

**MAHARASHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD, PUNE**  
**SEMESTER END EXAMINATION**

**B.Sc.(Hons.) Agriculture**

Semester : I (New)	Term : I	Academic Year : 2018-19
Course No. : AGRO 111	Title : Fundamentals of Agronomy- I	
Credits : 2(1+1)	Time : 09.00 to 11.00	Total Marks : 40
Day & Date : Friday, 14.12.2018		

- 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 What do you mean by weed? Write in brief the characteristics of weeds.
- Q.2 Define the term tillage. Give objects of tillage and effects of tillage on soil and crop growth.
- Q.3 a) How you will classify herbicides?  
b) Define plant ideotype and explain types of plant ideotype.
- Q.4 State and explain various methods of sowing.
- Q.5 What is seed? Explain in brief the objectives of seed treatment.
- Q.6 Define Tillth. Describe in detail the modern concepts in respect of Minimum tillage and Zero tillage.
- Q.7 Define crop rotation. Discuss various principles and advantages of crop rotation.
- Q.8 Define the terms manure and fertilizer. How will you classify the manures and fertilizers?
- Q.9 Give different methods of harvesting and threshing with example.
- Q.10 Write short notes (Any Two).
- a) Integrated Weed Management                      b) Green manuring  
c) Nutrient use efficiency

**SECTION "B"**

- Q.11 Fill in the blanks.
- 1) Jethro Tull is considered as a \_\_\_\_\_ of tillage.
  - 2) Agronomy is essentially an \_\_\_\_\_ science depending on basic science.
  - 3) A condition of soil suitable for germination of seeds is called \_\_\_\_\_.
  - 4) Thio-urea treatment is given to \_\_\_\_\_ seed for breaking dormancy.

- Q.12 Match the following pairs.

**'A'**

- 1) Selective herbicide *b*
- 2) Mimicry weed *d*
- 3) Complex fertilizer *c*
- 4) Leguminous *a*

**'B'**

- a) Rhizobium
- b) 2,4-D
- c) Diammonium phosphate
- d) *Phalaris minor*

♦ ♦ ♦ ♦ ♦ ♦ ♦ ♦ ♦ ♦

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MODEL ANSWERS - SECTION "A"

Q.1 What do you mean by weed? Write in brief the characteristics of weed.

- Ans.- **Weed** :- Any plant not sown in the field by farmer is out of place, called weed. The term, 'weed' used by Jethro Tull for the first time, suggested an useless and harmful plant that persistently grows where it is quite unwanted. Weed is a plant growing where it is unwanted plant, out of place, extremely noxious, useless, poisonous.
- Characteristics of weeds** :- Weeds are like any other crop plants in size, form, morphological and physiological characters but possess the following characteristics, on account of which they are considered as enemy of crops by the farmer.
- 1) The weed seeds germinate early and the seedlings grow faster. They being hardy, compete for light, moisture and nutrients.
  - 2) They flower earlier, run to seed in profusion and mature ahead of the crop. They are difficult to control and it may be even impossible to eradicate some weeds completely.
  - 3) They are non-useful, unwanted and undesirable.
  - 4) They are harmful to crops, cattle and human beings.
  - 5) They can thrive even under adverse conditions of soil, climate etc.
  - 6) They are prolific and have a very high reproduction capacity e.g. plant of satyanashi (*Argemone mexicana*) produces over 5000 seeds (while a plant of striga produces over half a million seeds).
  - 7) Viability of weed seeds remain intact, even if they are buried deep in the soil. In some cases, the seeds may remain viable even after passing through the digestive tract of the animals.
  - 8) The seeds may have special structures like wings, spines, hooks, stick hair etc. on account of which they can be easily disseminated over long distances.
  - 9) Many weeds like *Cynodon dactylon* are vegetatively propagated and spread rapidly all over the field even under adverse conditions.

Q.2 Define term tillage. Give objects of tillage and Effects of tillage on soil and crop growth.

Ans.- **Definition-** Tillage is the manipulation of soil with tools & implements for loosening and the growth of crops.

