Water Management
Doctor A. K. Gosain
Department of Civil Engineering
Indian Institute of Technology Delhi
Lecture 03
Soil, Water, Plant Relationships (Continued)

So we had started looking into the process of infiltration. As I was mentioning that the process of infiltration is important from the point of your knowing. When you irrigate the area how much of the water which you are using for irrigation goes into the soil and how much of it will flow over the soil surface? The rate at which the water will infiltrate into the soil is known as the infiltration rate. And to find out the infatuation rate we use various methods.

There are various equipments also which can be used for finding out the infiltration rate. What we do is you absorb the depth of water which has been lost in a unit time. That will give you the infiltration rate. What is important to understand is that what are the various factors which influence this infiltration rate? If you look in nature the soil when it is dry it will have the moisture tension at a very high level.

It will be able to attract the moisture with lot of force because when you look at the moisture availability in soil, the moisture is trapped in the soil pores in the form of the water under tension, okay. Now this surface tension is because of two things, one is the tension between the soil particles and water which is the force of adhesion, okay. And then there is another force which is working which is the tension between the water molecules that is (cal) known as the cohesion.

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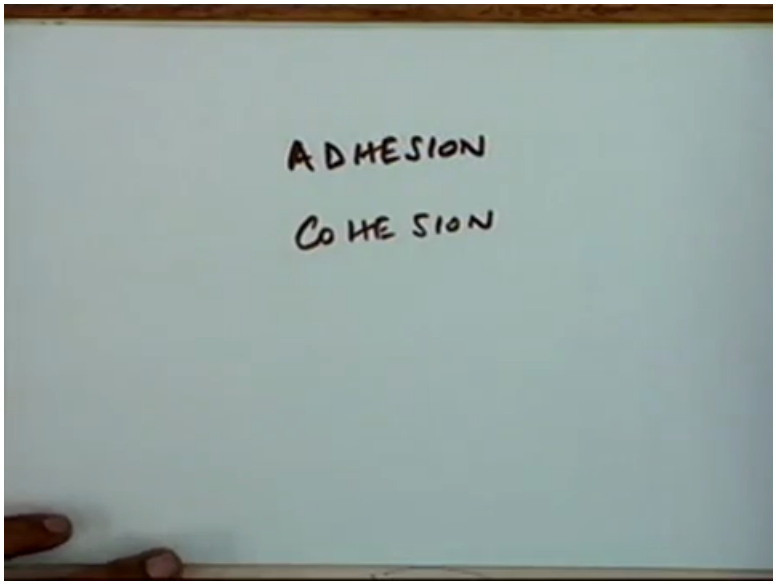

So these adhesive and cohesive forces they are responsible for the moisture availability in the soil and because of these forces the moisture tension keeps on varying depending on what is the level of moisture availability in the soil. So if we look at the various major factors which influence the infiltration rate, the soil texture is one, then the soil moisture content and the soil structure. These are the three major factors which influence the infiltration rate.

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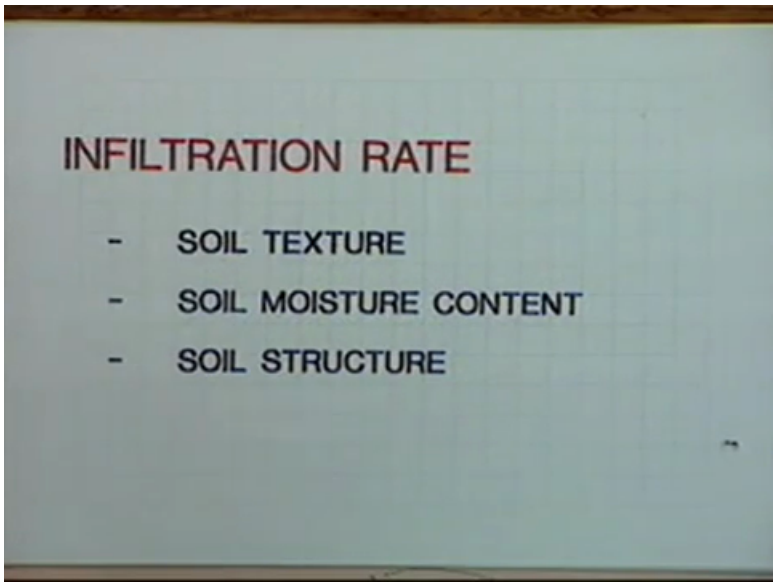

For example in the case of soil texture if the soil is coarse soil the pore spaces will be large enough, they will let the water move in the downward direction at a rate which is much higher in comparison to those soils which are fine soils. In the case of fine soils the pore spaces will be much smaller and they will be creating entrance to the movement of the

moisture. So the infiltration rate will depend largely on the type of soil which you are using to know the infiltration rate.

