Farm Machinery
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Lecture – 53
Conservation Agriculture

Welcome students to my lecture number 53, in fact after discussing with you about the implements at various aspects of testing etcetera. I have come for what to give you some idea about Conservation Agriculture. Now, this conservation agriculture is very important so far as machines are concerned, because what we are interested in we would like that the, with minimum cost we should be in a position to produce maximum that is the aim. So, in this conservation agriculture, what do you mean what we want to conserve this is what is important. So, let us go through the few slides which I have got for you and the considerations which we do when we are talking of conservation agriculture.

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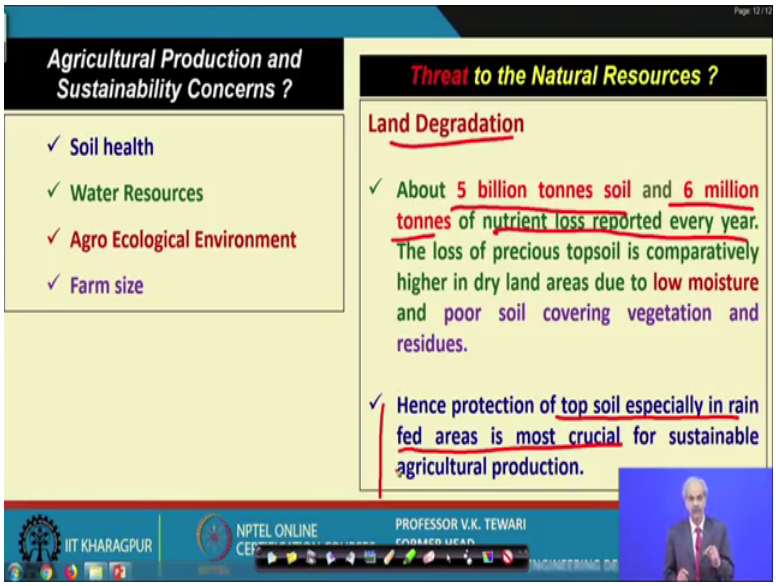

So, agriculture production and sustainability concerns, what are the agricultural production and sustainability concerns, this is very important. We would like to maintain the soil health, because if the soil health is not good definitely nothing will come out of that. What are the water resources that we have we must conserve our water resources, we must see that the water resources are full with water when we require. Then agro

climatic environment, what is the environment at some point or the time the environment has an effect. And today with all sorts of global warming and lot of noxious gases being produced, because of the vehicles etcetera, the whole environment is very much affected. So, this also affects our agro production and the farm size.

Now, I have put farm size particularly here with respect to agriculture production and sustainability concerns. Well, farm size does not come so much but I have particular reported here, because this also plays a role. If you have a small farm, then what sort of considerations you would need. And if you have a large farm, then what are the considerations you need and that is why I felt relevant that this must also be put in the sustainability concerns.

What are the threat to the natural resources, what may happen, see land degradation has taken place over the period of time. We I need not elaborate much, but I can just show you that see 5 billion tonnes of soil and 6 million tonnes of nutrient loss is reported every year. Now, see what happens, because of the various degradation methods, various methods which people are using for various aspects of infrastructure creation or for roads various kinds various things has happened. We would like to get this soil move from one location to another location. And maybe application of the chemicals over the period, so much of the several billion tonnes and of material has been spoilt.

Protection of the crop top soil especially in rain fed area is most crucial yes. We want to protect, because the crop is going to grow within the top soil. And we must see that that crop that the top portions, top soil is congenial for growth which is important. So, this while we consider the land gradation degradation what is our concern with respect to the soil health is the top soil, especially in rain fed areas, where when there is rain there is water if there is no rain, there is no water. So, though there where there is no source of irrigation, and we have to be careful about this.

