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* What is irrigation?/ Define irrigation

- Irrigation is the artificial (કૃત્રિમ) application (ઉપયોગિતા) of water to soil for crop production throught the crop period

Or

- Irrigation is the artificial application of water to the soil for the purpose of crop requirements from before sowing to pre-harvest.

* Advantages & disadvantages of irrigation

- Following summarised points are consider as advantages & disadvantages of irrigation

Advantages

- To increase the food production
- To improve the ground water storage
- To get the optimum benifits
- To generate the hydro-electric power
- To supply the water for domestic (ઘર-વપરાશ & industrial purposes.
- It provide the navigation facility & fish production
- To increase the value of land
- To increase the labour employment
- To modify the soil media by leaching
- To reduce the afforestation
- To eliminate the mixing of crop

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Disadvantages

- Water pollution due to use of fertiliz
- Water-logging problem which reduce the crop yields
- Due to colder & humid climate, spreding of disease like malaria & dengu
- Highly dumping of water produce poisonous gaseous like methane
- Problem of salinity & alkalinity of soil due to saline & alkaline water application
- Reduce the soil aeration
- Supplement of irrigation water is conn & expensive

* Necessity of irrigation / why need of irrigation

- Due to less rainfall than the crops/plant requirement

- Due to uneven distribution of rainfall even if rainfall is sufficient

- To develop the high yield variety (HYV) or in other words for better crop production

Adsorption :- It is the surface phenomenon

Absorption :- It is the bulk phenomenon

* Movement of water in the soil

or

How water move/passes through soil media

or

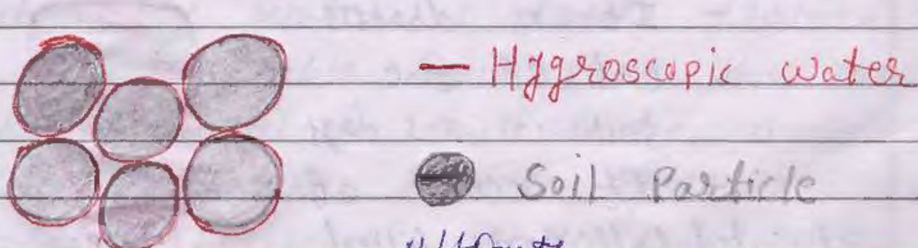
classes of soil water or soil-moisture relations

- There are mainly three classes of soil water or movement of water in the soil as;

1 - Hygroscopic water
2 - Capillary water
3 - Gravitational water

1) Hygroscopic water

- This type of water is tightly bound with soil particles by absorption forces.
- When an oven dry sample is kept open in the atmosphere then it absorbs some amount of water from the atmosphere is called hygroscopic water.
- This type of water is not able to move by the gravity or capillary forces.
- This type of water is not useful for plant.
- It is very tightly held by force of adhesion.
- It is not held in the pores but held on the particle surface.
- It is held in the soil at 31 bars



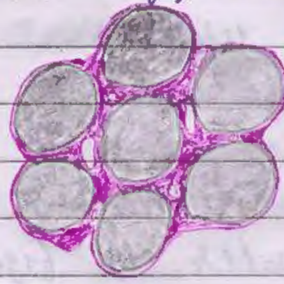
ultimate
- It occurs at permanent wilting point (PWP)

~~1 bar = 1.013~~

1 atmosphere (atm) = $1.013 \approx 1$ bar

2.) Capillary water

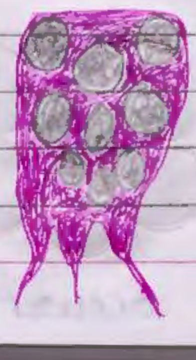
- The water held in the pore space (voids) against the gravity forces due to cohesion (attraction between water molecules) & adhesion (attraction between water & soil molecules) is called capillary water
- It is held at $\frac{1}{3}$rd to 31 bars
- It is useful for plants
- The amount of Capillary water is more than the hygroscopic water



- It occurs at field capacity

3.) Gravitational water

- The water which moves (चलना) downward freely under the influence of gravity & drain (निकल जाए) out from the soil
- It is also called as free water
- It is found in the macro-pores
- It is not useful for plants because it prevent the entry of water
- It is held at 1/3rd bar pressure
- It is drains out of the soil in 2-3 days
- It occurs at saturated (all pores filled with water) water content