**OBJECTS OF TILLAGE:-**

1. To make the soil loose & porous: It enables rain water or irrigation water to enter the soil easily & the danger of loss of soil & water by erosion and run-off, respectively, is reduced. Due to adequate proportion of microspores (capillary), the water will be retained in the soil & not lost by drainage.
- 2; To aerate the soil: Aeration enables the metabolic process of the living plants & micro-organisms, continue properly. Due to adequate moisture and air, the desirable chemical & biological activities would go on at a greater speed & result in rapid decomposition of the organic matter and consequently release of plant nutrients to be used by crops.

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3. To have repeated exchange of air / gases: There should be an exchange of air during the growing period of crop. At the supply of
2. from the air that is being constantly utilized in several biological reactions taking place in the soil, should be continuously renewed. At the same time  $\text{CO}_2$  that is released should be removed & not allowed to accumulate excessively in the air space. Two major biological reactions are respiration of plant roots & the aerobic decomposition of organic residues by micro-organisms where  $\text{O}_2$  is utilized &  $\text{CO}_2$  released. Deficiency or excess of  $\text{O}_2$  may reduce the rate of reactions.
4. To increase the soil temperature: This can be achieved by controlling, the air-water content of soil & also by exposing more 'heat' of sun. This helps in acceleration of activities of soil bacteria & other micro organisms.
5. To control weeds: It is the major function of tillage. Weeds rob food & water required by crop & competition results in lowering of crop yield.
6. To remove stubbles: Tillage helps in removing stubbles of previous crop and other sprouting materials like bulbs, stolons etc. & in making a clean field / seedbed.
7. To destroy in set pests: Insects are either exposed to the sun's heat or to birds who would pick them up. Many of the insect-pests remain in dormant condition in the form of pupae in the top soil during off season & when the host crop is again planted, they reappear on the crop. Some may harbour on stubbles or other remnant of the crop. Grubs & cutworms can be destroyed by tillage.
8. To destroy hard pan : Specially designed implements (chisel plough) are helpful to break hard pan formed just below the ploughing depth which act as barrier for root growth & drainage of soil.
9. To incorporate organic & other bulky manures: Organic manures should not only be spread but properly incorporated into the soil. This will help to improve physical condition of soil and nutrient availability in soil.
10. To invert soil to improve fertility: By deep tillage with method board plough the upper soil layer and layer which is less fertile comes to top.

#### Effects of tillage on soil and crop growth :-

- 1) Tillage loosens the soil thereby favours the germination & establishment of seeding.
- 2) Tillage helps in maintaining the optimum plant stand.
- 3) Increases depth of root penetration.
- 4) Roots proliferate profusely in loose soil & increases the growth of seminal & lateral roots.
- 5) Reduce the competition within crop & weeds for light, water, nutrients & space thereby held in better growth of crop.
- 6) Tillage reduces the pest attack on succeeding crop.
- 7) Tillage helps in availability of nutrients to crop in proper amount

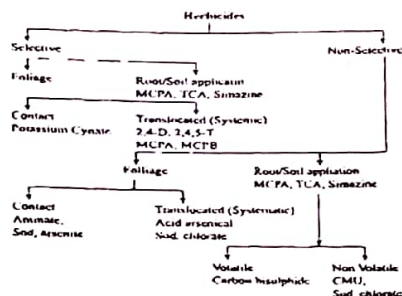
**Q.3 a) How you will classify herbicides.**

**Ans.- Classification of herbicides :-** Selective herbicides- are those which kill only weeds without injuring crop plants.

Non-selective herbicides- are those which kill all kinds of vegetations i.e. weed and crop plant.

Contact herbicides- kill all the plant parts which may get covered by the chemical by directly killing the plant cells. These chemicals are effective against annuals particularly when they are young but not perennials.

Translocated / Systemic herbicides- are first absorbed in the foliage or thorough roots and are then translocated to other parts of the plant. OR Kill plants after their absorption by accelerating or retarding the metabolic activities of plants. These are more effective in destroying deep rooted perennials.