Similarly the soil moisture content as we have just seen that the moisture availability in the soil is dependent on the adhesion and the cohesion forces. When the moisture content increases these forces the moisture tension also reduces. So when the soil is at a higher moisture tension it will have the capability of attracting more water into it and that will in turn increase the infiltration rate.

On the other hand when the moisture tension is much less or you can say when the moisture content of the soil is higher then the infiltration rate will be lower. Now the soil structure also influences the infiltration rate because if the soil is structured in granular fashion the infiltration rate will be higher. On the contrary if the structure of the soil is massive the infiltration rate will be influenced, it will reduce, okay. But later on we will again come back to these aspects when we deal with the infiltration process in detail.

Right now at this stage I will like you to have a basic understanding of the influence of these individual factors which influence the soil and water relationships. It is also important to look at the various conditions of soil moisture and when we talk of the soil moisture condition the first thing which we must know about is the soil moisture content. This is one term which we must have the clearest understanding about.

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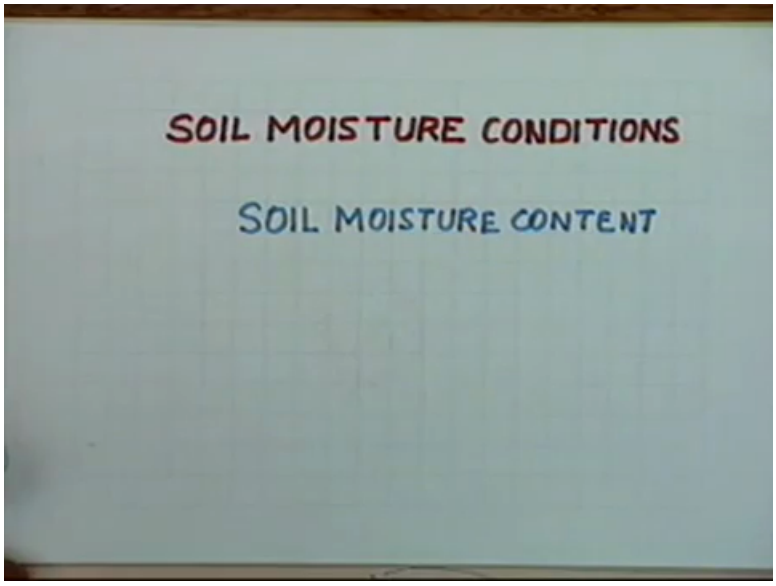

What do we mean by soil moisture content? Soil moisture content is nothing but it is the level of availability of the moisture in the soil with respect to either the depth. It can be expressed

in various manners. You can express in terms of the depth of moisture per unit depth of soil or you can express in the form of percentage by volume. How much of percentage of soil volume is occupied by the water?

Now this is one depiction where if we assume that there is a block of dry soil and you add its depth is 1 metre, its area is also 1 square metre and if you add depth of water of 150 millimetres that water will penetrate into the soil and it will increase its moisture content, okay.

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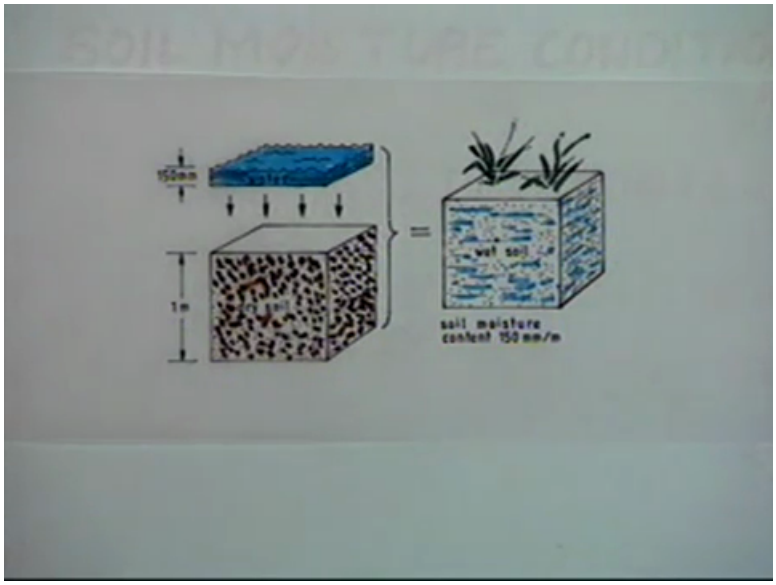

Now while presenting this moisture content either you can say that it is 150 millimetres per metre depth of soil or if you want to express this in terms of the volume you will have to find out how much is the volume of soil. If it is 150 millimetres, this much is the amount of water into 1 metre to 1 metre, the amount of water is point 15 cubic metre in 1 cubic metre of soil. That is what it amounts to. So in terms of percentage it will be 15 percent. Now this much depth is equal into 15 percent moisture content per volume.

