Farm Machinery
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Lecture – 14
Types of Fertilizer Metering, Furrow Opening and Soil Covering Devices

Welcome students. So far we have discussed about the tillage, which is preparation of the soil for seeding. Now, the next operation which we are talking of is the seeds into the field the prepared field, which we you have done through the different implements, which you have seen and we have discussed the various, aspects of the design, aspects of the parameters to be considered for the different equipment and things like that.

Now, when we are coming to the fertilizer seed come fertilizer devices or equipment. Let us have a look at the various aspects. So, today's lecture talks of the Types of Fertilizer Metering, Furrow Opening, and Soil Covering Devices.

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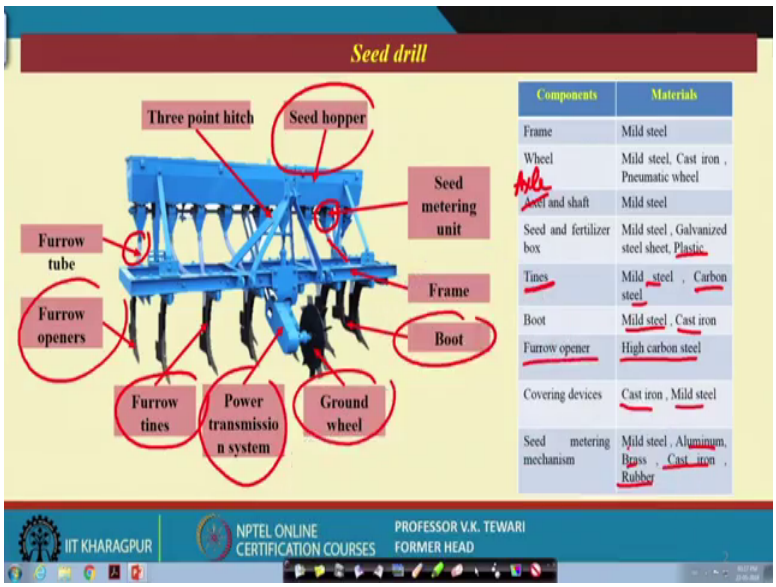

If, you go to the; now, you I recall I am sure you may recall the seed drill, which I had shown in earlier of my classes, that this has the various components. For example, where you have a seed drill, you should have a hopper in which the seed will be kept. If, it is only seed comfort laser beam then there will be hopper for the fertilizer also, so you have a seed hopper. So, there is a seed hopper here, there is a seed hopper here, than in the seed hopper. Ahen we have the seeds which are kept inside this. And, after the seed

hopper then we are talking of the metering device. We have discussed the different types of metering devices already, but then we will look into the other persons.

So, this is a metering unit. So, there is metering unit is over here. Then, after the metering unit; that means, seed which comes from the hopper, through the metering device, it will go through these tubes and then it will come into the furrow. Now, how it we will get the furrow itself, but how it will get the location in the furrow? So, furrow has to be created.

So, if you see these different elements there is a boot here, then there is a ground wheel here, then the power transmission system; the power transmission system, because we are taking power from the ground wheels so you must know how the metering mechanism will work. And the furrow tines: now, the furrow who how the furrow will be opened? In which the seed which will be meter from the seed hopper to this place will fall. So, you need to have the furrow tines or the different types of tines that we will talk of.

Then the furrow openers, now tines and the openers, actually it will more or less the same thing because you are trying to open. The furrow then furrow tube, actually these are the tubes through which the liquid I am sorry the seed will go and ultimately reach the place. So, the various components are given here. And let us look at these components and their corresponding material of construction, which is very important, from the designers point of view from a engineers point of view you must have an idea, as to what is the different material of construction of a particular component?

Say for example, the frame, may frame which is the main frame of the whole unit. So, it need not be very hard in one, but mild steel it can be used for this the wheel is made of mild steel, it could be a caster wheel also weight will increase. This could be a pneumatic wheel depending upon the condition in which we want to use it for the seed drill. This would be Axle here. Axle and shaft mild steel well many a times when we talk you might have seen that, when we talk of actually the shaft material on which a lot of load goes are those are made of forged steel, but here this is this shaft is a very less lighter less or light load carrying metering shaft. So, it could be made of mild steel, seed and fertilizer box the seed, and fertilizer box is also mild steel or galvanized see steel sheet or sometimes plastic for lighting for making for such that it is a lighter material, and also corrosion will

not take place. So, from that point of view it could be this, tines the tines are made because these tines are actually meeting with the soil. So, you should have some idea about these and these tines either mild steel or carbon steel, because you need to harden them. Then, boot mild steel or cast iron, furrow opener high carbon steel.