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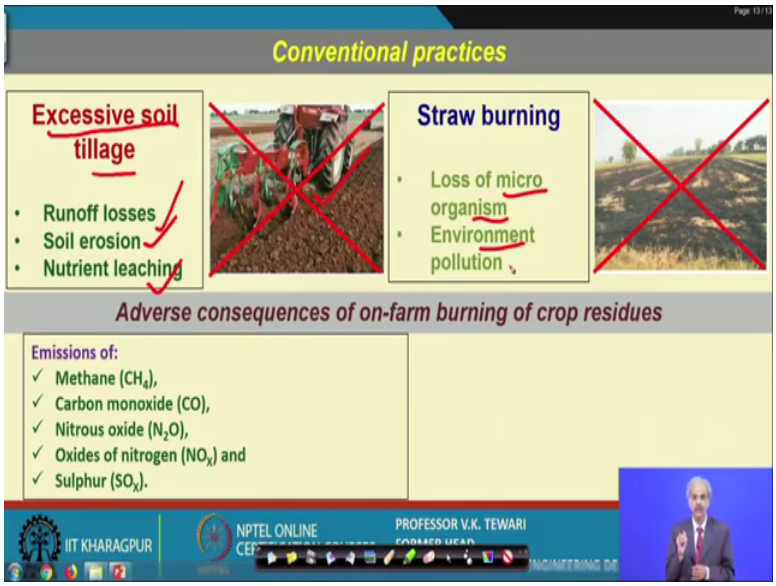

Conventional practices what we are doing as I said we are degrading the land, what we are doing excessive soil tillage we have been doing so far we have been doing excessive soil tillage. And this is what is shown here that the tillage is excessive so far we have been doing. And then runoff with these runoff losses soil, erosion and nutrient leaching this is going to happen.

Then straw burning this is a big concern in our country here, where loss of microorganisms the environment is totally polluted. And this is very very big concern in our country, you might have read in papers and then several aspects. The whole government machinery is behind this in the particularly in the Delhi and NCR and Haryana and all the areas lot of this is going on. Not only that area, but that is very high in those areas, because of which the whole environment is getting affected, and lot of people are getting affected. So, the adverse consequences of on farm burying of this crop are in fact, here emission of methane, carbon monoxide, nitrous oxide oxides of nitrogen and sulphur.

Now, these are all there and these are very harmful to human being, human beings and all sorts of living creature. So, it is very important that we need to have a check on this land degradation, which we are doing over the period for our different activities, what have we have done. So, what exactly we mean by conservation agriculture I have given a small definition of this over here. I would like to just read for you. Conservation

agriculture is a system of integrated management of what the soil water and biological resources combined with external inputs with a view to conserve natural resources.

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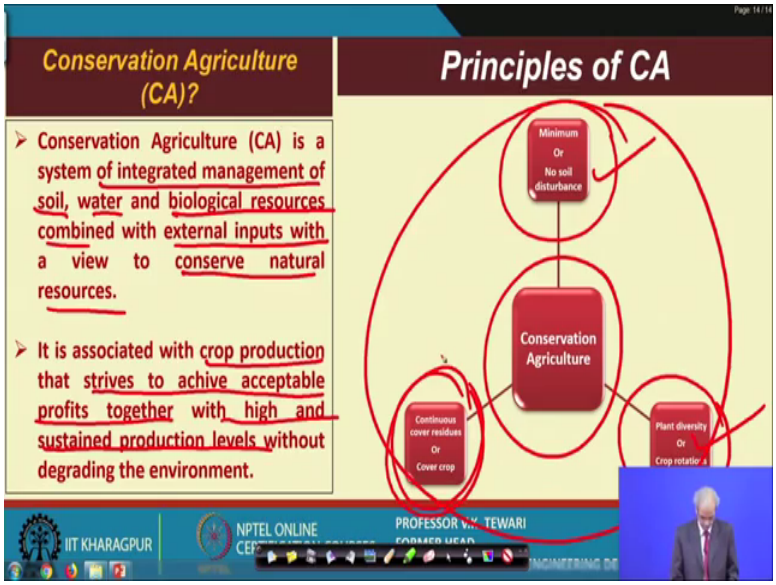

So, what exactly we are doing the soil water and biological resources need to be maintained. And then only you are talking of the conservation agriculture. Whatever you are doing you must produce at the same time maintain these in good health so that you have sustainability of production over a period of time that is the main concern. It is satured be is crop production that is strives to achieve acceptable profits together with high and sustained production that is the important part as I said, yes this is what we want that while we take care of these.

If you take care of these parameters, the soil water and biological resources, if we take care of them properly, and then do cultivation and minimise inputs and maximize target maximum production. So, that the sustainability of the produce out of that land remains over a long period of time as far as possible that is the main aim and that is what is known as conservation agriculture. So, if we put this in this particular farm that we have put here conservation agriculture of the centre means the continuous cover residues or cover of the crop, then plant diversity or crop rotation we need to look into this the minimum soil disturbance.