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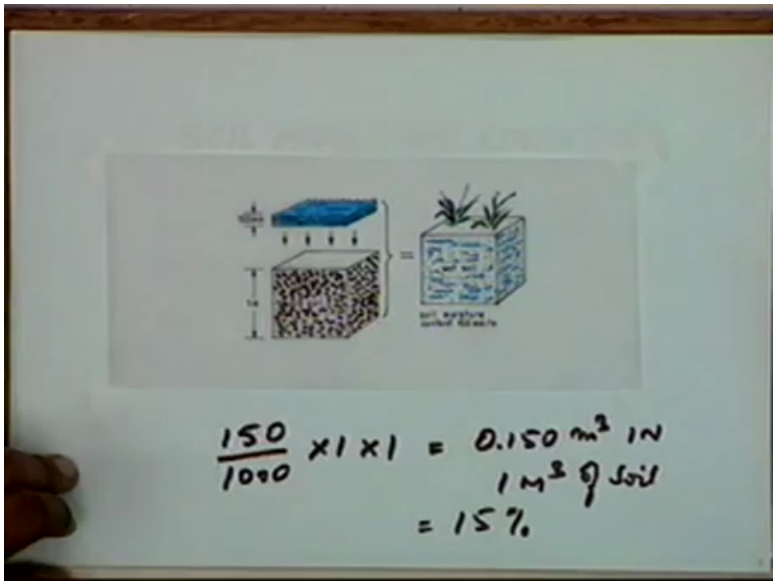

Because most of the time when you will talk in terms of the moisture availability that is what we are interested in. When we talk of irrigation we must know that where the irrigation water is going? Is it going and getting stored into the soil or is it going as a loss? There is anything which is not being used by the plants is a loss. So our total aim is to ensure that whatsoever water is being supplied through irrigation it must be stored effectively into the soil. By effectively we mean it must be later on consumed by the crop, okay.

Now the soil moisture content can be evaluated at any time and it is quite useful thing to define some of the properties of the soil in terms of the soil moisture content.

So in literature you will find that there are some soil moisture conditions which have been characterized, which have been defined in terms of the soil moisture content which signify the various levels of the soil moisture availability and those definitions are very important in terms of the usability of water, in terms of the availability of that water which has been stored subsequently by the crop.

And these conditions are the condition of saturation, field capacity and the permanent wilting point. They are also known as the soil moisture (equibili) equilibrium points.

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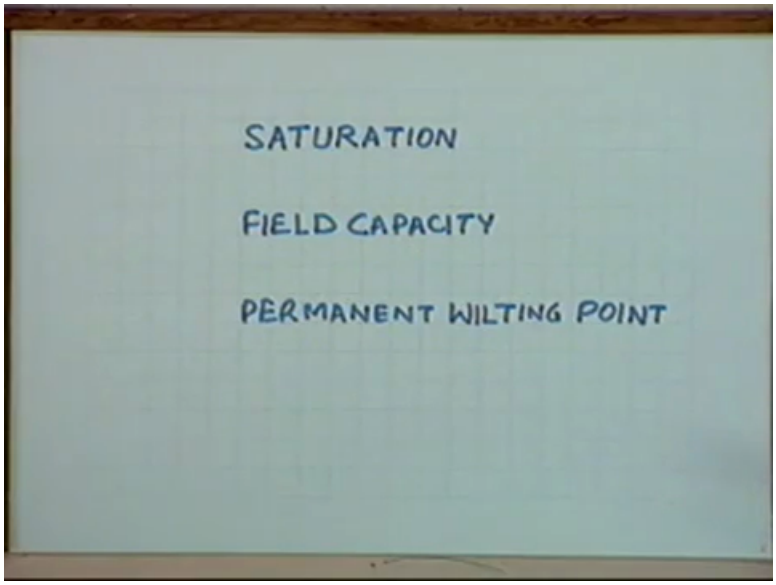

They will also be termed as soil moisture equilibrium points in literature. Let us try to look at these conditions of these levels one by one. What is the saturation level? The saturation level of the soil is that level when all the pore spaces are filled up with water. So if you supply lot of water to the soil either it can be in the form of natural rainfall or it can be in the form of artificial irrigation.

