MAHARSHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD, PUNE

SEMESTER END EXAMINATION

B.Sc. (Hons.) Agriculture

MODEL ANSWER PAPER

Semester : I (New) Term: I Academic Year: 2022-23
Course No: AGRO-111 Title: Fundamentals of Agronomy-I
Credits : 2 (1 + 1)
Day & Date: , / /2023 Time: Total Marks: 40

Note: 1. Solve ANY EIGHT questions from SECTION "A"
2. All questions from SECTION "B" are compulsory.
3. All questions carry equal marks.
4. Draw neat diagrams wherever necessary.

SECTION "A"

Q.1 Elaborate the term 'Agronomy' and state the relation of agronomy with other sciences. 04

Ans. Agronomy

Definition: is the branch of agriculture, which deals with the principles of crop production and field management. 01

OR

Definition: Agronomy is the branch of agricultural science, which deals with principles and practices of soil, water and crop management.

Meaning of term Agronomy:

The term Agronomy is derived from the Greek words "agros" meaning the field and "nomos" meaning to manage. So Agronomy means the study of plant, soil and related sciences for improvement, production and use of field crops. 01

Relationship of Agronomy with other allied sciences:

Agronomy is an applied science and it is closely related and largely dependent on basic and other applied sciences.

Agricultural Chemistry:- Agronomy would need the help of fertilizer chemistry when there is question of fertilizer application to crop. The soil science knowledge is helpful for management of acidic, saline and alkali soils. 02

Plant pathology: - Plant pathology is related with Agronomy for management of diseases of crops and knowledge of Microbiology is essential for use of bio-fertilizers.

Agricultural Entomology:- Agricultural Entomology is related with Agronomy for management of pests (harmful insects) on the crops.

Agricultural Economics: - Developed from economics and useful for maintaining farm records, farm accounts and marketing of various farm products. Economic analysis also determines benefit cost ratio, net profit fetched.

Agricultural Extension:- It is related with different methods techniques for transfer of the

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advanced agro-techniques to the farmers. Extension worker act as a bridge between farmers' problems and scientists as farmers problems are brought to scientists and new advanced technologies are given to farmers by extension workers.

Agricultural Botany:- It includes plant morphology, plant physiology and plant breeding. This science is useful for evolving varieties / hybrids of the crops suitable for particular region.

Agricultural Engineering:- It is concerned with care and use of improved tools implements and farm machinery required for carrying out various field operations and also use of micro-irrigation system for different crops.

Animal Science and Dairy Science:- Mainly concerned with Agronomy for management of livestock maintained on the farm including their feeding and care. These enterprises are combined with cropping systems to form farming system.

Horticulture: - It is concerned with vegetables, flowers and fruit production. These crops can be introduced in the cropping scheme of the form for proper land utllization and increasing receipts or production.

Agroecology:- is the management of agricultural systems with an emphasis on ecological and environmental perspectives. This area is closely associated with work in areas of sustainable agriculture, organic farming, alternative food systems and development of alternative cropping systems.

Agro-forestry:- Mainly concerned with selection of suitable multipurpose and economic tree species and agro-forestry systems for different eco-units.

Q. 2 Define tillage. Enlist types of tillage and explain in detail the objectives of tillage. 04

Ans. Tillage

Definition: It is the mechanical manipulation of soil with tools and implements for loosening the surface crust and bringing about conditions favorable for germination of seed and the growth of crops. 01

Or

Definition: Tillage of the soil consists of breaking the hard compact surface to a certain depth and other operations that are followed for bringing the soil in a good physical condition (fine tilth) for proper crop growth.

Types of tillage 01

1) Preparatory tillage
2) Seedbed preparation
3) Inter tillage or Inter culture or after tillage.