Soil sterilents are non-selective herbicides -and have to be applied into the soil. They make the soil sterile and incapable of supporting any plant growth. As such any weed seeds or seed seedlings present in the soil are killed.

b) Define plant ideotype and explain in brief the types of plant ideotype.

**Ans- Define of plant ideotype:** According to Warshner (1969), an Ideotype is a biological model, which is expected to perform behave in a predictable manner within a defined environment. The term plant ideotype is often known as model plant type. Ideal plant type, ideal model plant type etc.(1)

**Types of ideotype:** The most widely accepted classifications of plant ideotypes are as below.

- 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 maximum free tillering, leafy spreading plant that is able to explore the environment as fully as possible. It is unlikely to perform well at different crop densities.
- II. **Competition ideotype:** The 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 more share of nutrients and water.
- III. **Crop ideotype:** This ideotype perform best at commercial crop densities because it is a poor competitor.
- 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 given 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 ideotype which perform better under stressed conditions by making modification/ alteration 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 resistances, Mineral stress Heat and cold resistance. ii) Biotic stress- Disease resistance, Insect-pest resistance.

A drought-tolerant variety is one that produces a high grain yield relative to other cultivars under drought stress.(3).



Q.4

State and explain various methods of sowing.

Ans.-

**METHODS OF SOWING** - The sowing method is determined by the crop to be sown. There are 6 sowing methods which differ in their merits, demerits and adoption. Those are: 1. Broad casting 2. Drilling or line sowing 3. Dibbling 4. Transplanting 5 Planting 6. Putting seeds behind the plough.

1. **Broad casting**: It is the scattering of seeds by hand all over the prepared field followed by covering with wooden plank or harrow for contact of seed with soil. Crops like wheat, paddy, sesame, methi, coriandar etc. are sown by this method.

**Advantages**: -1) Quickest and cheapest method, 2) Skilled labour is not required 3) Implement is not required, 4) Followed in moist condition.

**Disadvantages**:-1) Seed requirement is more, 2) Crop stand is not uniform, 3) Result in gappy germination and defective wherever the adequate moisture is not present in the soil, 4) Spacing is not maintained within rows and lines, hence interculturing is difficult.

2. **Drilling or line sowing**: It is the dropping of seeds into the soil with the help of implement such as mogha, seed drill, seed-cum-fertilizer driller or mechanical seed drill and then the seed are covered by wooden plank or harrow to have contact between seed and soil. Crops like jowar, wheat, bajra etc. are sown by this method.

3. **Dibbling**:- It is the placing or dibbling of seeds at crop marks (+) made in the field with the help of marker as per the requirement of the crop in both the directions. It is done manually by dibbler. This method is followed in crops like G.nut, Castor, Hy. Cotton etc. which are having bold size and high value.

**Advantages**:-1) Spacing between rows and plants is maintained, 2) Seeds can be dibbled at desired depth in the moisture zone, 3) Optimum plant population can be maintained, 4) Seed requirement is less than other methods, 5) Implement is not required for sowing, 6) An intercrop can be taken in wider spaced crops, 7) Cross wise intercultivation is possible. **Disadvantages**:-1) Laborious and time consuming method, 2) Require more labour, hence increase the cost of cultivation, 3) Only high value and bold seeds are sown, 4) Require strict supervision.

4. **Transplanting**: It is the raising of seedlings on nursery beds and transplanting of seedlings in the laid out field. For this, seedlings are allowed to grow on nursery beds for about 3-5 weeks. Beds are watered one day before the transplanting of nursery to prevent jerk to the roots. The field is irrigated before actual transplanting to get the seedlings established early and quickly which reduce the mortality. Besides the advantages and disadvantages of dibbling method, initial cost of cultivation of crop can be saved but requires due care in the nursery. This method is followed in crops like paddy, fruit, and vegetable, crops, tobacco etc.