So at the end of that moisture supply you will find that the soil can come up to the saturation level. Just a sum of depiction here. Sorry this is for (())(16:47). In the case of saturation if I take the help of this slide this was the soil structure.

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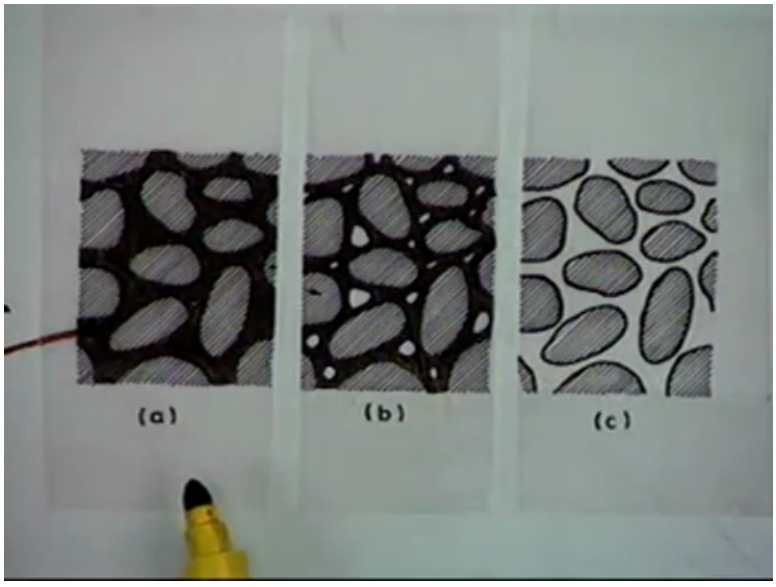

There is a level of saturation. Now this level of saturation cannot stay for long unless you assume that you keep on supplying the moisture or the rainfall continuous for a very long period or there is a depth of water which has formulated on the top of the ground and the moisture availability is continuous. Otherwise the moment the moisture supply is stopped you will find that all the excess water which can be drained out by the force of gravity that will be drained out of the soil and the moisture content of the soil will reduce, okay.

At that stage when all the excess moisture which can be drained out of the soil under the force of gravity it has been drained out, that level is known as or that moisture content is known as the field capacity level. So in this depiction that is what has been shown that if this is the total soil column and in this soil column you have at the saturation level, the total column was filled with water. When you have let the water get in under the force of gravity then all that water has gone down and maybe it has joined the groundwater table.

It has gone down this particular level of the profile or the column of soil. Once it has come out of this the level which is attained after that prolonged drainage and the time required for such drainage will vary from soil to soil and the coarse soils the time required minute will be much less, the draining will be quiet fast but in the fine soils in comparison it will require a longer period to let the water drain out from the soil due to the gravitational forces.

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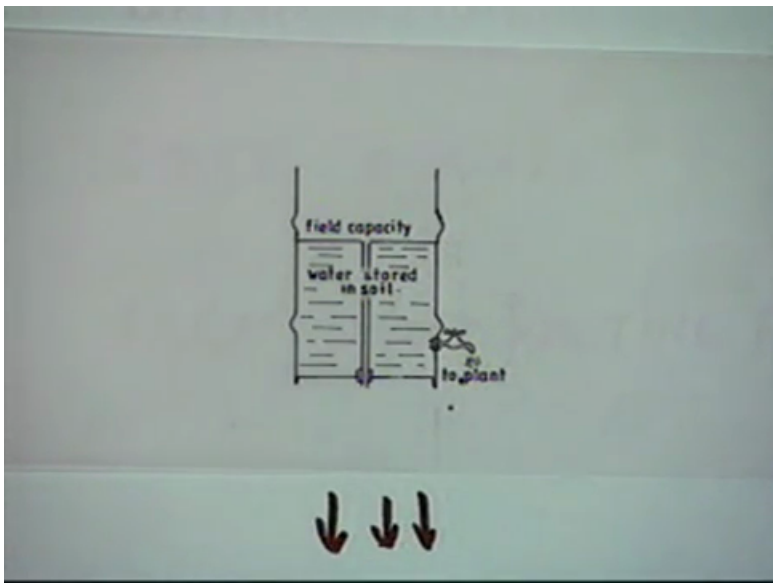

That might vary from 24 hours to 72 hours. That can be the order of magnitude. Once that has happened, the level or the moisture content which is prevailing at that time that is what is known as the field capacity level, okay. Then the permanent wilting point which is the third

important soil moisture condition is that level which when attained will not allow any further consumption of the soil moisture by the crop. So if you have a crop, the crop is consuming water from the soil through the evapotranspiration.