Objectives of tillage

1) To make the soil loose and porous: This will enable rain or irrigation water to enter the soil easily and less loss of rainwater and soil due to runoff and erosion. Due to adequate proportion of micro–pores the sufficient amount of water will be retained in the 02

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soil for crop growth and less losses of water due to percolation

2) To aerate the soil: It enables the metabolic process of living plants, microorganisms to continue properly. Due to adequate air and moisture, desirable chemical and biological activities would go on at greater speed. This would result in rapid decomposition of organic matter and making plant nutrients available to crops.

3) To have repeated exchange of atmospheric air with the soil air: The soil air and atmospheric air have more or less the same amount of oxygen i.e. about 20-21%, but the CO2 in atmospheric air is hardly about 0.03% whereas, the soil air contains 0.2 to 0.3% CO2 i.e. about 8 to 10 times more than the atmospheric air. Therefore, it is necessary to introduce fresh air in the soil to keep the CO2 concentration under check by suitable tillage operations.

4) To increase the soil temperature: This can be achieved by maintaining proper amount of air water in the soil and also by exposing the soil to the heat of sun. The optimum soil temperature in active root zone of crop is necessary for proper functioning of plant roots and useful microorganisms in the soil.

5) To control weeds: This is one of the major functions of tillage or an important object of tillage. Weeds are enemies of crops as they compete with the crops for plant nutrients, moisture, space and sunlight, which will result in poor crop yields. Therefore, management of weeds with suitable tools and implements is the definite advantage of tillage.

6) To remove stubbles of previous crops: The deep tillage helps in removing stubbles of previous crop and other sprouting materials like bulbs, stolons etc. and in making clean seedbed.

7) To destroy insects: Insects are either exposed to the sun's heat or to birds that would pick them up. Clean cultivation is useful for control of pests like sorghum and paddy stem borer, cotton bollworm etc. Similarly, some harmful grubs or cutworms can be destroyed by proper tillage operations. Thus, clean cultivation means a pest and pathogen free environment.

8) To break hardpan: Tillage with specially designed implement such as sub-soil plough (chisel plough) is often useful to break hardpan if any, formed just below the ploughing depth. This is helpful for better penetration of roots in deeper layers and also for maintaining proper drainage in soil. It also increases soil depth for water absorption.

9) To incorporate organic manures and fertilizers in the soil: Organic manures such as F.Y.M. or compost and fertilizers should not be only spread on surface of soil, but properly incorporated (mix thoroughly) into the soil for minimizing the loss of plant nutrients.

10) To invert the soil to improve fertility: By occasional deep tillage the lower layer of soil which is less fertile comes to top while upper layer rich in organic matter and plant nutrients goes down, thus plant roots can get benefit of rich layer.

11) To prepare seedbed for germination of seeds and growth of crop: Finally it is necessary to prepare the suitable seedbed as per requirement of crop and soil for good germination and emergence of the crop and also for proper growth and development of the

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crop achieving higher crop yields.

The most important objects of tillage are seedbed preparation, weed control and soil and water conservation. The other objectives are improvement of soil structure, soil permeability, soil aeration, root penetration, destruction of pests, soil inversion etc.

Q.3 **Define seed. Explain in detail the multiplication stages of seed.** 04

Ans. **Seed**

Definition: Any material used for planting and propagation, whether it is in the from of seed of food, fodder, fibre and vegetable crops or seedlings, tubers, bulbs, rhizomes, roots, cuttings or grafts and other vegetative propagated material is defined as seed. 01

Multiplication stages of seed

1) Nucleus seeds: It is produced and maintained by the respective plant breeder at the main research station. The plant breeder selects seed of individual plants with true morphological and genetically characters of variety of a particular crop. These seeds are of high genetically purity and being very small in quantity are often costly.