So, you do take care the soil health over here. It take the plant diversity, so that the crop, but use the proper crop rotation, then cut the residues crop residue is what you have

should be properly taken care of so that they conserve the moisture. So, you reduce on the water requirement. And then use the moisture which is available after the one of the crops is harvested.

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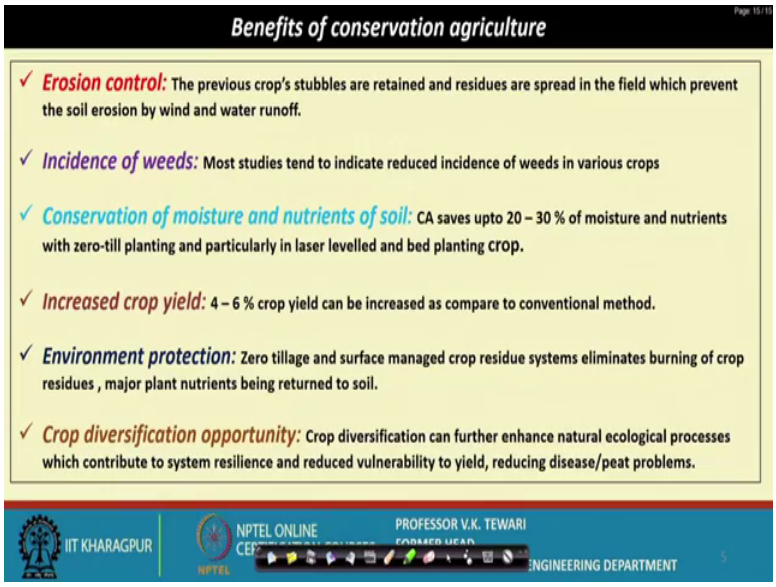

Benefits of conservation agriculture, where as I said in fact, if you add all these are all benefits, if you are going to talk about the soil, if you are going to talk about the crop rotation that you should take, and the moisture which you want to conserve through the crop residue which you have got; all these are going to give you benefits in terms of erosion of the soil erosion will be controlled.

Then weeds will be minimum, then the moisture will be remain for a longer period of time, then crop we will definitely increase we find that about 46 percent crop increases. Environment as such the total environment, where along with the crop you are also going to stay we are all going to stay in the environment so that environment is also protected. And crop diversity opportunities we should think of crop diversification opportunities, where we should think of multi cropping we should think of different crop rotations, we should think of inter cropping and in such a way that the soil health is maintained.

For example, if you take leguminous crop, then nitrogen fixation takes place and that is very essential for the next crop, if you take, so you can save form the nitrogen when you apply next time so that is very important. Therefore, these are extreme benefits of

conservation agriculture if you talk of the maintaining of, the all these parameters over a period of time.

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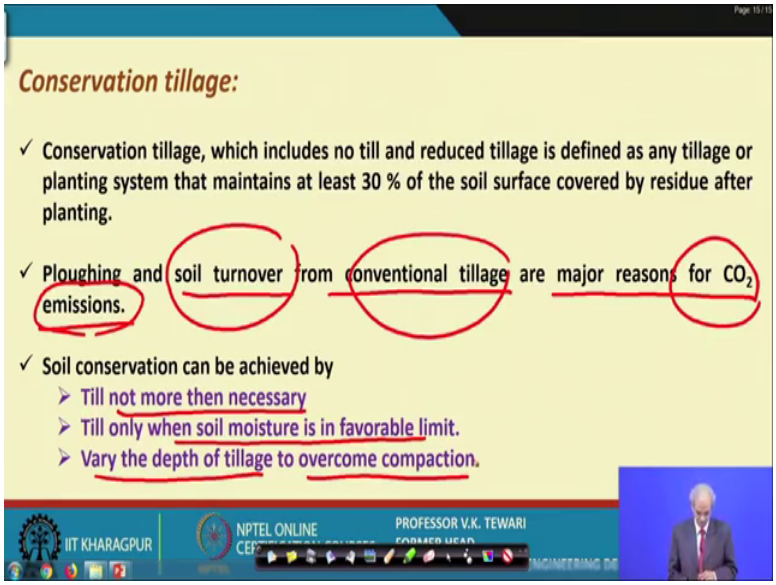

Conservation tillage well I told earlier that we are doing lot of tillage. So, conservation tillage is important that means I would say that you should do minimum tillage you should do no tillage. In fact, you should try to see the amount of tillage which is just required for that. So, these the concept which says when to that the 30 percent soil cover by residue planting, now we need to know that how much is the actual amount required for the tillage and that should be done. If you if you just go on tilling the land just like that each time, then you are increasing your tillage energy at the same time you are also damaging the soil.

