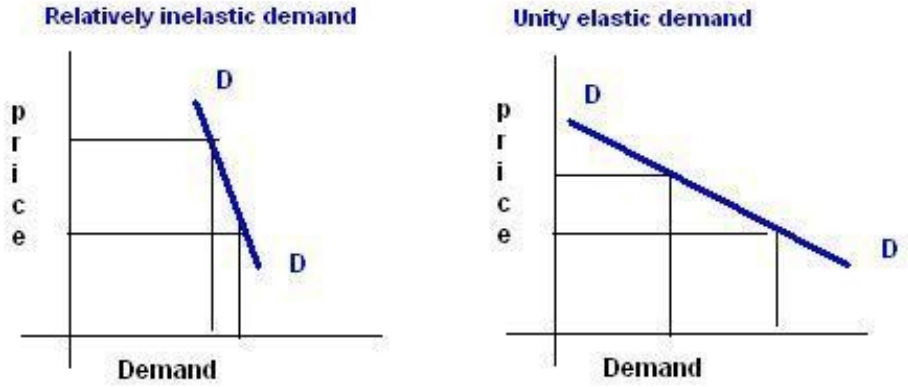
b) Inelastic demand

This is achieved when elasticity of demand is less than one i.e. Ed<1

C) Unit /Unitary elastic demand.

This is achieved when elasticity of demand is equal to one Ed=1





Example: Demand Schedule for tomato source

Price of Tomato source/bottle	Quantity demanded per week.(bottles)
160.00	1000
140.00	2000
110.00	3000
100.00	8000
80.00	9600
60.00	14000
40.00	16000
20.00	2000

Question: when prices fall from 160/= to 140/= demand extends from 100 bottles to 200 bottles.

Ed = 1000-2000x100

100

Hence Ed = -8 inelastic demand

Question: when prices fall from 40/=- 20/= demand expands

From 16000 – 2000 bottles

Ed = 16000- 2000 x100

16000

40-20x100

40

Hence Ed = 0.5 inelastic

FACTORS WHICH DETERMINES ELASTICITY OF DEMAND OF GOODS

I. Presence of goods and services with a lot of close substitutes have more elastic demand than those with few or no close substitute

II. Demand of essential commodities is usually inelastic e.g. salt, match boxes

III. Demand for luxury goods and services are usually more elastic than necessity goods and services.

SUPPLY

This is the quantity of a given commodity or service that producers are able to produce and are willing to offer for sale at a given price.

PRESENTATION

i) Supply Schedule.

This is a list or table showing the quantities of a commodity or service that are offered for sale at different prices

Example: Supply schedule for maize by peasants at Mikumi Market 2005

PRICE OF COB ob)	Quantity(Q) OF COBS
50	250
40	220
30	180
20	120
10	50

SUPPLY CURVE

This is the graphical presentation of supply Schedule

Law of supply

As the market price increase the quantity supplied of commodities increase while decrease/fall in price always results to decrease in commodity supplied

Factors causing changes in Supply

I. Climatic factor (Weather) Good weather results to high yield hence great supply.

II. Occurrence of pests and disease this reduces yields of agriculture commodities

III. Changes in the price of commodity. As the price increase, the quantity supplied increases and vice versa.

IV. Change in production cost when production costs rises production becomes law hence low supply and vice versa.

V. Change in technology used in production

VI. New production technology may increase production hence increase supply.

VII. Occurrence of was or other hazard

VIII. Occurrence of was or other hazards this may disrupt production to be low hence low supply.

IX. Government regulation e.g. taxation if tax is high for a return commodity production will decrease which leads to lows supply.

X. Change is taste and habit when this occur farmers may be stimulated to produce more of the other commodity leading to increase in its supply than the other one.

Change of supply.

When there is a change in supply it means that at each prices a different quantity is supplied than previously. When there is a decrease in supply the whole supply curve shift to the left and when there is an increase in supply the whole supply sure shift to the right.

Example supply schedule for manager by peasants at Kariakoo market in March June and december 2006.

price	QUALITY		
Tsh/mango	MARCH	JUNE	DECEMBER
1.00	2000	3000	1000
1.50	3000	4000	2000
2.00	4000	5000	3000
2.50	5000	6000	4000
3.00	6000	7000	5000
3.50	7000	8000	6000

Elasticity of supply (E)

This is a measure of how the quantity of a good or service change when the price of that commodity or service changes. i.e.

$$Es = \frac{\%\text{ change in Qt supplied}}{\%\text{change in price}}$$

Example: The supply of salt falls from 50kg to 20kg as a result price per kg increased from 10/= to 20/= per kg calculate elasticity of supply.

$$Es = \frac{50-20}{50} \times 100$$

$$\frac{10-20}{50} \times 100 = {}^{3}/_{5} = -0.6$$

Hence Es = -0.6

NB: As in the case of elasticity of demand; elasticity of supply has also three categories:

I. When Es is less than one (ES<I) the supply is inelastic

II. When Es is greater that one (ES>I) the supply is elastic.

III. When Es is equal to one (Es=i) the supply is said to be unit/unitary elastic.

PRICE

This is a measured of value (work per unit of Agriculture good as service.