Similarly covering devices, where the purpose of the covering devices is to cover after you have seeded, they it must be covered otherwise the birds etcetera will take away. So, you would like that they should be covered. So, for the covering devices could be various type we will discuss. Then the material for this could be cast iron, mild steel, yes these are general materials, then seed metering mechanism: the seed metering mechanism actually as I told that the seed metering mechanism is that we are taking power from the ground wheel. So, how the power will go?

Generally we do not use beds, we use chain and sprocket, because there are fixed distances and it is ease, the slippage etcetera will be less which happens in case of the belts etcetera. So, we have chain and sprocket most of the time you will find chain and sprocket short distances and you can maintain good ratio between this sprockets. So, see this is the one which is made.

This could be made of mild steel, aluminum, brass cast iron, or rubber, yes seed metering mechanisms could may comprised of different materials like this. So, with these; that means, this is the seed drill you know. And, now the components we have seen. So, what are the different furrow opening devices? Then, the covering devices etcetera, we will go one by one and have a look at the locations where they are used, the material of construction of them, and any uniqueness of particular type we will have a look at those in the subsequent slides.

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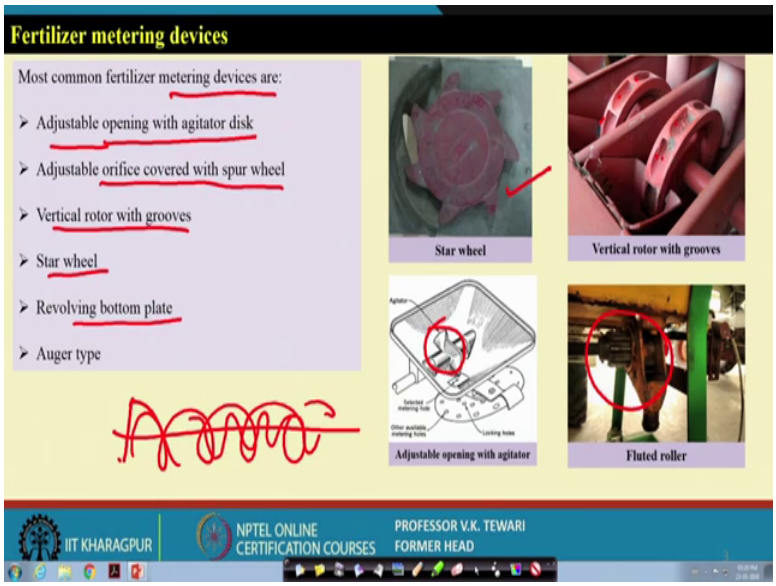

Let us have a look at those. Fertilizer metering devices well I said about seed. And I said that if there is a seed come fertilizer that that there will be another hopper for the seed fertilizer also. So, we are now talking of fertilizer metering devices. What are the different types of fertilizer and metering devices? See, because fertilizer is a hygroscopic material and it is there in the in the hopper.

So, we need to have some sort of a stirring always. Otherwise, it will become clogged and then it will not fall. So, the most common type of devices, metering devices are say opening with agitator disc adjustable opening with agitator disk. Then adjustable orifice covered with the spur wheels: yes, this is another thing because simple orifice which can be changed depending upon the amount, or depending upon the size of the granules of the fertilizer that you want you can change.

The vertical rotor with groups, yes vertical this is another one which is vertical rotor with groups. And, the star wheel type you can have a revolving bottom plate and auger type you must have seen auger like you see augers, when they are operating like this. So, this is up. So, on that the material could be transported through these actually like this and the revolving bottom type.

So, here you can have a look at these say star wheel type, this is the star wheel type, that this is these are the stars you can see that these sides which look like a star. So, we star wheel type it is a wheel which is there, then vertical rotor with groups.

Yes. This is a vertical rotor these are the 2 in which these are there are groups here made here. And, the vet this fertilizer goes inside this, because these are opening in these are operating or they are rotating in the fertilizer box itself. So, the groups will take this and then it will fall.

Similarly, then adjustable opening with agitator, a adjustable opening here this is the agitator. As I said earlier that you need to agitate. So, there this is an agitator, this portion is an agitator and their groups are made selected metering holes. There are different types of metering holes which could be selected; it could be this plate could be changed also sometimes if you want. And, sometimes you will also find that some of the granular particularly fertilizer just like urea or so you can also use a fluted ruler type.

Although, generally the fluted ruler generally used for our seeds, but you can use this also and it has been used.