* soil moisture constants / What are the soil moisture constants

- Following are the soil moisture constants

1 - Saturation capacity
2 - Field capacity (F.C.)
3 - Permenant wilting point (P.W.P.)
4 - Ultimate wilting point (U.W.P.)
5 - Available moisture/water (A.W.)
6 - Readily available water (R.A.W.)
7 - Moisture equivalent
8 - soil-moisture deficiency

1.) Saturation Capacity

- When all the pores (voids) are filled with water then the soil is said to be saturated or in saturation capacity
- It is also known as maximum water-holding capacity
- It is the upper limit of moisture content
- The tension (pressure) of water at saturation capacity is almost zero (0) & it is equal to free water surface.

2.) Field capacity (F.C.)

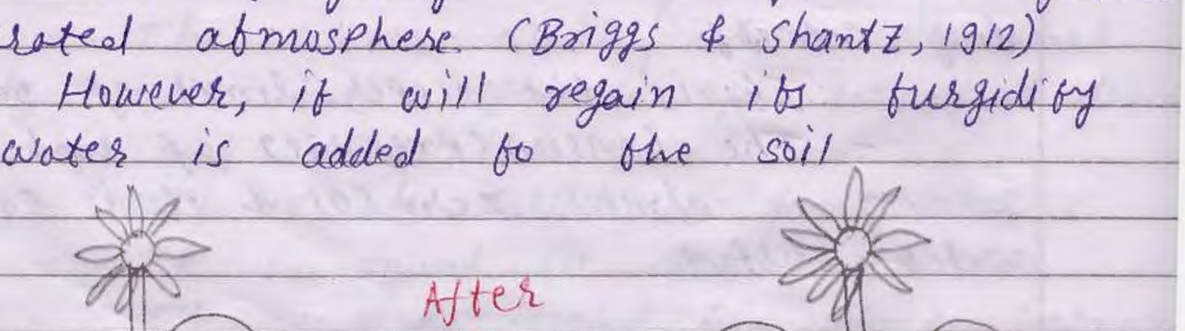
- When the water is freely drained due to gravity & become stable (स्थिर) then the moisture content of the soil is said to be in field capacity
- This situation becomes after 2-3 days after saturation (Veihmeyer & Hendrickson)
- At F.C., the large pores are filled with air & the micro pores are filled with water

- The soil moisture tension ranges from 1/10 to 1/3 atm.

3 > Permanent wilting point

It is measured by pressure membrane apparatus (Richard, 1947)

- When plant cannot longer extract sufficient water from the soil for its growth then the moisture content of the soil is said to be in permanent wilting point
- It is the lower limit of the available moisture range.
- The soil moisture tension at permanent wilting point ranges from 7 - 32 atmosphere & it is closely near to the 15 atmosphere
- If the plant does not get sufficient amount of water to meet its requirement then it will wilt (કરમાઈ જશે) permanently.
- A plant is considered to be permanently wilted when it will not regain (ફરીથી ટટ્ટાર થશે) its turgidity after putting in a saturated atmosphere. (Briggs & Shantz, 1912)
- However, it will regain its turgidity if water is added to the soil



Permanent wilting point (PWP) — Field Capacity (F.C.)

- It is also called wilting coefficient

4> Ultimate wilting Point (UWP)