Functions of price

I. Price inform producer what to produce and how much to produce

II. Price help consumers to decide what to buy and how much to buy.

III. Price a measure of value per unit of a good or service.

IV. Price help in the allocation of scarce resources such as facture of production.

V. Price distributed goods and service among consumers according to supply and demand

VI. Price help to determine the amount of investments and earning that people can make (profit or loss)

VII. Price guider goods and service so that they are available at the right place and at the right time when they are wanted by the consumers.

Types of Agriculture price.

a. There are 4 main types of agricultural prices mainly.

Market price: There represent the actual value of goods and services.

- They are determined by the forced of demand and supply Categories of market price.

i. Farm gate price (producer price) these are prices which farmers receive when they sell their farm products at the farm boundaries.

ii. Whole sale price these are prices which are paid by traders pay when they buy goods in large quantities. Such traders who are buying in large quantities are known as whole sales.

iii. Retail price: These are prices which retail traders receive when they sell goods are consumers.

NB: Retail traders (O2 retailers) are middlemen who receive or buy goods from whose sales and all them at retail price.

b. Shadow prices: This is the opportunity cost of a commodity as good. Price which exist under pure and perfect competition.

c. Price at factor cost These are price which are determined the factors of production that were used in producing that good.

d. Import or export parity prices These are price which is paid by importers when importing a given good or commodity

Price fluctuation.

The price of Agriculture produced normally moves up and down over time. This process occurs in cycles.

This rising and falling of price over time in called price fluctuation.

Types of price

i. Short term price fluctuation: This is the rising and falling of prices which occur from years to year month to month week to week, hour to hour etc. Such movements are caused by temporary changes in supply and demand.

- Most of the commodities are perishable e.g. milk, eggs vegetables etc.

ii. Long time price fluctuation: These are fluctuations which occur over generation resulting from long term changes of demand and supply.

- These are caused by change in population technology and real incomes of consumers.

iii. Amount price fluctuations: these are fluctuations which occur years to year caused by change in yields and level of production, due to weather and other factors.

iv. Seasonal price fluctuations: These are fluctuations which is brought about by annual crop production whereby during planting weeding supply is low and prices becomes high; while during harvesting, supply in high and price decreases.

v. Cyclical price fluctuations: These are fluctuations which occur in regular patterns or cycles during the production of perennial crops e.g. coffee and some livestock e.g. pigs and poultry.

- These fluctuations are brought about by cycles in the level of production whereby production decision in done in cyclic manner. For example the producers of pig this year may fetch high price hence next plan year production in increased: but due to long production period there may be a delay in increased output. When the products states of come large quantities may arise coming decrease in price.

Assignment.

Read and write other causes of price fluctuation Ref: Basic Agro economics (K sibuga) pg 35-36

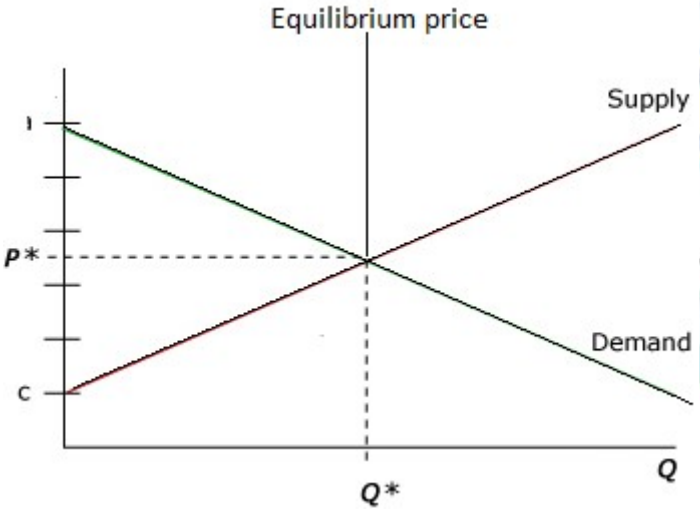
i. Problems caused by price fluctuation pg 36
ii. Price control stabilization

MARKETING.