5. **Planting** : It is the placing of vegetative part of crops which are vegetative propagated in the laid out field e.g. tubers of potato, mother sets of ginger and turmeric, cuttings of sweet potato and grapes, sets of sugarcane.

6. **Putting seeds behind the plough**: It is the dropping of seeds behind the plough in the furrow with the help of manual labour by hand. This method is followed for crops like wal of gram-in some areas for better utilization of soil moisture. The seeds are covered by successive furrow opened by the plough. This method is not commonly followed for sowing of the crops.

Q.5

What is seed? Explain in detail objects of seed treatment.

Ans.-

**OBJECTS OF SEED TREATMENT** -

Some seeds need treatment with some specific objectives before sowing.

1. **To control disease**:- There are some seed borne or soil borne diseases, seeds are treated with fungicides or organo mercurial compounds like thiram, captan, carbendazim,



agrosan, cereson etc. e.g. to control paddy blast, seed is to be treated with agrosan @ 3 g per kg of seed.

2. To have convenience in sowing:- Difficulties are encountered in sowing certain crops due to special characteristics of the seed like fuzz of cotton seeds, coriander seeds, small seeds of chilli, ragi, bajra etc. e.g. coriander seed is to be splitted by rubbing it against hard surface. Seed of chilli, sesamum, bajra are mixed with fine sand or soil.

3. To have quick germination:- Germination of certain leguminous crops is delayed due to thick seed coat which restricts water absorption. Such seed coats are broken to some extent by mixing them with coarse gritty sand and trampling or pounding it lightly in a mortar with a wooden pestle for breaking the thick seed coat. Some times seeds are soaked in water for a specified time. e.g. cotton seed or paddy seed is soaked in water before actual sowing. Seed of lucerne and Indigo is pounded with pestle.

4. To increase nitrogen fixation in legumes :- Legume seeds are inoculated with a particular Rhizobium culture. This is mixed with jaggery solution and applied to seed and dried in shade. It increases nodulation and thereby N fixation.

5. To protect the seed against insect pests:- There are some insect pests like ants, white ants, in the soil which attack on seed and eat. Sometimes, seed may be picked up by birds after sowing. To avoid this,, seed is treated with repellents like campor, kerosene or soil drenching with insecticides like BHC, heptachlor etc. For example, the carbofuran treatment in jowar.

6. To induce earliness (Vernalization treatment) :- This is important for breeding programme by vernalization treatment. As a result of this, life span is reduced. In this, seed is soaked in water and incipient germination is induced in the form of awakening of the dormant embryo and commencing the changes favoring germination is the endosperm. Such seeds are kept in cold storage for a specified time in which germination power remains intact but the process of germination is temporarily halted. Thus, the plant spends part of its vegetative period or phase in the form of sprouted seed and the seed so treated is as a dormant plant. The period from sowing to flowering is thus greatly reduced and with such adjustment, a variety which is normally a long duration one, can be made to flower early.

7. To induce variation :- Seed is treated to induce variation in its morphological and general structure by 'X' ray treatment. It changes the genetically make up and helps in selection of desired types e.g. sonora, a wheat variety, is the result of sonora - 64 treated with gamma rays.

8. To break dormancy:- Some crops are having seed dormancy in fresh harvested produce. Dormancy is the state of rest period of a seed in which it does not germinate even if all the favourable conditions are available for germination. Due to dormancy of seed we cannot use the fresh harvested produce for sowing. It is desirable if the crop get rains at maturity e.g. groundnut varieties. This dormancy is broken by treating seed with chemicals e.g. Thiourea 1% treatment to potato tubers.

9. Seed treatment for special purpose:- In vegetative propagated crops, planting material is treated with growth promoting hormones like colchicine, Gibberalic acid (GA), Indol acetic acid (IAA), Seradix, sometime cattle urine. These promotes sprouting and growth of plant e.g. onion bulbs or potato tubers are treated with maleic hydrazine (MH) for avoiding sprouting and growth of sprouts and thereby reducing losses due to sprouting.