2) Breeders' seeds: It is very important class of seed. They are the seeds or vegetative propagating materials directly produced or controlled by the originating plant breeder or breeder institution. It is multiplied at the receptive research station and if required on other research farms, agricultural college farms, etc. The seed is multiplied under strict supervision and the standing crop is inspected from time to time, off types, mutations, and other mixtures may be rouged out before their seed maturity for avoiding cross-fertilization and also to prevent admixture during threshing, drying and storage etc. 03

3) Foundation seeds: They are direct increase of breeder's seed and multiplied on research farms, agriculture college farms and Taluka seed farms. The seed plot is required to be registered at office of the seed certification officer of that respective area. The seed certification authority staff insect the plot from time to time. The off type plants, disease and pest affected plants and weeds are removed for avoiding their mixture in seed. As per seed act, the seed is tested for its purity, germination and moisture percentage. If the foundation seeds fulfil all above requirements only then it is processed in seed processing plant (unit) and it is bagged, tagged and supplied for further multiplication.

4) Registered seeds: Registered seeds are the progeny of the foundation seeds, which are multiplied on the farms of registered growers (progressive farmers) under guidance and supervision of the seed certification staff. The seed is tested for purity, germination and moisture content as per the standard specified for the particular crop. The produce is bagged, tagged and given further multiplication. If the quantity of foundation seed is less than requirement then this stage of seed multiplication is fallowed.

5) Certified seeds: The term certified seed production is widely used to denote the production of commercial seed sold to the farmers for raising crops. The foundation seeds or registered seeds are further multiplied on the farms of registered growers under the guidance and supervision of seed certification staff. Care is to be taken to remove off

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types, disease pests affected plants and weeds for avoiding their mixture in seed. The seed is tested for its purity, germination and moisture content as per the seed certification standards. After the satisfaction of seed certifying agency, the seed is bagged, tagged and later on distributed to the cultivators for commercial cultivation of crops through co-operative agencies.

Q.4 Define plant ideotype. Describe in detail various types of ideotypes. 04

Ans. Plant ideotype

Definition: It is a biological model, which is expected to perform or behave in a predictable manner within a defined environment. 01

Types of ideotype:

I. Isolation ideotype: An isolation ideotypes are also known as space-planted ideotypes which have the potential to perform better when they are planted in a defined row- to-row and plant-to-plant spacing. In case of cereals isolation ideotype is free tillering, leafy spreading plant that is able to explore the environment as fully as possible. It is unlikely to perform well at crop densities.

II. Competition ideotype: The competitive ideotypes are those ideotypes which perform well in genetically heterogeneous population rather than in a homogenous population. In case of cereals competition ideotype is tall, leafy, free tillering plant that is able to shade its less aggressive neighbor and thereby gain a layer share of nutrients and water.

III. Crop ideotype: This ideotype perform best at commercial crop densities because it is a poor competitor. 03

IV. Market ideotype: These ideotypes includes traits like seed colour, seed size, cooking and baking quality etc. So these ideotypes have their importance in improving the quality of the food grain or a product which may fetch higher price in the market and gave more remunerative returns per rupee of the invested money. These ideotypes focus on an improvement of the product quality and to make the product highly acceptable and to give higher monetary returns.

V. Climatic ideotype: They include traits important in climatic adaptation such as heat and cold resistance, maturity duration, drought resistance etc. Therefore, these are the ideotypes which perform better under stressed conditions by making modification/alterations in the genetic makeup to make them more adaptable under harsh climatic conditions.

VI. Edaphic ideotype: They include traits importance in soil adaptation viz., salinity tolerance, mineral toxicity/deficiency tolerance etc. The plant ideotype, which exhibit alteration in their genetic behavior so as to make them more comfortable under edaphic (soil) stress conditions.

VII. Stress ideotype: The stress ideotypes shows resistance to biotic and abiotic stress, disease/pest resistance ideotype, drought resistance etc. i) Abiotic stress - Drought resistance, Mineral stress, Heat and cold resistance. ii) Biotic stress – Disease resistance.

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Insect-pest resistance.

A drought-tolerant variety is one that produces a high grain yield relative to other cultivars under drought stress.