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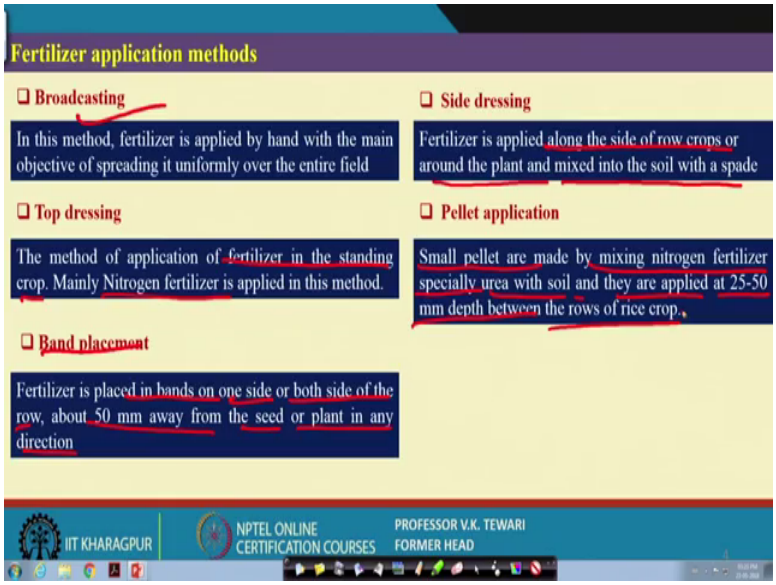

Fertilizer application methods well, when we are talking of the metering we should also know the methods. What are the methods which are actually invoke? One method which I said long be back that either seed or fertilizer you can simply broadcast and throw away. So, that is one is broadcasting, the top dressing actually method of application of fertilizer in the standing crop, this is top dressing you would like to do. Mainly nitrogen fertilizer is applied in this method. In fact, we know that NPK are the 3 fertilizers, which we utilize.

And, generally we see that nitrogen is the one which is given in different doses and P and K are fixed right in the beginning itself, because they have their different purposes which you might have learned in agronomy classes.

And the band placement well, band placement is one where we are particularly talking with respect to the seed come fertilizer drills where, the seed will be there and where the fertilizer will be there that is very important. So, the band placement is very important. Fertilizer is placed in bands on one side or on both sides of the row, about 50 millimeter away from the seed or plant in any direction. This is very important you must have a look at this, and must understand band placement. Otherwise, the effect of this we will not be on the seed and many times the seed gets buried and it does not come out and does not get the effect of the fertilizer.

Then, side dressing yes this is another aspect. Fertilizer is applied along side of the row crop or around the plant and mixed into the soil with a spade. Yes, that is there sometimes these we do for orchard crops, sometimes vegetable you might have seen vegetable growers do like this around the plant when they want to give the fertilizer, particularly these are done for very small fields and plants.

Pellet application, yes this is another thing which in fact, which is also done for seeds? Sometimes for effective utilization and better germination of the seeds also pelleting is done, which is generally about 19 millimeter to millimeter in length and 6 millimeter in diameter. Those are the sizes of pellet us which are made. Now, the small pellet us which are small pellet us are made, by mixing nitrogen fertilizer, especially, when urea with soil and they are applied at 25 to 50 millimeter depth. Between, the rows of the rice crop so, 25 to 50 millimeter depth.

So, it depends on this pellet where you want to give, because the pilot must go to a right place. It, it must get a right environment. So, that the pellet material which is covered with the either the fertilizer or the seed will simply dissolve. And, then the fertilizer we will come into action and it will have a better efficiency better effect of that.

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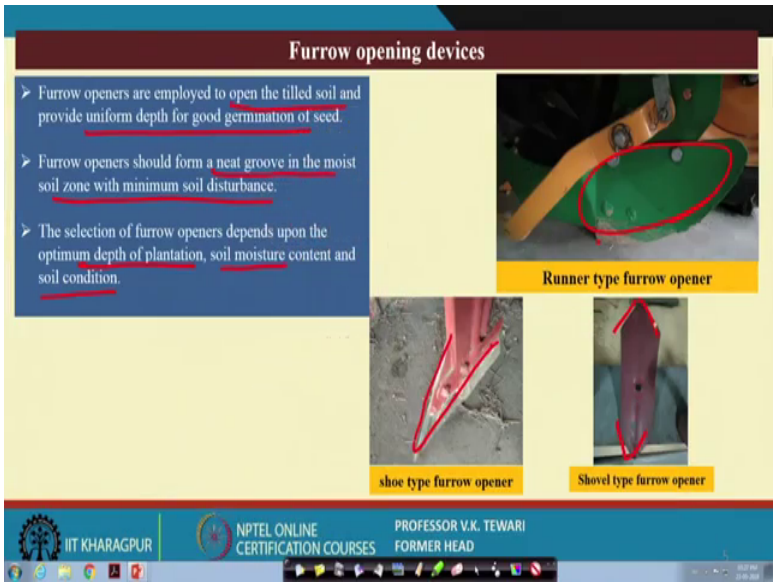

Furrow opening devices well, we talked of the fertilizers, we talked of the methods of fertilizer, we talked of the devices which are used. Now, let us look at the furrow opening devices. These are very important, because once you know a particular crop, that this is the crop to be grown. Whether, it is a cereal crop or a pulse crop or a vegetable crop whatever, you must have an idea as to what type of furrow is required? And, for that what type of the furrow opening element will be suitable? So, this is very important for an from an engineer's point of view to have a look at that. So, let us see furrow openers.

