MAHARASHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD, PUNE

SEMESTER END EXAMINATION

Model Answers

Semester :-	II New	**Academic year** :-	2018-19
Course No. :-	AGRO – 123 (New)	**Title** :-	Fundamentals of Agronomy-II
Credits :-	2 (1+1)	**Total Marks** :-	40
Day & Date :-		**Time** :-	

SECTION 'A'

Q.1 Define the term irrigation and state role of water in plant. (4 Marks)

Ans. Irrigation – Definition

It is the artificial application of water, with good economic return and no damage to land and soil, to supplement the natural sources of water to meet the water requirement of crops.

1) Water is a structural constituent of plant cells and it maintains the cell form through turgor pressure. Water accounts for the largest part of the body weight of an actively growing plant (85 to 90 % of body weight of young plant and 20 to 50 percent of older or mature plants).
2) Water is a source of two essential elements, oxygen and hydrogen required for synthesis of carbohydrate during photosynthesis.
3) Water serves as a solvent of several plant nutrients, photosynthetic and other substances are dissolved in water and it facilitates movement of these materials from cell to cell.
4) Food manufactured in green parts is distributed to various parts of the plant in soluble form and water act as a carrier of food materials.
5) Leaves get heated up with solar radiation. Plants dessipate heat by increased transpiration. Water acts as a buffer against high and low temperature injury as it has high heat of vaporization and high specific heat.
6) Water is essential part of protoplasm.
7) It is the important ingredient in photosynthesis.

Q.2 Describe in brief the factors affecting infiltration rate of soil.

1) **Texture/structure:** - Infiltration rates are generally lower in soils of heavy texture than soils of light texture. Similarly soil with large amount of water stale aggregates have faster rate of infiltration.
2) **Initial moisture content:** - higher the initial moisture content, lower the infiltration rate of soil.
3) **Condition of the soil surface:** - any resistance to the flow of water in to and through the soil profile, reduce the rate of infiltration. Infiltration rates are affected by the porosity of the soil, which is changed by cultivation or compaction. Cultivation increases the infiltration rate by increasing the porosity of the surface soil and breaking up the surface seals.
4) **Grass cover, forest land and soil mulch:** - infiltration rates on grass land, forest land or soil covered with mulch is higher than bare land. Mulches allow water to stay in field for a longer period before runoff.
5) **Organic matter content:** - addition of organic matter encourages soil aggregates and an increase in micro pores, a porosity resulting in greater infiltration.

Viscosity of water: - there is an inverse relationship between viscosity of water and infiltration water soil. Warm water in tropics has low viscosity and thereby higher infiltration rate, in comparison with temperate zone.

Q.3 Classify soil water and write in detail about each class.

It is mainly classified into three categories *viz.* hygroscopic water, capillary water and gravitational water.

1. Hygroscopic water :-

It is that part of soil water, which is very tightly held on the surface of soil particles and in very thin film by the forces of adhesion and cohesion. It is mostly in vapour form and the force with which it is held on the surface of soil particles is estimated at about 10,000 atmospheres at the outer side of the hygroscopic film and 31 atmospheres at inner side. Hygroscopic water is not available to the plant and agriculturally it has no importance. The absorption of moisture by soil varies with the humidity of the atmosphere. More humid the atmosphere more will be the absorption, by soil.

2. Capillary water :-

When soil particles absorb water even after the hygroscopic coefficient is reached the additional water is also held around the particles in the form of thin film. This retention of film of water continues until the film becomes quite thick and the micro pores inside the soil mass also get filled with water. The capillary water is that water which is held in the soil in excess of hygroscopic water, but is upto the point where the gravity pull begins to move the water downwards, when free drainage conditions exist in the soil.

3. Gravitational water :-

When maximum capillary capacity of a soil gets satisfied, any further addition of water comes under the force of gravity. This water starts moving as free water through the macro-pores and is called gravitational water. It is excess superfluous and as such it is of no use to the plant. Usually within 2-3 days after irrigation or heavy rain all such water drains down from the soil surface.

Q.4 State the different factors affecting absorption of water by plants

1) Available soil water :-

The rate of absorption of water is decreased under decreased availability of available soil moisture. Soil water content above field capacity affects the aeration causing decrease in the absorption of water. Excess water in soil, interferes with root growth and water absorption in most of crop plants.