We will try to discuss that later what we mean by evapotranspiration but evapotranspiration is a combination of evaporation and transpiration which is the (consum) consumption of the moisture by the plant plus the evaporation activity which is taking place. That consumption can be only allowed up to a level which is known as the permanent wilting point.

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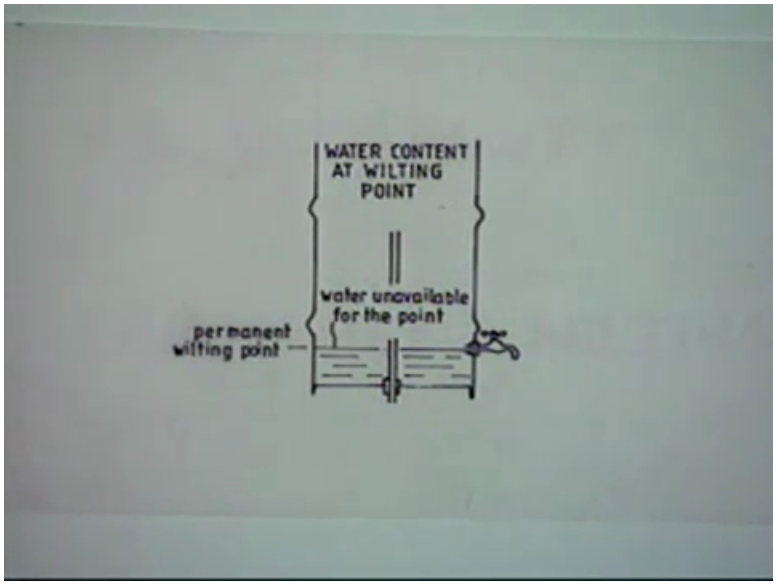

So if the moisture content reaches that level of permanent wilting point then the crop will wilt. There will be a permanent damage to the crop in terms of its yield and it cannot revive. Even if you supply water at that level it will not be able to revive. So in other words you can say that this is the lowest level up to which the crop might be in a position to use water but this is not the level of moisture up to which you can afford to go.

Though at even that stage if you look at this picture, this was the total moisture at the level of saturation. Up to this level it drained out and the remaining was the content at the field capacity level and the crop could only utilise the water between this level and up to this level.

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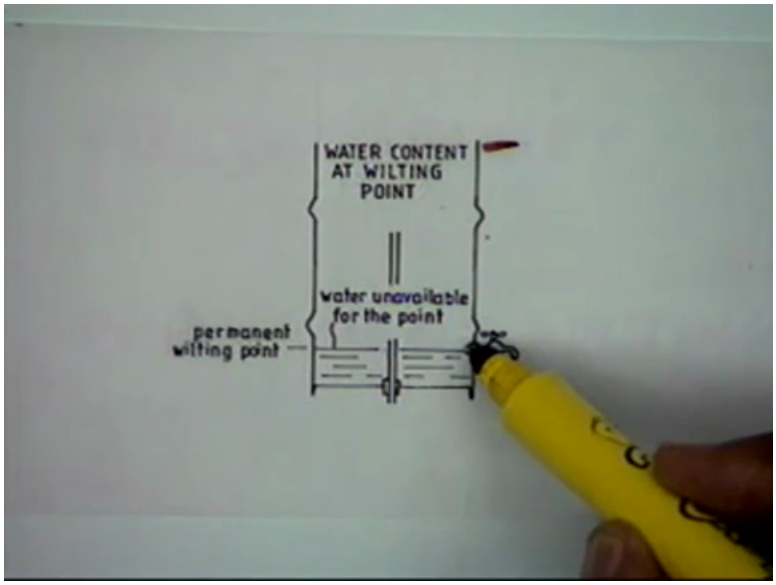

But by reaching here at this level which is the permanent wilting point the crop has damaged itself and the yield is affected. You might not get anything out of the crop. Though there is still some water left in the soil that water is the water which cannot be used by the crops. There is still some moisture available in the soil which is there but it cannot be used by the crops.

So from the angle of knowing what is the level of moisture availability in the soil, these moisture conditions are very essential, they are very useful and we will discuss the various aspects related to these moisture conditions in the next class.