Q.5 Enlist the methods of sowing of agronomic crops and explain any one in detail. 04

Ans. Methods of sowing 01

1) Broadcasting
2) Drilling or Line sowing
3) Dibbling
4) Transplanting
5) Planting
6) Putting seeds in plough furrow

Broadcasting:

It means scattering seeds by hand all over the field and then covering it by soil with the help of light implement like wooden plank or blade harrow.

Advantages:

1. It is the quickest and cheapest method of sowing.
2. This method can be adopted in moist condition of soil also.

Disadvantages: 03

1. It requires more seed per hectare
2. Crop stand is not uniform, as required spacing is not maintained.
3. Germination is gappy and defective when adequate moisture is not available in soil.
4. Interculturing with the help of implements is not possible.

This method is followed in crops like carrot, coriander, leafy vegetables and fodder crops such as Lucerne, berseem etc.

Drilling or Line sowing :

In this method the indigenous seed drill, two bowl seed drill or mechanical seed drill is used for dropping seeds into the soil and then seeds are covered with the help of wooden plank or blade harrow.

This method is adopted for sowing the crops like jowar, bajari, hill millets, upland rice, wheat, oats, barley, soybean, gram, black gram, green gram, safflower etc.

Advantages:

1. Seeds are placed at proper and uniform depth.
2. Less seed-rate is required as compared to broadcasting method.
3. The spacing between crop lines are maintained uniformly.
4. Interculturing with implements is possible.
5. Sowing is done at the correct soil moisture level.
6. Uniform stand of the crop maintained by carrying out timely gap filling operation.

Disadvantages:

1. The seed drill can be used when soil moisture is optimum or at Vapasa condition.

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2. Plant to plant spacing within a line is not maintained.
3. Skilled person is required for sowing.

This method is adopted for sowing the crops like jowar, bajari, hill millets, upland rice, wheat, oats, barley, soybean, gram, black gram, green gram, safflower etc.

Dibbling :

In this method the field is marked with the help of marker as per the spacing requirement of the crop and required number of seeds are dibbled at each cross or hill with the help of manual labours.

Advantages:

1. The spacing between crop lines as well as plants within a line is maintained.
2. Seeds are placed at desired depth.
3. Optimum plant population of the crop can be maintained for getting higher crop yields.
4. Croswise intercultivation with the help of implements is possible.
5. Less seedrate is required.

Disadvantages:

1.It is slow method and requires more labours and hence cost of sowing is high.
2.It requires strict supervision.

This method is followed where costly seed is used or spacing is more or size of the seed is big e.g. groundnut, hybrid cotton, maize, castor, hybrid-jowar etc.

Transplanting :

In this method seedlings are raised in the nursery beds for a period of about 3 to 5 weeks depending upon type of the crop and then transplanted in the field.

In this method less area is required for raising the seedlings so it saves initial cost on cultivation of crop. Advantages and disadvantages are similar to dibbling methods.

e.g. rice, tobacco, onion, brinjal, tomato, cabbage, chillies etc.

Planting :

Some of the crops are sown by using vegetative plant parts and the method of sowing in such crops is known as planting.

e.g. Sugarcane is planted by using setts, turmeric by mother setts, ginger by rhizomes and fruit crops like fig and grapes by cuttings, potato by tubers, onion for seed purpose by bulbs, garlic by cloves.

The advantages and disadvantages are similar to dibbling except the seedrate required is more as the vegetative plant parts are used for planting.

Putting seeds in plough furrow :

This method is followed for crops like gram in some areas for better utilization of residual soil moisture.

The seeds are dropped behind the plough in the plough furrow with the help of manual labour is covered by successive turn of ploughing.

This method is not commonly followed for sowing the crop.

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Q.6 Define planting geometry. Enlist its types and describe the factors affecting planting geometry. 04

Ans. Planting geometry

Definition: Planting geometry refers to shape of space available for individual plants.