So, the important thing is ploughing and soil turnover from conventional tillage are major concern for CO2 emissions, now is very important. Soil turnover and conventional tillage are major reasons for CO2 emissions. Now, we have to check on these aspects. Conservation can be achieved by then what we do, how do we achieve soil conservation or the conservation agriculture what exactly means is soil conservation till no more than necessary as I said. Till the only when soil moisture is in a favourable limit, and then vary the depth of tillage to overcome compaction. So, it should not very highly compacted (Refer Time: 10:43) how create problem for germination of the crop. So, this

is very important, when you are talking of conservation agriculture the conservation tillage first aspect.

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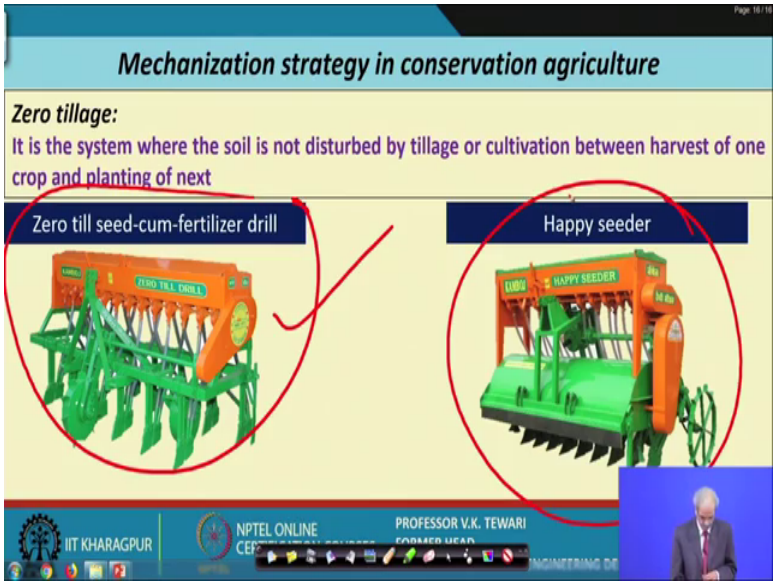

Mechanization strategy in conservation agriculture; well here I just like to tell you that I have been biased towards mechanization as such, because when we are talking of maintaining of the soil health, and also talking of not disturbing the environment. We what is that which is disturbing the environment what is that which is disturbing the soil health. It is the equipment which will it is the operations which we do.

Once the crop has come we are going to weed the crop and then harvest the crop and (Refer Time: 11:34) crop and keep it here, but what is that which happens before that it is the tilling of the land, what sort of tilling you should do, what sort of equipment is reduced, what should be the design of that equipment so that is why it is becomes very imperative that mechanization strategy must be very clear and concrete in conservation agriculture. We must have an idea about which machine to use and when. So, this is what is given as I said that we would like to say paddy is harvested.

Then immediately after that there is proper enough moisture in the soil and at that time if you simply open a slit and put the seeds of wheat, it will simply grow so that is what is say that we should have a machine. Now, here is a machine which does this job zero seed comfort it has a drill here. It is the one which is very effective and very widely used.

Similarly, another equipment of similar type which is there which cuts, the any cuts the front certain portion of the small stubbles which are there.

