

UNIT- IV (Chapter –II)

WATER LOGGING AND CANAL LINING

Water Logging:-

Effects of water logging:-

1. Inhabiting activity of soil bacteria:

The liberation of plant food is dependent upon the activity of soil bacteria, which requires adequate amount of oxygen in the air for proper functioning. When the soil pores within the root zone of the crops normally grown are so saturated as to effectively cutoff the normal circulation of air, the land is water logged.

2. Decrease in available capillary water:

Plant life draws its substance from the soil solution round the soil particles which is drawn into the plants by capillary action and osmosis. If the water-table high, the roots of the plants are confined to the top layers of the soil above the water table when if the water table is lower, the roots of the plants have more room for growth.

3. Fall in soil temperature:

A water logged soil warms up slowly and due to lower temperature, action of soil bacteria is sluggish and plant food available is less.

4. Defective air circulation:

When water table is high, the drainage becomes impossible and the carbon dioxide liberated by the plant roots cannot be dissolved and taken away. Consequently fresh air containing oxygen is not drawn and activity of soil bacteria and plant growth suffers.

5. Delay in cultivation operations:

In water logged areas, cultivation operation such as ploughing and mulching are either impossible or difficult and in any case they are delayed. Sowing of crops and their growth are also delayed. Crops yield is poor and it arrives late in market causing loss to cultivators.

6. Growth of wild flora:

In water logged, natural flora such as water hyacinth grows profusely. This crop reduces the crop yield. A cultivator has to waste money and time both for clearing it out.

7. Rise of salt:

The rise of water table also causes accumulation of alkali in the surface soil by the upward flow of water which is established in waterlogged lands.

The alkaline deposit changes the pH value of soil. Soil with pH value 7.0 to 8.5 gives normal yields, with pH value 8.0 to 9.0 the yield decreases; when pH value raises to 11.0 the soil become infertile.

8. Adverse effect on community health:

The climate of a water logged area becomes damp. Formation of stagnant pools may become breeding places for mosquitoes. The climate thus becomes extremely detrimental to the health of community.

Causes of water logging:

Water logging in any particular area is normally the result of several contributory factors. The main factors causing water logging are given below:

1. Inadequate surface drainage:

When the surface drainage is not adequate, the heavy precipitation in the area is not drained off quickly and rainwater remains stagnant over the area for considerable time. This gives rise to heavy percolation and water table rises in the area.

2. over irrigation field:

When the irrigation water applied to the field is in excess of the requirement of the crop, deep percolation takes place which is retained in the intermediate zone augmenting the groundwater storage.

3. Obstruction of natural drainage:

If a natural drainage is obstructed by irrigation channel, rail or road embankments, it will not be able to pass the rain water of catchment. There will thus be floating of land and consequent water logging.

4. Obliteration of natural drainage

Sometimes the cultivators plough up and obliterate an existing natural drainage. This results in stoppage of storm water flow, consequent flooding and water logging.

5. Construction of water reservoir:

The seepage from canal and reservoir augments the water table and may cause water logging.

6. Natural obstruction to the flow of groundwater:

Sometimes subsoil does not permit free flow of subsoil water due to natural obstruction. This may accentuate the process of raising the water-table.

The creation of a high false water-table or perched water-table also leads to water logging.

Remedial Measures:

In devising anti-water logging measures, the nature and magnitude of various factors, enumerated in previous article, should be correctly assessed and allowed for various remedial measures adopted for prevention of water logging.

1. Efficient surface drainage:

This system, which permits a quick flow of rainwater in short period helps to reduce the water logging. They have initial cost of construction.

2. Under-drainage by tile drains:

The drainage of agricultural land is done more satisfactorily by the drains. A suitable tile drain can hold the water table at a predetermined level which will be most beneficial to the crops. It has large initial cost.

3. Reducing percolation from canals:

Measures for substantial reduction of percolation losses from canal have to be undertaken.

- (a) Lining of irrigation channels so as to make bed and sides of canal impervious.
- (b) Lowering of full supply level of irrigation channels. If the full supply level of irrigation channel is reduced, there will be lesser seepage loss from embankment. The effective head between full supply level and field will also reduce and therefore chances of waste ful use of water are avoided.

4. Restriction of irrigation:

(a) The cultivators should be educated for economic use of water and induced to divided his field into "Kiaries" to avoid wastage. He should also encouraged to supplement his water requirement from open and tube wells.

(b) Area with high water table may be allowed only for Kharif irrigation and during Rabi the cultivators may irrigate from open and tube wells.

5. Lining of water courses:

The losses by percolation from cultivators water course are the order of 20% and above. Their lining therefore, further checks the inflow of canal water to subsoil through water courses.

6. Removing obstruction in natural drainage:

Drainage crossing with road, railways and canals should be remodeled to make it more efficient.

7. Prevention of seepage from water reservoir:

Adequate and suitably designed toe filters provided so that seepage ultimately finds its way into the natural stream.

8. Adoption of sprinkler method for irrigation:

This reduces the percolation losses from watercourses as only predetermined amount of water is applied to the land.

9. Changes in crop pattern:

A change in crop pattern may minimize the damage to plant line.