Or It is the pattern of distribution of plants over the ground. 01

Or It is the optimum space or distance to be kept in between two crop lines in case of drilled or line sown crop

Or The arrangement of the plants in different rows and columns in an area to efficiently utilize the. natural resources is called planting geometry.

Types of planting geometry.

Square planting

Rectangular planting 01

Sole planting

Paired planting

Skipped row planting

Strip planting

Factor affecting planting geometry:

1. Type of crop : crops with branching or spreading habit require more spacing. e.g. spacing for castor, cotton, tobacco, etc is more. Crops with errect growing habit and small size of plant and without branching habit require less spacing.

e.g. spacing for rice, wheat, oats etc. is less. 02

2. Variety of the crops: Spreading varieties of crop require more spacing than erect growing varieties of the same crop. e.g. Spreading varieties of groundnut and redgram require more spacing than erect varieties.

3. Purpose of sowing: Jowar crop sown for grain purpose requires more spacing (45cm) but for fodder purpose requires less spacing (30cm.)

4. Type of Soil: Heavy soils – more spacing due to vigorous growth of crop.

Light soils – less spacing due to less growth of crop.

Q.7 Define growth and development. Explain the growth curve in detail. 04

Ans. Growth

Definition: An irreversible change of a cell, organ or whole organism is called as growth.

Or Growth is irreversible increase in size or weight. It is attained mainly by photosynthesis less what is lost through respiration. 01

Development

Definition: It's a whole series of changes which an organism goes through during its life cycle.

Or The development of a plant from germination to maturity can be considered as a series of discrete periods, each identified by an accompanying process of change in the structure, 01

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size or weight of specific organs.

Growth curve

Growth of a plant can be expressed in different equations or models. Growth curve (Sigmoid growth curve) – All plants pass through various stages of growth. Growth is best expressed by means of a curve plotted against time. Growth curves are helpful in understanding the general pattern of growth. The S-shaped or sigmoid curve is typical of growth pattern of individual organs, of a whole plant and of population of plants.

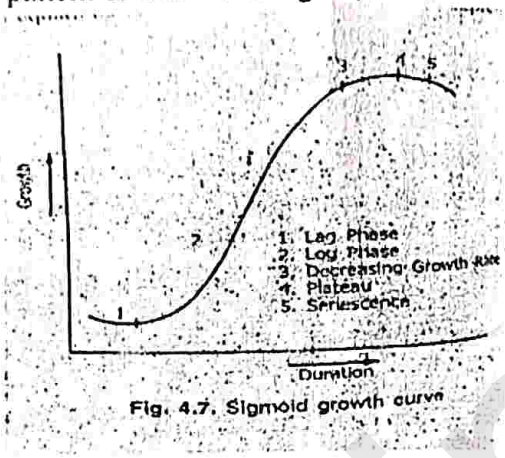

Fig. 4.7. Sigmoid growth curve

02

It consists of five distinct phases:

Lag phase: An initial lag period during which internal changes occur that are preparatory to growth. The increase in size or weight is very slow or negligible during this period.

Log phase: It is followed by log phase or log period of growth or the grand period of growth during which growth is very fast. The logarithm of growth when plotted against time is a straight line during this phase.

Diminishing phase: Subsequently, a phase in which growth rate gradually diminishes.

Stationary/ Plateau phase: At plateau, organism reaches maturity and growth ceases.

Senescence phase: Senescence and death of organism sets in, giving rise to another component of the growth curve.

Q. 8 What do you mean by weed? Write the classification of weed on the basis of ontogeny with suitable examples. 04

Ans. Weed

Any plant not sown in field by farmer is out of place is known as weed. 02

Or Weed is a plant growing at a place and time where it is not desired.

Or A plant that is extremely noxious, useless, unwanted or poisonous.