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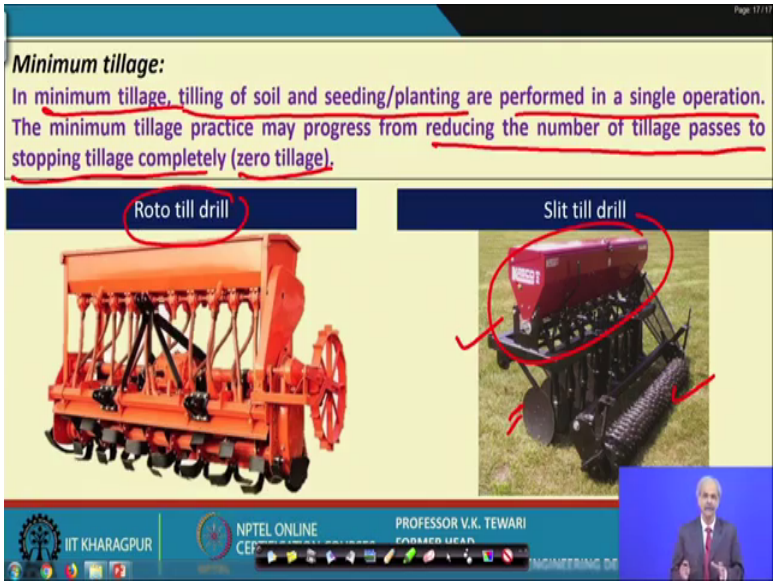

And then seeds, so these are some of the very popular equipment, which are used for conservation agriculture. Minimum tillage this is what I think we have been talking of this time and again, because minimum tillage tilling of the soil and seeding planting a performance single operation, when we are talking of minimum tillage, we are talking of no tillage, when we are talking of zero tillage, where we are talking of roto till drill, when we talking of slit till drill, now these are all the equipment which are helping us in doing what zero tillage virtually so that the tilling of soil and seeding planting and perform in the single operation in minimum tillage.

The minimum tillage practices may progress from reducing the number of tillage passes to stop tillage virtually. So, have minimum process as I said that you have to so the other equipment which are available you can say roto till drill, if the say rotovator here in the front which will cut the stubbles which are there. And then the for a openers are there through which you can sow the seed or fertilizer both.

Similarly here you can see that this slit is there by slit is created by these, and this one will try to smother the small stubbles which are there, and then you can sow the seed through seed and fertilizer. Hopper is here and you have the same seed fertilizer system which you can see separately. So, these are the some of the equipment which are used for

minimum tillage these are all towards minimum disturbance to the soil and no degradation of the soil, but maintain the health of the soil that is important.

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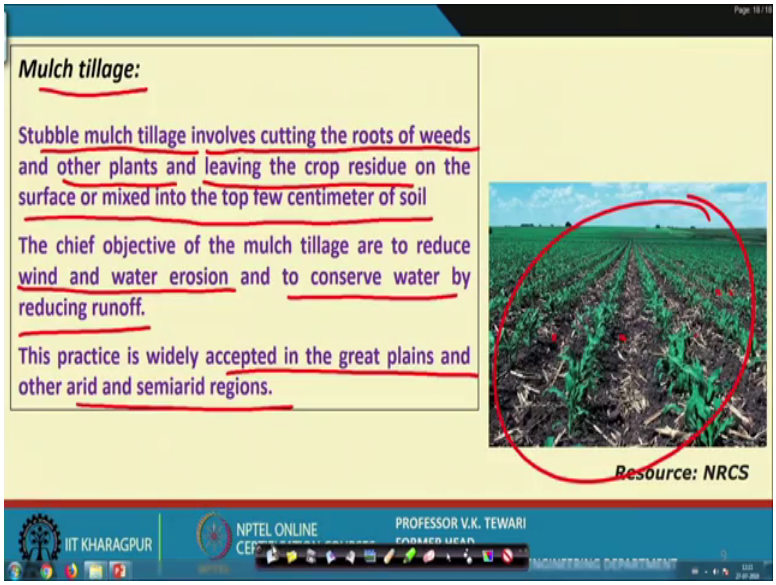

Mulch tillage well as I told you that you would like to do some sort of mulching sometimes when a stable mulch sometimes with the stubbles which are cut there we would like to keep them for some time and conserve the moisture, so that is what it is written here. So, mulch tillage is nothing which stubble mulch tillage involves cutting the roots of the weeds and other plants and leaving the crop the crop residue on the surface and mixed into crop top few centimetres of the soil. This is the portion which is then you can say that you can mulching mulch tillage if you maintain there.