This refers to the movement of row agriculture products from the farm to the ultimate consumer.

This includes: - Storage, transportation, grading standardizing, processing, packaging labeling, advertizing etc.

Equilibrium price-This is a market condition whereby quantity supplied and quantity demanded at market place are the same.



Example Demand and supply schedule related price.

DEMAND (Millions of bags)	PRICE/90KG Buying price	SUPPLY Million of bags
0.85	80.00	3.70
1.20	75.00	3.60
1.70	70.00	3.45
2.30	65.00	3.25
3.00	60.00(Eq.price)	3.00 Equilibrium point
3.80	55.00	2.70
4.70	50.00	2.35
5.65	45.00	1.95
6.75	40.00	1.50
7.90	35.00	1.00

FACTORS OF PRODUCTION: Ref chapter 4 which a farm wants to produce any farm pg 13
products he has to use input or sources of which they are of different types. These factors are divided into 4 groups collectively known as factors of production.

These factors include:-

- Land
- Labour
- Capital
- Entrepreneurship (management)

This includes all the natural resources which are found in a particular place such as soil and its minerals. Rivers, lakes, pests, venation, climate itself etc.

Characteristics of land as a factor of production.

- The quantity and quality of the land of a place determine the type of informing which can be done in that particular place.
- Different area of Tanzania has different type of land as such different place is suitable for different type of forming.
- The amount and distribution of rainfall are the main factor limiting the use of land of Tanzania.

Importance of land.

o It is a source of raw materials such as coal, oil for power, rivers for Hydroelectricity power etc which could be used in the country or exported for exchange.

o It is a source of food and agriculture materials which are necessary for both domestic consumption and for export.

Land Tenure systems

This refers to the procession of right to the use of land. Forms of land tenure systems adapted in Tanzania.

i. **Individual land tenure systems** : These include

a. Individual owner operator system: This implies forming on the land the individual process individual right.

- Here the farmer has greatest possible degree of freedom of choice of his production plan.
- This system tends to prevail in highly populated areas such as Kilimanjaro region.
- This system provide greatest incentive to effect forming and in conservation and improvement e.g. Agriculture credit.

b. Land lordism/tenancy tenure system. This system of tenure involves ownership of land by relatives few individuals who leave its operation to tenants to form the land for sent.

c. Estate/plantation land tenure system.

This form involves estates or plantations which are owned by individual foreigners or joint venture between foreign investment and individual shares.

- They are often involved in large scale production of single commodities/good such as sisal tea, tobacco, coffee, sugarcane etc.

ii. **Collecting land tenure system.**

a. Communal tenure system. This is the possession of right over land by the whole community.

- Each individual makes as much as he wants' from the land without any incentive to receive or to improve the land.
- This system is prevalent in most pastoral area as well as mixed primary area; and unlimited land in relation to the community needs.

b. Cooperation tenure system: This category includes various collective arrangements under governmental or other authority.

- Here farmer may own their land individually but operate them on a cooperative basic.
- The whole land unit may be operate in a communal basic e.g. ujamaa farmer in Tanzania.

Land reform\This is any organized action designed to improve the structure of land tenure and land use.

Aim: To alter way as to achieve the most efficient use of agriculture resources.

Measures under land reforms: includes

a. Redistribution of land: This involves taking land from a few individuals who own large area of land and relocation/redistribute to tenants etc. e.g. transfers of land ownership from wealthy Europeans owners to poor citizen.
b. Consolidation and registration of holding: Individual land ownership fragment are brought together and given a title dead in suspect of holding.
c. Land use and conservation control: Government may intervene where traditional land use pattern leads to overstocking over cultivation and subsequent soil deterioration in such cases measures are imposed by the government to ensure that land is contently consisted.
d. Planed transfer of population: Transfer of population from sparely population residents transferred to Lindi as Morogoro regions

LAND CAPABILITY CLASSES

- In farming every piece of land hex to be used without being raided or undergoing any other types of deterioration. The best way to determine the suitable use of any piece of land is to consider it capabilities and its limitation.
- land capability includes all good properties e.g. good drainage fertile soil moderate ph values: sufficient soil depth good climate good water holding capacity and less risk of erosion
- Land limitation include all bad properties e.g. steep slope poor drainage presence of toxic substances presence of socks, poor climate too acidity or alkaline etc.
- Hence land is classified according to its capability and limitation as follows:

Land class I: This class has soil with very few limitations that may prevent its use

- Characterization: land is almost level (flat)
    - Have deep well drained soil
    - The soil are naturally fertile and if not they give crop yield when manure are applied
- Have high water holding capacity
- Soils give good result for many years with minimum crop husbandry e.g. use of fertilizers, crop rotation etc.