The weeds compete with crop plants for plant nutrients, moisture, space and sunlight, but also interfere with agricultural operations, increase cost of tillage, reduce quality of farm produce and reduction in crop yields. The extent of yield reduction depends upon the time, duration and weed intensity and it is more where the crop infested with particularly root parasitic weed.

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e.g. Cynadon dactylon (Hariayali), Cyperus rotundus (Lavala), Argemone maxicana (Piwala Dhotara), etc.

Classification of weeds according to life cycle (Ontogeny)

1. **Annual weeds:** They complete their life cycle within one year or season. 02

a) Kharif annuals/ Kharif weeds: They appear with the onset of monsoon (June, July) and complete their life cycle when rainy season is over (Oct. or Nov.) e.g. Cock's comb, dudhi, math, chimanchara, parthenium.

b) Rabi annuals/ Rabi weeds: They complete their life cycle during winter season (Oct./Nov. to Feb.) e.g. Chandan batawa (Chenopodium album), Ghol (Portulaca oleracea) wild oat (Avena fatua)

c) Summer annuals/ Summer weeds: They complete their life cycle during summer season (Feb. to May). Majority of the kharif season weeds grow during summer season in irrigated farming. e.g. Parthenium, dudhi etc.

d) Ephemerals: The short- lived annual weeds are called ephemerals e. g. Hajardani- (Phyllanthus niruri). This weed completes its life cycle within a very short period of 2 to 4 weeks.

2) Biennial Weeds: They take at least two years or two seasons to complete their life cycle. They complete their vegetative growth in first year or season and produce flowers and seeds in next year or season e.g. Wild carrot- Daucas carota, Wild onion-Asphodelus spp., Jangali gobhi - Launea spp.

3) Perennial Weeds: They continue or grow for more than two years or several years. They may propagate by seed or vegetative parts or both.

i) According to root system:

a) Shallow rooted perennials (Roots: 20 to 30 cm. deep)- e.g. Hariali- Cynodon dactylon, Quack grass- Agrophyron repens.

b) Deep rooted perennials (Roots one metre or more deep) e. g. Nut grass- Cyperus rotundus, Johnson grass - Sorghum halepense, Acacia spp, Wild ber, etc.

ii) According to mode of reproduction:

a) Simple perennials: Reproduce mostly by seeds. e. g. Ghaneri- Lantana camara, Acacia- Acacia spp. Wild ber - Zizyphus spp.

b) Bulbous perennials: Propagate by underground parts like bulbs, rhizomes, tubers etc. as well as seeds. e. g. Cattail (Pankanis) – Typha spp. Nut grass or Nut sedge - Cyperus rotundus, Johnson grass- Sorghum halepense

c) Creeping perennials: Spread by lateral extension of the creeping above ground stem or roots or by seeds. e. g. Hariali- Cynodon dactylon, Ambooshi - Oxalis latifolia.

Q.9 Define fertilizer. Write in detail the methods of manure and fertilizer application. 04

Ans. Definition:

Any natural or manufactured material dry or liquid added to the soil order to supply one or more plant nutrients. 01

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Methods of manures and fertilizers application are as follows:

I) Application of fertilizers in solid form:

A) Broadcasting: Spreading of manures and fertilizers evenly and uniformly all over the field and then mixing with soil by tillage implements is called broadcasting. To apply larger quantities this method is useful.

i) broadcasting at sowing or planting: Broadcasting is done at the time of planting or sowing of the crops. 03

ii) Top dressing: Broadcasting of fertilizers in the standing crop is known as top dressing. The fertilizer should be given between rows of the crops and not on the plants for avoiding scorching of leaves.