**Q.6 Define Tilt. Describe in detail about modern concepts in respect of Minimum tillage and Zero tillage.**

**Ans.- Definition- Tilt** is the term used to express soil condition resulting from tillage.

**MODERN CONCEPTS OF TILLAGE :-**

Tillage is tire consuming, laborious & costly, owing to this new concepts like minimum tillage & zero tillage are introduced.

**1. Minimum Tillage:** It is ainfetfat reducing tillage operations to the minimum necessary



for ensuring a good seedbed, rapid germination, a satisfactory stand & favorable growing conditions. Tillage can be reduced by:

- 1) Omitting operations which do not give much benefit when compared to the cost and
- 2) Combining agricultural operations like seeding & fertilizer application.

Advantages :- 1) Improve soil condition due to decomposition of plant residues in situ.  
2) Higher infiltration caused by decomposition of vegetation present on soils & channels formed by decomposition of dead roots.

- 3) Less resistance to root growth due to improved structure.
- 4) Less soil compaction by reduced movement of heavy tillage vehicles.
- 5) Less soil erosion compared to conventional tillage

Disadvantages :- 1) Less seed germination. 2) Nodulation may affect in some legumes.

- 3) More 'N' has to be added as rate of decomposition of organic matter is slow.
- 4) Sowing operations are difficult with ordinary implements.

**2. Zero tillage :-** It is an extreme form of minimum tillage. Primary tillage is completely avoided and secondary tillage is restricted to seedbed preparation in the row zone only. It is followed where:

Advantages- 1) Soils are subjected to wind & water erosion.

2) Timing of tillage operations is too difficult.

3) Requirement of energy & labour for tillage is too much high. Advantages:

1) Soils are homogenous in structure with more no. of earth worms.

2) Organic matter content increased due to less mineralization.

3) Surface runoff is reduced due to presence of mulch. Several operations are performed by using only one implement. In this weeds are controlled by spraying of herbicides.

Disadvantage :- 1) Higher N is to be applied due to slower mineralization of org. matter.

2) Large populations of perennial weeds appear. 3) Build up of pests is more.

**Q.7 Define crop rotation. Discuss various principles and advantages of crop rotation?**

**Ans.-** Crop Rotation - Refers to recurrent succession of crops on the same piece of land either in a year or over a longer period of time is called as crop rotation.

Advantages of crop rotation.-

1. Crop rotation maintains and even improves soil fertility.

2. Prevent the build up of pests, weeds and soil born diseases.

3. Control of soil erosion, insect, pest diseases.

4. Conserve moisture from one season to next.

5. Proper distribution of labour and their work, Proper utilization of all farm resources.

6. Family person and labour get work all over the year.

7. Diversification of cropping reduces the risk of financial loss due to unfavorable condition.

8. The family needs of feed, food, fuel, fiber, spices, sugar etc are fulfilled and also fulfill needs of livestock.

Principles of crop rotation-

1. The crop should suit existing soil, climate and economic factors.

2. Sufficient acreage should be provided to legumes to maintain N supply of soil.

3. Cropping sequence should be based on proper land utilization,

4. Selection of crops should be demand based (crops needed by the family members and peoples of the area market) 5). It should provide sufficient employment to the labourers and family.