LAND CLASS II: This class has soil with some limitations which prevent the use of land for growing certain crops

Characterization: The land has gentle slope

- Has inadequate soil depth and restricted drainage
- They may have light to moderate alkalinity and salinity condition
- The land is subjected to moderate erosion
- Soil structure and soil workability are not equal

NB: Because of these limitations: Class II soil requires better management rotation etc

LAND CLASS III: This class has soil with serious limitation which allow only few types of crops to be grown

Characteristic: Have shallow soil depth

- Have low water permeability of soil
- Very low soil fertility
- Moderately alkaline soils
- Moderate steep slopes encourages erosion

NB

Because of these limitation class III soil require the application of the most management practice than in class I.

LAND CLASS IV

Land in this class has soil that can be used for cultivation of only few crops

Row crops are not suitable due to possibility of erosion hence close spaces crops are suitable.

Characterization

- Have soil with low water holding capacity
- Have steep slopes which are subject to soil erosion
- Have shallow soil
- Have poorly drained soil
- Soil have plenty of salt i.e. too alkaline or acidic

NB:

Due to this limitation soil in class IV Require move intensive management practice: and few crops can be grown.

LAND CLASS V: This type of land is not suitable for cultivation of any crop as there is serious limitation

Characterization

- Have stone and rocks in the soil
- Have poor drained soil
- Have too short rain season not suitable for crop production
- Have possibility of floods from rivers and steam

NB: Due to these limitations such land is only suitable for development permanent pasture

LAND CLASS VI:

This type of land has soils which are not suitable for cultivation. They have limitation that are similar to those of class V; however in this case limitations are more serious

The best use for such land is mainly for pasture range management or else the land should be left as a wood land

LAND CLASS VII:

Has soil with limitations similar to classed V& VI but the limitation are serious that even pasture improvement is not possible. The land can be used for wild life or left as a wood land.

LAND CLASS VIII:

Soil in this class is mainly rock sand beaches etc. they are complete not suitable for crop production. Is only suitable for wildlife, catchment areas, recreation etc.

II. LABOUR- This refers to the human physical and mental services employed in the production process. Labour varies in skills as some lack any skill while others are highly skilled.

Labour input is usually measured in unit of man hours or man days. This represents the work input of t he average man for one hour/day.

Characteristics of labour as a factor of production.

- Labour is supplied only by livings especially human being; as such it involves social problem.
- Labour is not transferable between people i.e. the ability to do work canno t be transferred from one period to another.
- Labour can within limit choose what to do. This means that human being can decide on what to do on particular days or how long to work if they are not notified with working conditions, or get tired they may refuse to work to be done on the farm.

Categories of labour

Labour has been categories into two main groups mainly

1) Family lab our: this consists of members of a family and is organized by the head of the family when is the main operator. Since member is of different ages in the family; labour tasks are assigned according to age and ability.

2) Hired lab our. There are two types of hired labor

   a. Casual lab our: This type supplement family and permanent lab our, when there is a lot of work to be done on the farm.

- It is usually hired as agreeable terms in relation to the amount of work in task to be done.

b. Permanent labour: The need of permanent lab our doe

c. Depend on the nature and size of the farm enterprise.

Method of improving lab our productivity.

a. Training the lab our force. This may take place in training centers, field day agriculture shows (e.g. name) workshop, seminars etc.

b. Supplying to workers proper tools and Equipments:

Using farm machinery e.g. fracture drawn equipments (egg) ploughs, harrows welders act) milking machines, spraying machines etc.

c. Living incentives: These are things given workers without much supervision e.g. attractive salaries medical facilities, housing security, rewinds etc.

iv. CAPITAL

These are man-made assess which are used to produce other goods or assist other factors of production e.g. land and labour to produce. Capital increase productivity of land and lab our. Characteristics of capital as a factor of production.

- Capital results from the accumulator of assess over the years, through saving by a person or people.
- Capita is largely man-made by using his labour power and natural resources.

NB: Form assert: This include all those things which are present in the farm e.g. buildings machinery, livestock crop produce act.

Depreciation: This refers to the date of wearing out of an assent in the farm. All long life farm assets such as machinery buildings act, continue to exist in the farm for fairly long period determine in time either through natural wearer hence need replacement.

Investment: This is a process of utilizing saving generated from agriculture to acquire assets used for production activities.