Chief objective of mulching tillage are to reduce wind and water erosion very important this to conserve water reducing runoff. So, this will help the mulch tillage will help you to conserve on the erosion of the soil because of the wind or because of the water etcetera. And this practice is widely accepted in the great plains and arid and semi arid regions this mulch tillage in where particular in dry areas, areas, dry regions where they are only dependent on the only dependent on the aspect of rainwater. So, these are important. You can see one photograph which is given over here it talks of the mulching which is given in this particular crop and you can see this once where the mulching is maintained. So, mulch tillage is also a practice which is important for conservation agriculture.

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Furrow irrigated raised bed farming system, yes, this is another thing because furrow irrigation is done and raised bed farming system when we do this we have the equipment here and through this equipment in fact, we are in a position to do.

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Now, some the other equipment for residue management, now this is another equipment for residue management. So, a stubble shaver you can you can have a look at this. You can see that this is going to maintain stubble here. Similarly, this another equipment which is for rotary slasher. Now, these stubble shavers, rotary slasher, these are going to

actually for residue management what reason do are have left. They will say for example, if you operate this will cut they into a very carpet sort of thing and very small size reduction of the grasses or weeds which will be there. And they will be left over there, so that we also you can say conserve the moisture of the soil which is there. So, this equipment are also used and known as residue management equipment which are there.

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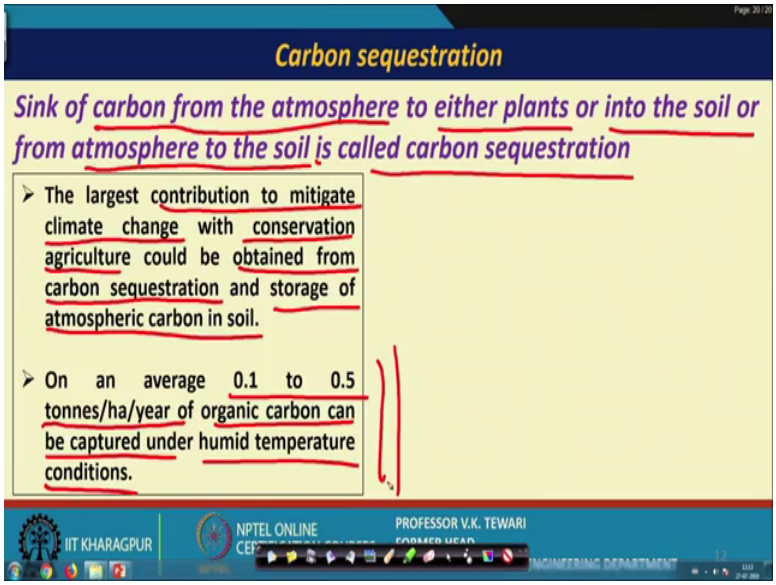

Carbon sequestration, now what exactly we mean by this. Actually well we are talking of these sink of carbon from the atmosphere to either plants or into the soil this is what we are trying to do. The sink of carbon from the atmosphere we want to take and to mix with either plants or into the soil of from atmosphere to the soil is called carbon sequestration. Now, this is what we are looking trying to do. Now, what we do by this the largest contribution to mitigate climate change with the conservation agriculture could be obtained from carbon sequestration and storage of atmospheric carbon in the soil.

Yes, how do we do that? So, this is an aspect which is very important and we must try to do this on an average 0.1 to 0.5 tons per hectare per year of organic carbon can be captured under humid temperature conditions from the atmosphere. So, this is one important thing which must be looked into when you are talking of conservation agriculture. So, you must employ the methods and mechanisms by which you should be in a position to conserve the carbon or get the carbon of the atmosphere and get into your soil. This is very important.

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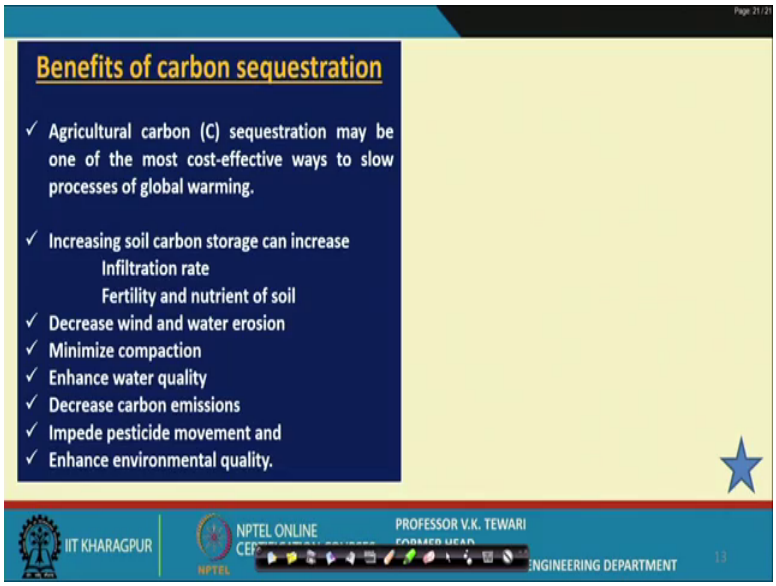