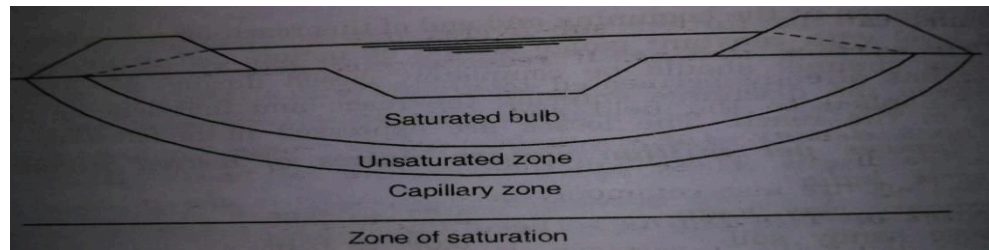
Losses in canal:

The losses in canal comprise evaporation from the surface and seepage through the bed and sides of the drains.

- Loss due to evaporation from a canal system depends upon the climatic conditions of the region and hence it can never be prevented. However, losses by evaporation forms a minor part, hardly 1 to 5 % of seepage loss and hence, in most of the cases evaporation loss is not significant.
- Loss due to seepage is the most significant as this forms the major portion of the loss of the canal water. The seepage loss depends mainly upon the following factors.
 1. Position of subsoil water-table.
 2. Porosity of soil and subsoil.
 3. Extent of absorbing medium.
 4. Design of canal cross section.
 5. Conditions of canal system.
- Depending upon the position of water table the seepage loss from the canal occurs in two ways, namely:

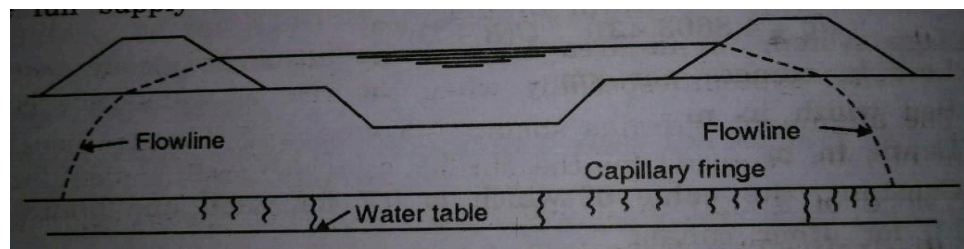
a) Absorption:

When the water-table is considerably below the ground level, the water seeping through pores is unable to join the water table and wets the subsoil locally forming a saturated bulb. The zone in between this saturated zone and the zone of capillarity moisture remains unsaturated.



b) Percolation :

When the water-table is close to the ground level, the seepage water may establish a direct and continuous flow in between the canal section and water table .the space between the water table and canal bed enclosed by the two flow lines, remains completely with water. When once a direct flow is established, the seepage loss depends upon the head difference between the full supply level of canal and water-table.



Lining of Irrigation channels:

Necessity:

1. To minimize the seepage losses in canal.
2. To increase the discharge in canal in canal section by increases the velocity.
3. To prevent erosion of bed and side due to high velocities.
4. To retard the growth of weeds
5. To reduce maintained of canal.

Advantage of Lining:

1. The lining of canals prevents seepage loss and thus more area can be irrigated by the water so saved.
2. The increased velocity minimizes the losses due to evaporation.
3. The increased velocity helps to provide a narrow c/s for lined channels.

4. The lining of canal is an important anti –water logging measure as it reduces seepage to the adjoining land.
5. Higher velocity helps in providing a flatter hydraulic gradient or bed slope. Thus better command can be obtained.
6. Higher velocity prevents silting of channel.
7. Lining makes the banks more stable in light textured soil.
8. Lining reduces maintenance costs and possibility of breaching due to increased stability of section.
9. Lining of a canal increases available head for power generation as a flatter gradient can be provided.
10. Canal lining assures economical water distribution.
11. Canal lining prevents water to come contact with harmful salts during transit.

Disadvantage of canal lining:

1. Canal lining requires a heavy initial investment.
2. Lining being permanent, it is difficult to shift the outlets very often.
3. It is very difficult to repair the damage lining.
4. A lined channel section is without berm.

Suitability of canal lining material:

1. The material used for lining should provide complete water tightness.
2. The material used should have low coefficient of rugosity so as to marked the section hydraulically more efficient.
3. The material chosen for canal lining should be strong and durable.
4. The lining should not have a very high intial cost.
5. The material used should be unaffected by tramping of cattle.
6. The materials should withstand high velocity.
7. The material should permit construction of required slope easily.

Types of lining:

1. Hard surface type lining
 - a. Cement concrete lining
 - b. Shotcrete lining.
 - c. Precast concrete lining.
 - d. Cement motor lining.
 - e. Brick lining.
 - f. Asphaltic lining
 - g. Stone blocks or undressed stone lining.
2. Earth type lining
 - a. Soils cement lining.

- b. Clay puddle lining.
- c. Sodium carbonate lining.
- 3.** Buried and protected membrane type lining
 - a. Prefabricated light membrane lining.
 - b. Bentonite soil and clay membrane lining.
 - c. Road oil lining.