Categories of capital.

a. Long-term class of capital (fixed capital) this includes all long life assets such as machinery building structure acts.
b. Medium term class of capital (working capital) these are assets which can be used for production.
c. They cannot stay for a long time, since they are used up completely in the production process e.g. Feeds, seeds fertilizer, pesticides et
d. Shark term class of capital (liquid capital) Refers to capita which can easily and quickly changes to money. They include have cash, money in bank, debts payable act.

Ways of capital investment.

a. By saving: capital may be accumulated by saving income during production.
b. By purchasing: This include acquisition of asset e.g. purchasing building or machinery.
c. Physical effort: individual effort through hard working.

IV. MANAGEMENT (Entrepreneurship)

This is the process of planning and diction making in the organization of other factors production so as to minimize total loss and maximize total profile (revenue) in the production process.

Factors of management or entrepreneurship.

Management activities take into account of utilizing the manager who combine and organize other resource appropriately. Hence the manage helps:-

i. Short term planning: This involves making quick decision when urgent operations are implemented e.g. crop or livestock infected by diseases.
ii. Long term planning: These involve decision which is linked to the future plans and operation on the farm e.g. constriction of dips fence purchases of farm machinery etc.
iii. Information gathering: Such information includes price market trend production technique, production constraints weather condition, disease outbreak soil condition labor trend etc.
iv. Keeping farm record up to date and using hem in day to day management of the farm.
v. Risk evaluating and bearing which results from his decision action e.g. fire outbreak loss or damage of an asset etc.

Management process

The following steps are importance in decision making

I. Recognition/identification of the problem

II. Observation and collection of relevant fact (data collection)

III. Analysis and specification of alternating iv. Crisis of alternative (i.e. risk bearing)

5.0 SOILS ITS AGRICULTURE UTILIZATION

SOIL FORMATION

This can be defined as the genesis or evolution of the soil from the parent rock material.

- The process is continuous and is taking place through the action of weathering process on the parent rock materials being physical, chemical and biological activities in nature.
- As the process of weathering take place the parent rack material is broken down into smaller units which then become mixed up with organic matter water air and living organisms to make up the soil.

SOIL PROFILE

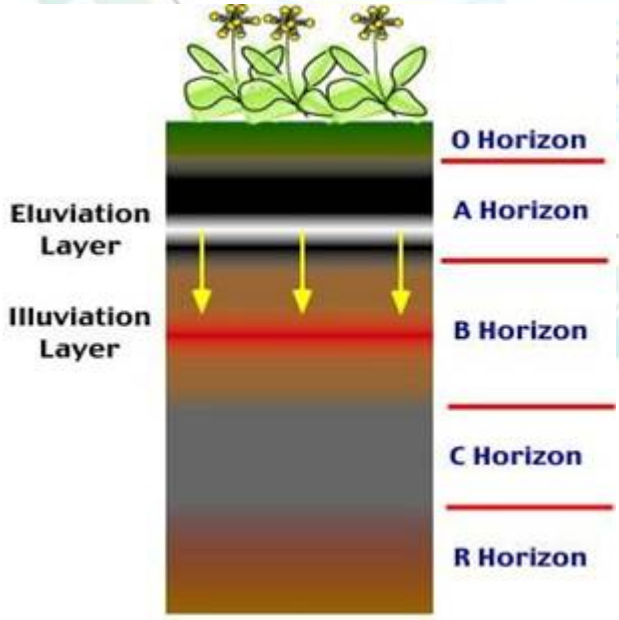
If a hole of about 4m deep is dug in the soil, it is possible to see several horizontal layers of soil which differ in depth colour as well as organic matter content.

1. O horizontal – Organic horizontal

2. A horizontal

3. B horizontal – Mineral horizontal

4. C horizontal



- A soil showing such layers is said to be STRATIFIED and each layer in called a STRATUM OR HORIZON.
- The whole vertical section of such layers is called soil profile.
- The SOIL PROFILE can be defined as a vertical section through the soil from the surface to be underlying unweathered materials (or bedrock) consisting of several horizontal layers differing in physical chemical and biological properties.

Characteristic of soil profile; Soil horizontal: The horizontal found in the soil profile are general divided into 4 main groups.(NB): The number of horizontal depends on the age of the soil i.e. the older the soil, the greater number of horizontal.

I. O horizons (Organic horizons)

- There are found on the surface of the soil above the mineral soil.
- These are farmed from remains of dead plants and animals.
- The uppermost part is called O1, sub horizon and below is O2 sub horizons.
- The original forms of animal and plant material in O1 can be seen by naked eye, while 02 organic matter is more decomposed then the original forms of animal and plant
- Material cannot be easily seen.