What are the benefits of this in fact, what are the benefits of this carbon sequestration. Now, the benefits could be maximum because, what we want is you are interested in having the details the carbon more and more inside the soil. So, agricultural carbon sequestration maybe one of the most cost effective way to slow process of global warming, very important. Global warming increasing of soil carbon storage can increase in filtration rate fertility and nutrients of the soil. Yes, we will be able to increase the nutrition quality of the soil then decrease wind and water erosion this is what we want to.

Minimise the compaction of the soil yes we would like to minimise the compaction because harder and harder the soil becomes it will be difficult to sow the seeds and we will have to do the tillage. So, the compaction level must be the extent that we can control this then decrease the well. The minimise compaction enhance water quality, we should try to see that the quality of water which is being used is a good quality water. Decrease the carbon emissions which are there as much as possible we should be trying do this then impede pesticide movement and enhance environmental quality.

Now, these are the things which we need to do or we do it for the benefits of carbon for you can see that conservation agriculture. So, as such if we look into what conservation agriculture is we can see that we want that maximum moisture of the soil must maintained. We must maintain the soil health, we must maintain the nutrients which are there in the soil. These are important because until less you maintain this properly, you

are not going to get a good crop and for that what should you do. So, you should in fact as we have seen that we are going to disturb the soil. The degradation of soil has taken place a lot and this degradation must be care must be looked into must be taken care of.

And for that what are the equipment so we have talked of the various equipment that they are there, and what are the designs and types which are there, what sort of benefits they give, and how they should be used. And, what is mulch mulching because mulching is another aspect of tillage mulch tillage which tries to maintain the moisture. Some areas where irrigation is not possible the areas which are totally dependent on rain rainwater there you have to have.

So, dry land agriculture which we call of dry land agriculture what is the dry land agriculture we are trying to conserve these. So, if we will like to have mulching, we will like to trap the carbon of the atmosphere into our soil, and see that we are in a position to do a good quality conservation agriculture and have these things in common. Now, I think this way we have tried to give you some idea about carbon I mean conservation agriculture as such.

This you may not find in many books this portion, but then what I can say that it I found it very essential and an essential input as well as very just for give you some idea about conservation agriculture you might say that this is not coming into which farm machinery. In fact I would say it does come into formation because we have talked of the mechanization with respect to not degradation of the soil. So, what sort of tillage machines we should use, what sort of machines we should use for maintain this condition of the soil and other aspects the way we have discussed about reclamation of the land.

When we discussed about reclamation of land, when we are reclamating land for our crop, what we should maintain, where our water resources should be properly maintained, what are the other biological resources which should be maintained. So, all these aspects have to be taken into consideration that then that is why I wanted that we must have some lecture on conservation agriculture as an agriculture engineer, you must have idea about this. If you go into various types in various countries you will find different types of different equipment depending on the size of the farm. See, we have not talk of the size of the farm here, but size of the farm is very important, because when you talk of the tillage machines which are to be taken the size of the farm is important.

In countries where it is very difficult to have bigger machines or the farmers who have very very less amount of area or farm size, they would like to get small machines. And, in fact in this area the small equipment and devices are used for total cultivation of the crop whether you talk of a cereal crop or you talking of a vegetable crop or you talking of a fruit crop and so on and so forth.

So, the farm size is another important aspect which must be considered in conservation agriculture that is what I have thought of. And, that is why this lecture I wanted to share with you my knowledge with respect to conservation agriculture. I am sure that at least some idea you have got you might have certain questions we would like to consider as and when they come up. But, then I think we will try to stop here and we will look forward for your questions.

Thank you.