2) Concentration of soil solution :-

The osmotic pressure of a solution depends upon its concentration. If the solution is highly concentrated due to the presence of salts etc., its osmotic pressure will be greatly increased which will inhibit the absorption of water. Lack of water absorption by plants growing in the saline water is an example of physiological dryness.

3) Soil aeration :-

Absorption of water by the plant will be faster in well-drained soils. Under ill drained conditions due to poor supply of oxygen, the absorption of water will be retarded. Accumulation of Co_2 is also detrimental to water absorption as it increases the viscosity of protoplasm and decreases its permeability, thus reduce the rate of absorption. Under water logging conditions in general, plants are not able to absorb enough water and it is a example of physiological dryness.

4) Soil temperature :-

Maximum absorption of water by plant will be between 20 to 30^0C. Increase in temperature beyond 30^0C retards the rate of absorption. Absorption reduced with decrease in soil temperature and it is nil at 0^0C.

Q.5 Define the term, evapotranspiration and explain factors affecting ET. (4 Marks)

Definition: Loss of water from the cropped fields partly by transpiration and partly by evaporation from soil between the plants. The combined loss of water is called as evapotranspiration.

I) Climatic factors 1. Temperature a) Water temperature b) Air 2. Wind 3. Relative humidity 4. Pressure 5. Light II) Water factors 1. Composition of water 2. Area of evaporation	III) Plant factors 1. Plant height 2. Leaf characteristics 3. Availability of water to the plant IV) Cultural factors 4. Irrigation 5. Tillage 6. Weed control 7. Fertilizer application 8.Mulching

Q.6 Define water requirement and explain factors affecting the water requirement of crops.

Definition – The quantity of water required by a crop in a given period of time for its normal growth of crop under field condition, at a place

Factors influencing the water requirement of crop

1.Nature of crops grown
2.Nature of the soil
3.Climate factors
4.Type of irrigation
5.Management practices
6.Quality of water
7. Land preparation

Q.7 Write in short about water management for groundnut and wheat crop.

Groundnut

The tap root grows up to 60 to 80 cm. The extensive network of small lateral roots which are within upper 10 to 20 cm depth of soil. Flowering, peg formation and pod development, are critical stages.

Water requirement is - 40 ha –cm.

Wheat Crown root initiation most sensitive growth stage for water

Crown root initiation, late tillering, late jointing, flowering, milk and dough stages are most important.

Water requirement is - 26 to 30 ha- cm

Q.8 Classify in detail the surface irrigation methods.

Surface method: - Surface irrigation methods are most commonly used. In this method water is applied directly to the soil surface from the cannel located at the upper side of the field may be distributed within field by flooding in border strip, check basin and furrow.

1) Border strip method: In border method parallel ridges are used to guide the down flowing water. The land is divided into a number of long parallel strips called borders and is separated by low ridges. This method is also called as sara method. The water spreads and flows down the strip in area separated by ridges. Field is laid out into long narrow strips, bordering with small bunds.

Length of strip ranges from 30 to 100 m and width from 3 to 15 m.

Advantages :-

1) Compared to check basin, labor required for layout and irrigation are less and can be prepared with the help of bullock drawn. Bund ridger.
2) Large irrigation stream can be used efficiently.
3) Operation of system is simple and easy.
4) Adequate surface drainage can be provided.

Disadvantage :

1) Precise leveling is essential
2) Large water stream is required

2) Check Basin method: Most common method of irrigation. Suitable for close growing crop like groundnut, vegetable, flowering plants etc. Field is divided into small plots surrounded by bunds on all four sides. Water from the main channel is supplied to the field channels and to the check one after another. The size of check basin varies from one square meter to as long as one hectare used for growing rice under low lying condition. Advantages of check basin:-

1) Use of small stream is possible.
2) Useful when leaching is required to remove the salts from the soil profile.
3) High water application efficiency.
4) Conserves rain water.

Disadvantages:-

1) More labours required for field layout and irrigation.
2) More land is wasted under channels and bunds. (10 to 15 percent).
3) Intercultivation is difficult due to obstruction by bunds.
4) Surface drainage cannot be provided.