II. Aâ€– horizons or horizon of eluviations

These are horizon that lie below O horizons and are generally leached (Eluviation) and donated as A1 A2 A3.

- A1 is darker in color due to organic matter.
- A2 is composed of day oxides of iron and iron have been washed away and deposited down the B HORIZONS.

III. B horizons or horizon of eluviations

- These are horizon which is below a horizon.
- They contain materials washed from A and O horizons and have accumulated (i.e. illuviated) and ar e donated by B1 B2 B3

- In this horizons day oxide of iron and aluminum are deposited after being washed away from horizon above

IV. This is the zone of the soil where very little weathering or no weathering has taken place.

- It is unconsolidated bedrock weathered slowly to give rise to soil particles.
- Below this horizon it the consolidated bed rock.

IMPORTANCE OF SOIL PROFILE

- Good soil profile facilitates good plant growth.
- Facilitate drainage aeration and penetration of plant roots e.g. a deep and well structured profile hold more water than shallow one also deep rooted plant require a deep soil.
- Likewise hard Pans and impervious layers in the soil profile slow down the rate of water movement plant root growth, root distribution as well as air movement.

PHYSICAL PROPERTIES OF THE SOIL

Meaning: This refers top physical characteristics in a given soil divided from physical force interaction in the development of the soil. The resulting effect renders characteristic properties to soil which can be described in physical terms as:-

a. Soil structure
b. Soil texture
c. Soil cloud
d. Soil density
e. Soil porosity
f. Soil water
g. Soil temperature

SOIL TEXTURE

This is the relative proportion of soil separate i.e. sand salt and day particles or relative proportion of soil particles of different diameter in the soil.

Therefore clay soil particulars with less than 0.002mm diameter

Silt – Soil particles ranging from 0.002x-0.02mm

Sand - Soil particles ranging from 0.002x-0.02mm

Gravel - Soil particles ranging from 0.002x-0.02mm

Importance of soil texture

I. Determine the rate of water movement: This varies with the finesse of the soil texture.

II. Soil fertility i.e. the finer the texture of the soil the greater is its fertility.

III. Root penetration where the surface of the soil is loops textured.

This is the arrangement of individual soil particles within the soil and subsequent arrangement of this aggregation in the soil profile.

Types of soil structure

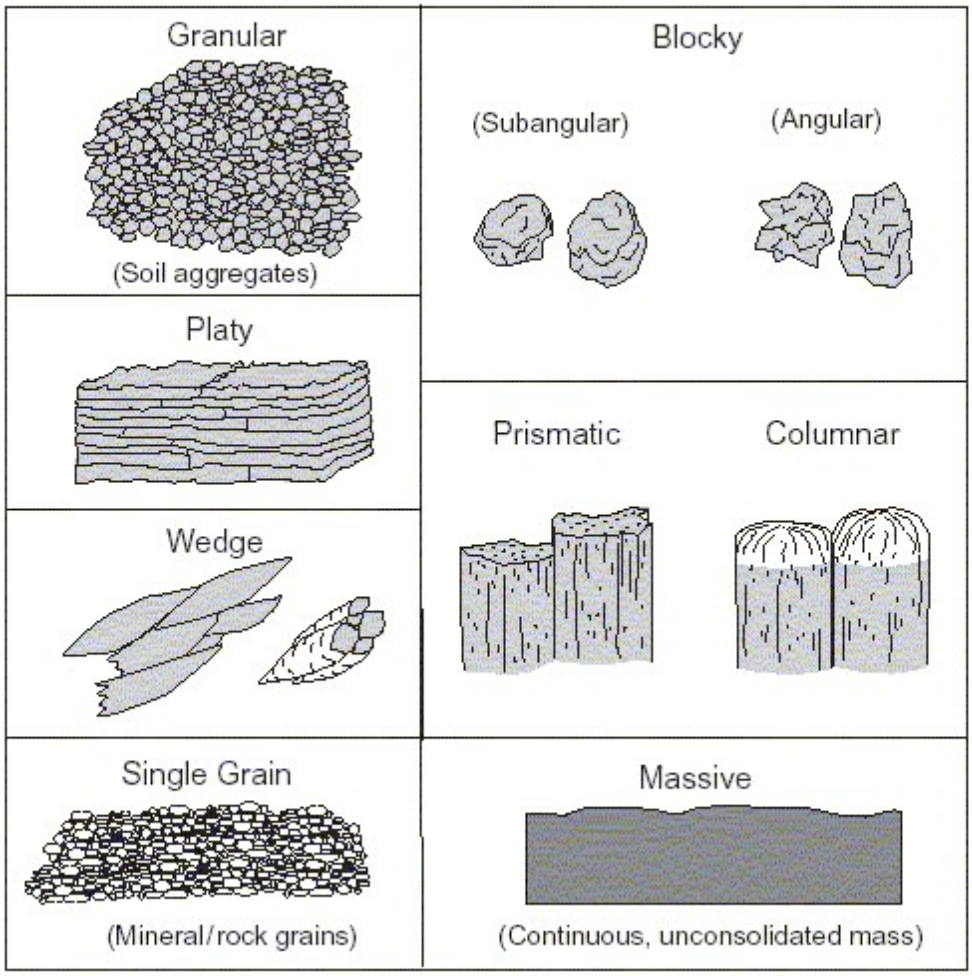
I. **Single grained structures**: In this type of structure, each soil particle in not cemented to any other soil particle example of which is sand.