B) Placement: - In this method, fertilizers are placed in the soil irrespective of the position of seed, seedlings or growing plants before sowing or after sowing the crops.

i) Plough sole placement: Fertilizer is placed in a continuous band in the bottom of the furrow at the time of ploughing in moist soil zone where it can become more available to growing plants during the dry season.

ii) Deep placement: In this method, the fertilizers are applied in the plough furrow in the dry soil before flooding. It is mixed thoroughly in the active root zone of the crop by piddling.

iii) Sub soil placement: Placement of fertilizers in the sub soil with the help of heavy power machinery is known as sub soil placement. This method is useful for application of phosphatic fertilizers such as rock phosphate in acidic soils in humid and sub humid regions.

C) Localized placement: Application of fertilizers in the soil by taking into account the position of seed, seedlings or growing plants. Fertilizers are placed in bands or pockets. This method reduces fixation of phosphorus and potassium.

i) Contact placement: Drilling of fertilizer and seed together while sowing i.e. placing of seed and fertilizers in the same row. The greatest hazard of this method is that the seed germination may sometimes be affected.

ii) Band placement: Fertilizer is placed either continuous or discontinuous bands. Application of fertilizer in discontinuous bands is known as 'hill placement'. It is most useful for widely spaced crops e.g. fruit crops, vegetables etc. Application of fertilizer in continuous bands is known as row placement. It is most useful for crops like – Sugarcane, Potato, Maize, Cotton, Tobacco etc.

iii) Pellet application: In this method, the nitrogenous fertilizer is applied in the form of pellets 3 to 5 cm. deep between two rows of the paddy crop. Urea Super Granules (USG) is also conveniently placed in rice.

iv) Side dressing: The fertilizers are spread in between the rows or around the plants. e.g. Maize, Sugarcane, Tobacco etc. In fruit trees like Banana, Grape, and Mango, it is known as hill application or ring method.

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II) Application of Fertilizers in Liquid form: -

A) Starter solution: Solutions of fertilizers consisting N, P2O5 and K2O in the ratio of 1:2:1 or 1:1:1 are applied to young seedlings at the time of transplanting. The starter solution helps in rapid establishment and quick early growth of the seedlings.

B) Foliar application: Spraying the leaves of a growing crop with a fertilizer solution of one or more nutrients. The most common materials used are urea and some micronutrients. For foliar application concentration of the fertilizer solution should be of 2 to 3 % otherwise, marginal leaf burning may occur and should be done early in the morning or late in the evening.

C) Direct application of liquid fertilizer to the soil: With the help of special equipment anhydrous ammonia and nitrogen solutions are directly applied to the soil.

D) Application of fertilizers through irrigation water: Fertilizers are allowed to dissolve into irrigation stream. The nutrients are thus carried into the soil in solution. Nitrogenous fertilizers are most commonly applied through the irrigation water (Fertigation).

Q.10 Write short notes on (Any two): 04

Ans. a) Biological method of weed control:

Use of living organism's (Bio-agents) viz., insects, disease organisms, herbivorous fish, snails or even competitive plants for control of weeds is called biological control. By this method, it is not possible to eradicate weeds but weed population can be reduced. This method is not useful to control all types of weeds. Introduced weeds are best targets for biological control. 02

Qualities of bio-agent:

-Bio-agent must feed or affect only one host and not other useful plants.
-It must readily adapt to environmental conditions.
-It must be free of predators or parasites.
-It multiplication rate is high than its host species.

Examples of biological weed control

Insects: In Australia, Lantana camara was controlled by two beetles' viz. Octotoma scabripennis and Uroplata giraldi. Prickly-pear weed (Opuntia) was controlled in India by Dactlopius tomentosus, a scale insect.

Fish: Common carp (Cyprimus carpio) and Chinese carp control aquatic weeds. Fungi. Water hyacinth can be controlled by Rhizoctinia blight.

Plants: Cowpea sown in between sorghum rows effectively reduces growth of weeds.

Merits: 1. Least harm to the environment; 2. No resldual effect, 3. Will not affect non-targeted plants and safer in use, 4. Cheap and long lasting.

Demerits: 1. Multiplication is costlier 2. Control is very slow.