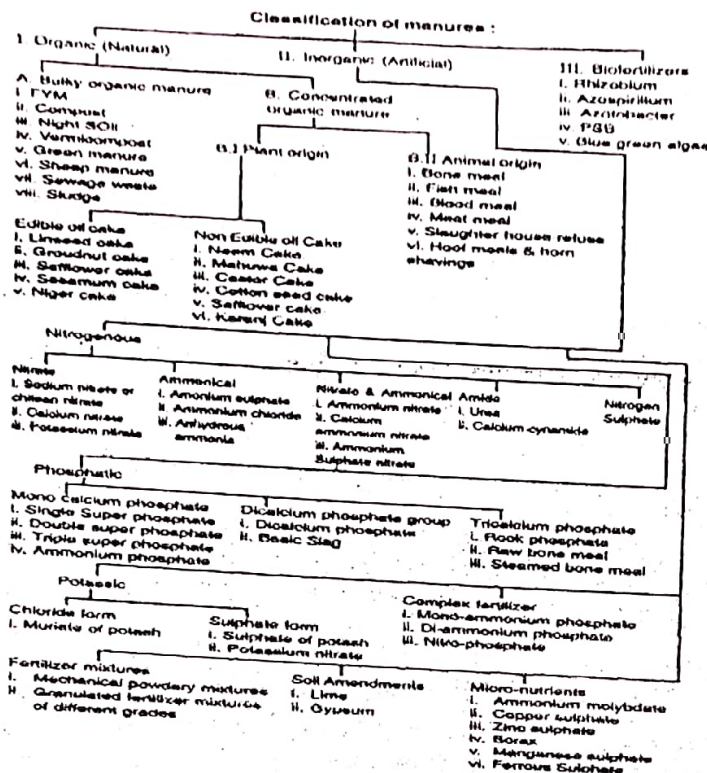
6. Tap rooted crops should be followed by fibrous rooted crops to make the uniform use of nutrient.

7. Crops belonging to same family should not be grown in succession to avoid the incidence of weed, pest and diseases.

Define term manure and fertilizer. How will you classify the manures and fertilizers.

Ans8.- **Manure** -It is a well decomposed refused from stable or barn yards it is both animal

excreta and straw or other litter OR the term manure implies to any material with the exception of water which when added soil makes it productive and promotes plant growth.



**fertilizer**-These are Industrial manufacture chemical containing plant growth OR It is an artificial product containing the plant nutrients which when added to the soil makes it productive and promotes plant growth.

Q.9

Give different methods of harvesting and threshing with example.

Ans.-

**Different methods of harvesting.-**

1. Cutting the plants close to the ground- Stems of cereals, (wheat, rice, barley) oilseed (linseed, rapeseed, mustard, safflower, sesamum) and pulses (gram, lentil) are cut from the ground level by sickle and then tie bundles of suitable size. Allow them to dry in field for few days and collect on threshing floor. Sugercane cut close to the ground with sharp knife (sucrose content is more in lower portion) and remove leaves and top immature portion (50 to 60 cm). the canes are then bundled in suitable size and transport to crushing within 24 hours. If crushing is delayed sucrose is converted to glucose (inversion of sugar) and reducing the sugar recovery.

2. Plucking and picking of pods - Pods of pulse crops like, moong and pea are picked up when they are matured. Green pods of pea plucked and send to market immediately for selling.

3. Digging the produce from the soil :- Crops like sugarbeet, potato and groundnut are harvested by uprooting the plant or by digging the soil with the help of suitable tools and produce the collected from the soil, cleaned and stored.

The groundnut and potato digger are also used for harvesting of crops.

**Threshing :-** The process of separation of grains from earheads / capsules / siliques is known as threshing.

Following methods are adopted for threshing.

1. **Beating** -The earheads / pods of the harvested crop are beaten with sticks or wooden thresher on hard surface or tarpolin. This method is suitable for jowar, wheat, paddy and moong crops for limited quantity of produce.

2. **Bullock power** - Threshing of produce is done under the feet of bullock on threshing yard e.g. jowar, paddy, wheat, Moong.

3. **Hand driven machinery**- Shelling of groundnut pod is done by Sheller. Threshing of



paddy is done by paddy thresher. Sunflower heads are rubbed on concave type iron net.

4. Use of power driven machinery - Number of threshers are available in market for sunflower and wheat crop. It can do the work of harvesting and threshing at a time in a very short time.

Q.10 Write short notes on (Any Two)

1. Integrated weed management. 2. Green manuring 3. Nutrient use efficiency.

Ans. a) Integrated weed management -

Integrated weed management makes use of a combination of different agronomic practices to manage weeds, so that reliance on any weed control technique is reduced. Integrated weed management uses a variety of techniques to keep weed 'off balance', it can also be defined as a rational use of direct and indirect control methods to provide cost effective weed control. Direct methods include : manual, cultural, mechanical and chemical methods of weed control and indirect methods are : land preparation, plant spacing, seed rate, water management, fertilizer application etc.