II. **Massive structure**: In this the soil particle are cemented together to form aggregates or pad. These pads may be in different forms.

These pads (aggregates) are bound together by organic matter and substances such as mucilage and gums decomposition. Through this binding we get different shapes as:-

i. Plate like structure (platy) in this type the soil particles are formed into plate like aggregates that are arranged horizontally in the soil.
ii. Such structure can reduce penetration of air water and roots. Is very common in horizoA.
iii. Prism-like structure: In this type the pads are arranged vertical in some soils.
iv. They have sharp pointed ends (tops)
v. Columnar-like structure: These are prim like structure which has rounded tops.

Examples of Soil Structure Types



NB: Broth of them are found in horizon B

- Blocky structure: These are made up of equal amount of flat and upright unit which easily fit together.
- They can further divided into:-

Angular blocky: This is when the angles of the sides of the pads approach 900 (right angle).

Sub angular blocky: These are blocks whose angles of the pads are sharps than 900.

Sheet like structure: These are types usually loose and never more than 1-2 cm in diameter. These sphere like aggregated are characteristics of many surface soil in horizon A especially those high in organic matter.

They may have two types; depending on the porosity of the aggregation.

- Granular like These are non-porous
- Crumby like-These are porous

Importance of soil structure

Soil structure influence almost all plant growth factors e.g. water supply; creation availability of plant nutrients microbial activities; seed germination root penetration. e.t.c.

Characteristics of a good structure of soil.

i. Stability: Soil stability is a power of resistance against disintegrating force of water and physical action such as wind.
ii. Facilitate porosity: Assist creation downward water movement.

Improving soil structure

- Soil structure is liable to change under different management practices such as tillage (pouching) liming fertilizer application maturing and drainage system improvement soil structure in the soil horizon.

SOIL COLOUR- Refers to various colours which may compact in the soil mass.

- Usually all colours except pure blue and green occur in the soil.
- Such colors include, white yellow, grey Brown red and black.
- Color can be an indicator of climatic condition parental materials of the soil.

Importance of colour

- Affect temperature hence regulation soil moisture retention.
- Determines the productivity of the soil e.g. black colored soils have high productively compared to white or seed colored soil.

SOIL TEMPERATURE-Temperature is extremely important of the soil.

- It affects plant growth directly and influence moisture, aeration, structure, microbial activities along with decomposition of plant/animal residues and availability of plant nutrient i.e.

Low temperature has the following effects:

i. Slow enzyme reaction thus decrees metabolic activities.

ii. Plant cell partiality decreases.

iii. Root elongation is retarded limiting the ability to search for water and nutrients.

iv. Affect used germination of different special.

SOIL WATER

Water plays an important role in the soil plant system. These include:

- It is are vent and a carries of plant nutrients in the soil
- It is essential for photosynthesis.
- It is a constituent of protoplasm.
- It maintains turgidity and body temperature of a plant cell.
- Affects weathering of rocks will formation and soil.

MOISTURE CLASSIFICATION

The forces with which water is held in soils determine its availability to plants. Forces of adhesion hold water strongly to mineral and humus surfaces and less strongly to itself by cohesive forces. A plant's root may penetrate a very small volume of water that is adhering to soil and be initially able to draw in water that is only lightly held by the cohesive forces. But as the droplet is drawn down, the forces of adhesion of the water for the soil particles make reducing the volume of water increasingly difficult until the plant cannot produce sufficient suction to use the remaining water. The remaining water is considered unavailable. The amount of available water depends upon the soil texture and humus amounts and the type of plant attempting to use the water. Cacti, for example, can produce greater suction than can agricultural crop plants.