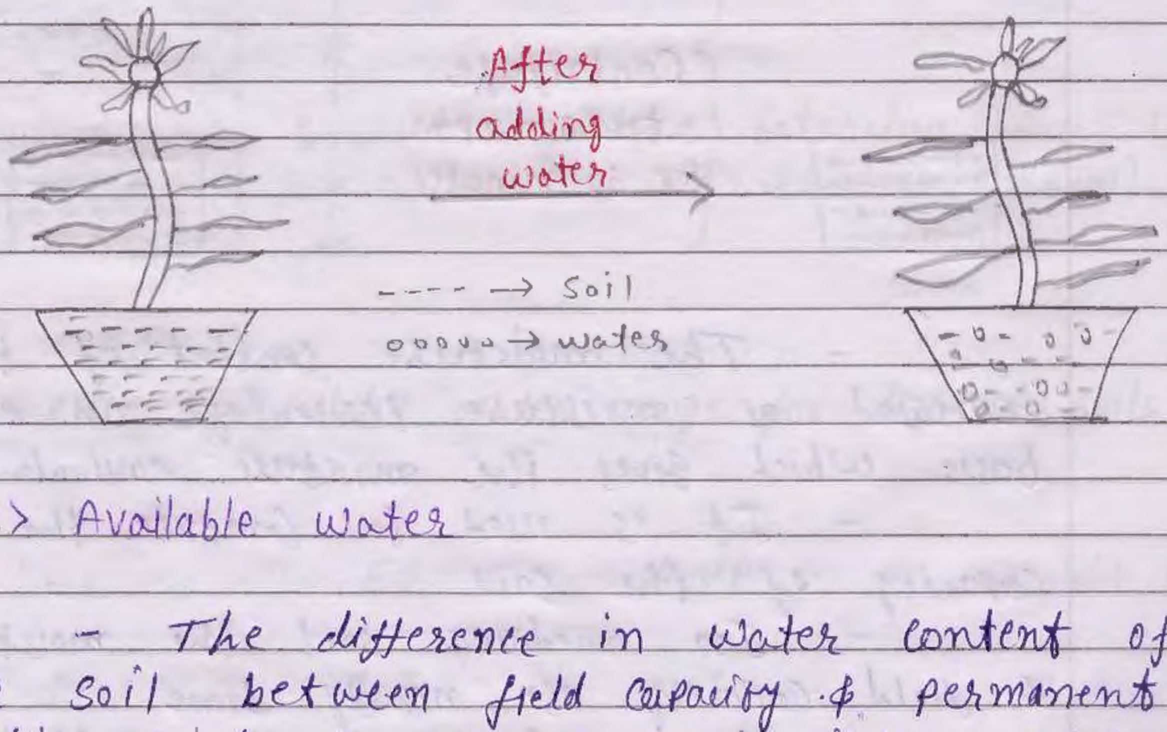
- When plant is die (મૃત્યુ પામવું, નાશ પામવું) ~~after adding the water to the soil then~~ due to unavailability of water then the moi content in the soil is said to be in ultimat wilting Point

- ~~In~~ At this Point after adding th water the plant can not ~~get~~ regain its tu gidity or can not alive again

- The soil moisture tension at ultimat wilting Point is about 60 atmosphere.

- It is occurs at hygroscopic water co

- It is also known as hygroscopic coefficie



5.> Available water

- The difference in water content of the soil between field capacity & permanent wilting point is known as available water

Available water = Field Capacity - Permanent wil Point

A.W. = F.C. - P.W.P

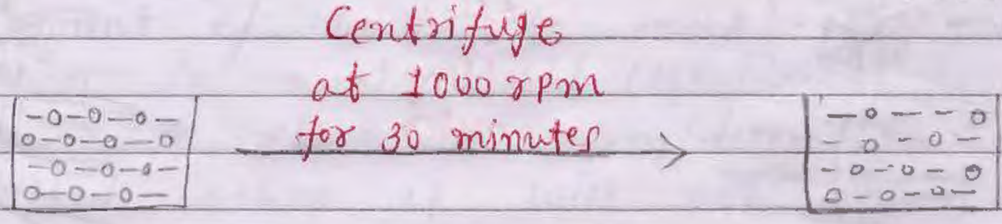
5.) Readily available water

— The portion (भाग) of the available moisture content which can easily extracted by plants is called readily available water.
- It is approximately 75% of the available moisture RAW = F.C. – Critical soil moisture content

7.) Moisture equivalent

- It can be defined as the moisture content of saturated soil after centrifugal force of 1000 times that of gravity for a period of 30 minutes

----→ soil
ooooo → water



- The moisture content of the sample expressed as moisture percentage on oven dry basis which gives the moisture equivalent
- It is used to compute the field capacity of the soil
- In medium soil the moisture equivalent & field capacity are nearly same
- In sandy soil the field capacity is more than the moisture equivalent (Rapid drain of water due to centrifuge)
- In clay soil the field capacity is less than the moisture equivalent (slow drain of water due to centrifuge)