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b) **Allelopathy** 02

The phenomenon of one plant having detrimental (harmful) effect on another plant through the production of chemical compounds (allopathic compounds) is called alleopathy.

Or It is any direct or indirect harmful effect that one plant has on another plant through release of chemicals or toxins into root environment.

Allelopathic effect of weed on crop :-

-Quack grass (Agropyron repens) exudes toxic substance through leaves, roots, seeds and affect the absorption of nutrient to maize crop.

-Allelopathic effects of nutsedge on beans and lentil but not pea & chickpea.

-Parthenium leaves and inflorescence affect the germination & seedling growth of maize, sorghum, Wheat.

Allelopathic effect of weed on weed :-

-Dry dodder (Cuscuta spp.) powder has been found to inhibit severely the growth of water hyacinth and eventually kill it.

-Dry parthenium hysterophorus powder was found detrimental to certain other aquatic weeds.

-Weed Cassia spp. exterted suppressive allelopathic effects on parthenium

Allelopathy effect of crops on weeds :-

-Root exudation of corn inhibits the growth of Chenopodium album and Amaranthus spp.

-Wheat, oats, peas, and buck wheat suppress the growth, accumulation of above ground biomass and leaf surface of Chenopodium album

-The cold water extracts of wheat straw when applied to weeds reduce the germination and growth of Ipomea spp. and Abutilon spp.

c) **Crop rotation** 02

Definition: It is recurrent succession of crops on the same piece of land either in a year or over a longer period of time. Component crops are so chosen so that soil health is not impaired.

Or It means growing a set of crop in a regular succession over a same field within a specified period of time.

e.g. cotton – gram, sugarcane – wheat.

Characteristics of good crop rotation :

1) Should be adaptable to existing soil, climatic and economic factors.

2) Proper land utilization.

3) Legumes should be incorporated to build organic matter of soil and to maintain nitrogen supply of soil.

4) Should reduce erosion.

5) Should provide food grains, pulses, oilseeds etc. to the family and roughages and fodder to live stock.

6) Should help in control of pests, diseases and weeds.

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7) Should provide maximum area under the most profitable cash crops of area
8) Economy in production and labour utilization.

Advantages of crop rotation :

1) There is over all increase in the yield of crops due to maintenance of proper physical condition of the soil and its organic matter content.
2) Inclusion of crop having different feeding zones (root system) and nutrient requirements helps in maintaining better balance of nutrients in the soil.
3) Diversification of crops reduces the risk of financial loss due to unfavorable conditions.
4) It facilitates even distribution of labour.
5) There is regular flow of income over the year.
6) The incidence of weeds, pests and diseases is reduced.
7) Proper choice of crops in the rotation helps to prevent the soil erosion.
8) It supplies the various needs of the farmer and his cattle.

SECTION "B"

Q.11 Define the following terms 04

1) Threshing

Definition: The process of separating grains/economic part from plants after harvest is known as threshing

2) Puddling

Definition: Ploughing the field repeatedly in standing water until the soil becomes soft and muddy is known as puddling.

3) Tilth

Definition: It is the physical condition of the soil resulting from tillage.

4) Physiological maturity

Definition: When the translocation of photosynthates to the economic part stopped.
Or When fruit growth is complete and photosynthate are no longer translocated to fruits known as physiological maturity.

Q. 12 Do as directed. 04

1) Give the formula for Nutrient Use Efficiency.

$$\text{NUE (\%)} = \frac{\text{Yield of field with applied nutrient} - \text{Yield of field without applied nutrient}}{\text{Amount of nutrient applied}} \times 100$$

2) <u>Potassium (K)</u> nutrient is responsible for resistance in plants.

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3) ***Zygograma bicolorata*** **(Mexican beetle)/** ***Cassia tora*** is the biological control measure for *Parthenium hysterophorus.*

4) **Pre-plant application** is the application of herbicide before sowing.

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