3) Furrow irrigation:-

1) Straight furrow Straight
2) Contour furrow
3) Corrugated furrow
4) Graded furrow

Advantages:-

1) Water in the furrows contacts only one half to one fifth of land surface, there by reducing puddling and crusting of the soil and evaporation losses.
2) Earlier cultivation is possible in heavy soils.
3) No wastage of land in field ditches.
4) Furrows serve as drainage ways for surface runoff in heavy rainfall areas.

Limitations :-

Requires proper land grading – land must be graded so that water can travel the entire length of the row without ponding

Q.9 State the various causes of waterlogging.

Causes of water logging

Water logging is caused when inflow into ground water exceeds outflow from it. The problem is serious when hydraulic conductivity of soil is less than 2.5 cm/hr.

1. Heavy rainfall with high density affecting quick disposal of water through natural and artificial drainage system.
2. Accumulation of water in low-lying flat land surrounded by high lands affecting natural drainage.
3. Presence of hard pan and impervious soil layer, bedrock causing poor percolation of water and accumulation of water on the soil surface.

4. Absence of adequate natural drainage or obstruction of natural drainage by construction of irrigation channel, rail road or embankment.
5. Unauthorized occupation of natural drains for other purposes.
6. Over irrigation helping to raise the water table.
7. Seepage from high rise canals that is particularly unlined.
8. Seepage from water reservoirs.
9. Flood water which is of course, seasonal and occurs in certain areas.

Q.10 Write short notes on (Any two)

a.Moisture extraction pattern :-

Moisture extraction pattern within root zone. The moisture extraction pattern shows the relative amount of moisture extracted from different depths within the crop root zone. The moisture extraction pattern of average crop plants growing in deep uniform soils. It may be seen that about 40 per cent of the total moisture used is extracted from the first quarter of the root zone, 30 per cent from the second, 20 per cent from the third and only 10 per cent from the last quarter. This indicates the importance for making soil moisture measurements at different depths (at least two) within the root zone in order to have a fair estimate of the soil moisture status.

b.Water quality parameter:-

Water quality criteria –

The quality of irrigation water is generally judged by observing following components.

1. Salinity - Total salt concentration increases the soil salinity.
   Low salinity – EC < 3 mm hos/cm
   High salinity – EC > 10 mm hos/cm
   Moderately saline – EC = 3 to 9 mm hos/cm
2. Sodium adsorption ratio (SAR)
3. Magnesium : calcium ratio
4. Bicorbonate
5. Boron
6. Potassium and nitrate

c). Effective rainfall

Effective rainfall means useful or utilizable rainfall. Rainfall is not necessarily useful or desirable at the time, rate, or amount in which it is received. Some of it may be unavoidably wasted while some may even be destructive.The term effective rainfall has been interpreted differently by specialists in different fields. To a canal irrigation engineer, the rain which reaches, the storage reservoir directly and by surface runoff from the surrounding area is the effective rainfall. Agriculturist consider as effective that portion of the total rainfall which directly satisfies crop water needs.This it may be seen that even though the concept is the same in all above cases, the values of effective rainfall are different for different agencies for the same total rainfall. Rainfall which is ineffective according to one may be effective according to another. The point of view of the water requirement of crops, effective rainfall is defined the annual or seasonal effective rainfall as that part of the total annual or seasonal rainfall which is useful directly and or indirectly for crop production at the site where it falls, but without pumping.

SECTION "B"

Q.11 A) Fill in the Blanks .

1. On the basis of effective root zone depth, cotton is categorized **deep** rooted crop.
2. The force of attraction binds the molecule of the same kind is **Cohesive force**
3. The average rainfall of India is **1194 mm.**
4. **Sunflower** plant is used as an indicator plant while scheduling of irrigation.

Q.12 Define the following terms

1. **Percolation:-** Movement of water vertically downward from surface in to the soil due to gravitational force is known as percolation.
2. **Net irrigation requirement:-** The quantity of water required to bring soil moisture content in to field capacity condition is called as Net Irrigation requirement.
3. **Seepage:-** Slow movement of water trough small cracks pores, interstices etc. in the surface of unsaturated material in to or out of a body of surface or sub-surface water.
4. **Irrigation interval:-** The time between two successive field irrigation application on the same field, in days.

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