Importance of Integrated Weed Management:-

- Weed can be controlled by adopting different methods. However each control method has advantages, disadvantages and limitations.
- Continuous use of the same method leads to develop tolerance in the seeds and resist it.
- Therefore, suitable combination of different weed control or integrated weed management system approach becomes effective to control weeds, minimize losses caused by weeds to crops with the protection of environment. There are three main types of agronomic practices that we can use to develop integrated weed management programme. 1. Practices that unlimited the introduction or spread of weeds (Prevention of weeds) 2. Practices that help the crop to compete with weeds 3. Practices that keep weeds off balance (make difficult for weeds to adopt)

b)

Green manuring - It is a practice of ploughing or turning green plant tissues into the soil for the purpose of improving soil structure as well as fertility.

Methods of green manuring - green manuring in situ, green leaf manuring, Green manuring crops, sunhemp, dhaincha, guar beans, senji, kulthi, glyricidia, sesbania, karanj.

Characteristics of green manuring - -quick growing, able to grow on poor soil, have deep and fibre root system, preferably legume to fix atmospheric nitrogen, succulent and more leafy growth, yield large quantity of green material in short period.

Advantages : help in suppressing the weed growth, fixed atmospheric nitrogen, green manuring crop takes nutrients from lower layer of the soil, increases availability of  $P_2O_5$ , calcium, magnesium and iron, -Improves soil structure, water holding capacity and decreases runoff, adds organic matter and stimulates activities of soil micro-organisms.

Disadvantages : Incidence of pests and diseases, Depletes moisture level, Loss of one season especially kharif.

c)

Nutrient use efficiency - Nutrient use efficiency (NUE) may be defined as yield per unit input. In agriculture this is usually related to the input of fertiliser, whereas in scientific literature the NUE is often expressed as fresh weight or product yield per content of nutrient. Improvement of NUE is an essential pre-requisite for expansion of crop production into marginal lands with low nutrient availability. The nutrients most commonly limiting plant growth are N, P, K and S. NUE depends on the ability to efficiently take up the nutrient from the soil, but also on transport, storage, mobilization, usage within the plant, and even on the environment. Two major approaches may be taken to understand NUE. Firstly, the response of plants to nutrient deficiency stress can be explored to identify processes affected by such stress and those that may serve to sustain growth at low nutrient input. A second approach makes use of natural or induced

genetic variation. NUE can be advantageously analyzed through quantitative trait locus (QTL) analysis in recombinant inbred or near isogenics lines (RIL, NIL) sets derived from crosses between wild accessions, which show tremendous variation for most physiological traits studied. For this, *Arabidopsis* is an ideal model plant as many different RILs exist with different parental ecotypes, which when in combination with the availability of genomic sequence enables the use of quantitative genetics to identify the genetic factors responsible for such variation. Alternatively, *Arabidopsis* mutant populations can be screened for mutants less sensitive to growth inhibition by low nutrient conditions. The information obtained from *Arabidopsis* can be translated into crops by identifying target genes for breeding.

### SECTION "B"

#### Q. 11 Fill in the blanks.

1. Jethro Tull <sup>is</sup> considered as a Father of tillage.
2. Agronomy <sup>is</sup> essentially an applied science depended on basic sciences.
3. A condition of soil suitable for germination of seeds <sup>is</sup> called as seedbed.
4. Thio-urea treatment is given to potato seed for breaking dormancy.

#### Q.12 Match the pair.

##### Group A

1. Selective herbicide
2. Mimicry weed
3. Complex fertilizer
4. Leguminous crops

##### Group B

- b) 2,4-D
- d) *Phalaris minor*
- c) Diammonium phosphate
- a) Rhizobium

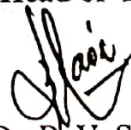
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Signature of course instructor



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