The following description applies to a loam soil and agricultural crops. When a field is flooded, it is said to be saturated and all available air space is occupied by water. The suction required to draw water into a plant root is zero. As the field drains under the influence of gravity (drained

water is called gravitational water or drain-able water), the suction a plant must produce to use such water increases to 1/3 bar. At that point, the soil is said to have reached field capacity, and plants that use the water must produce increasingly higher suction, finally up to 15 bar. At 15 bar suction, the soil water amount is called wilting percent. At that suction the plant cannot sustain its water needs as water is still being lost from the plant by transpiration; the plant's turgidity is lost, and it wilts. The next level, called air-dry, occurs at 1000 bar suction. Finally the oven dry condition is reached at 10,000 bar suction. All water below wilting percentage is called unavailable water.

SOIL DENSITY

This refers to the relationship between weight and volume of a given soil mass.

Types of soil density.

i. Particle density (P.D)

This refers to the weight per unit volume of the solid portion of the soil mass. It is not affected by the fines and arrangement of soil particles. Hence

$$P.D = \frac{\text{Weight of soil solids (gm) gm}}{\text{Volume of soil solids (cc) cc}}$$

Generally for mineral soil the range of P.D may be from 2.40-2.75g/cc. But accepted volume for normal soil is 2.65g/cc.

b. Bulk density (B.D)

This refers to the weight per unit volume of the total volume of the soil occupied by both solids and pore spaces. It is given as:-

$$B.D = \frac{\text{Weight of the soil g/cc}}{\text{Volume of soil}}$$

- The B.D of soil is always small then than its P.D
- Normally sand soil have B.D between 1.2.-1.80g/cc and peat soil 0.5g/cc
- The magnitude of B.D decreases with finess in tenure.

Porosity.

This term refers to the percentage of the soil volume that is occupied by water and air.

- Since water and air occupy the non-solid space of the soil; the arrangement of the soil particles in the soil, determines the total pone space to a great extent.
- Soil porosity (% pore space) is calculated as follows:-

  % soil space +% pore space =100

  % pore space =100-% solid space. But.

$$\% \text{ solid spec} = \frac{\text{Bulk density}}{\text{Particle density}} \times 100$$

Hence

$$\% \text{ pore space} = 100 - \frac{BD}{PD} X100$$

OR

$$\% \text{ PORE SPACE (POROSITY)} = 10\left(1 - \frac{BD}{PD}\right)$$

Soil porosity varies with texture, shape of individual particles structure, organic matter content and compactness of the soil.

- Sand soil has large pores but % porosity is small due to great P.D while fine textured soil have high % porosity due to high B.D

TYPES OF SOILS IN TANZANIA

Types of soil commonly found in Tanzania are:-

- Volcanic soil
- Sand so clay soil
- Clay soil
- Sand soil
- Loam soil clay loam soil
- Stony soil
- floury soil
- Red plateau soils
- Alluvial soil
- Colluvial soil.

Sand soil: These are particles lying loosely to each other as such easily eroded by water or coined.

Characteristics:

- Well aerated
- Easy to cultivate (light soil)
- Have low water holding capacity.
- Have low nutrient supply/status in supper layers due to high leaching.
- Good for deep rooted crops.

Types of crops grown: Cashew nuts, coconuts, pineapples etc.

Clay soil (35% clay)

Characteristics

- Have fine pores thus have moderate to poor aeration and drainage.
- High moisture retention
- Difficult to cultivate (heavy soil) Types of crops: Rice and sugar cane.

Sand clay/loam sand.

- This soil contains clay and sand in almost equal proportion.
- It is composed of approximately 40% sand 40% site and 20% clays
- They are ergonomically the most important kind of soil as they are ideal for the majority of agriculture crops.

Volcanic soil

These types of soil are located in volcanic mountain such as Kilimanjaro, Meru, Monduli, and Rungwe. Types of crops: Bananas, maize, beans, coffee, tea and sugarcane.

Colluvial soil

These soils are located in the bottom of mountain ships such as Uzambara and Ulluguru mountains. Crops grown: Bananas, maize, beans, coffee, tea and soil. vii. Red platedux soil.

Types are located in arid and semi arid areas e.g. central zone of Tanzania –Dodoma, Singida and Shinyanga. Crops grown Sorghums, Millets Groundnut and grapes.

Alluvial soil.

These are located in big river bases such as Ruaha, Rufiji, Ruvu. They are very fertile.

Crops grown: rice maize banana cotton sugarcane tropical fruits etc.

Floury sand soils.

These are mainly located in the western part of the country e.g. Kigoma and Tabora. They are generally low in fertility is low soil fertility (or infertile)

Crops grown: Sorghum, Millets, Maize, Groundnuts, Cassava, Sweet potatoes and tobacco.

The end