This is aim is to open the tilled soil, because already you know that the seed bed is prepared already and then you have to only show the seeds. So, when you have to see show the seeds or put the fertilizer side by side as we discussed, then you would simply need to open a slit there depending upon the situation. So, the tilled soil which is there it will open. And provide a uniform depth for good germination of seed idea is that, it provides uniform depth of good germination of seed, because the unique environment has to be a good environment to be provided to the seed, when it is placed inside the soil.

Furrow opening should form a neat groove. In the moist soil zone without minimum soil disturbance yes, minimal soil disturbance in the sense that, it needs only to be placed at a location. There is no need of unnecessary and disturbing this. So, majority of the portion of the soil, because then you will have either job of covering that we will come to that later, selection of furrow openers depends on well, on then this selection depends on

what? It will depend on the depth of plantation, soil moisture content, and soil condition. It will definitely you have to even I would say that it also depends on what is the crop that you have taken? And, where should be it is actual placement. So, accordingly you will decide the furrow openers.

We have a couple of furrow openers. See here we have shown here, see runner type furrow opener you can see here, runner type furrow opener this is the one which is here and this opens a very clean cut, so that these generally used in a pneumatic seed drill, then a shoe type furrow opener. You can see the shoe here shoe type this is shoe type of furrow opener, then a shovel type well. This is another one which is a shovel type. I will discuss more of this shovel type. Here, you can see that there is a shovel here there is also a shovel here. So in fact, a double shovel type of furrow opener.

It is just given an in order to have an idea about, what are the furrow opening devices? What are their jobs? And, what are the basis on which they are actually decided. So, we have given something to connect. Now, we will go to the details of those.

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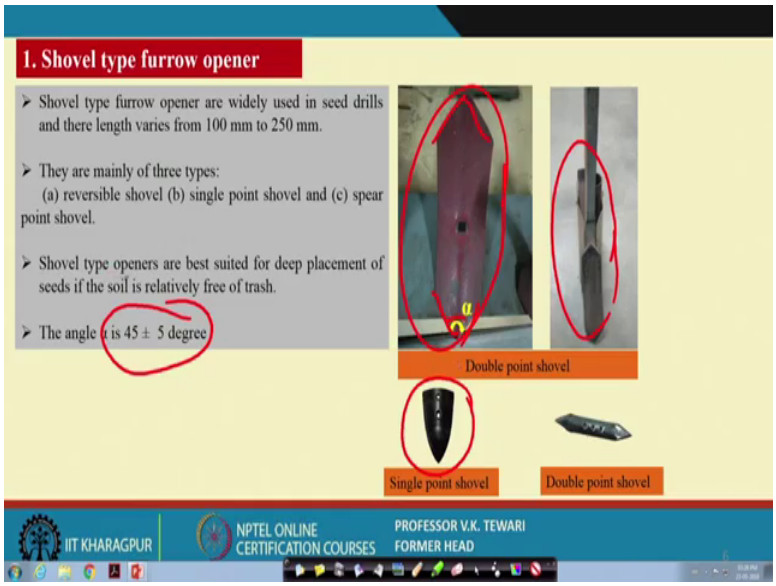

Shovel type furrow openers well, shovel type furrow openers I as I said earlier. See this is the shovel type of furrow opener; it is a double point shovel, double point shovel the beauty is that well if this is the shovel this portion is actually worn out you can just turn. And, then you have this portion and generally this angle include angle is between 40 to 45 plus minus 5 degree is the angle, which is maintained for the soil.

And, well you can see that this is when it is connected to the seed drill. Actually, with the component looks something like this. A sometimes, it is also a single point shovel, sometimes single point shovel and in fact, shovel types openers are best suited for deep placement of seeds relative to the feed free of tress well.

This is important these are very good for, generally for deep placement of this and such shovels are generally about 100 to 100 250 millimeter length, these are the length of this 100 250 millimeter length; reversible shovel type, single shovel type, and spear point shovel type. These are there are main 3 types of this shovel types are available, which we you will encounter. And you may design depending upon the amount you want to cut inside the soil, if you do not want to disturb much of the soil, then you may have to take a spear point solvent, which will less serve your purpose.

This is a double point shovel same things shown here well, another view of view where you can see here there are 3 locations where it can be fitted.

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Hoe type furrow openers, you must have heard of these Hoe type furrow openers. The purpose of this is this type of opener; lifts and pushes the topsoil toward these sides. And forms a V-shaped groove. This is the beauty of the hoe type of furrow opener, that it pushes the topsoil towards the sides and forms a V-shaped groove. Such furrow openers are best suited for a stony and the root infested soils, virtually lot of roots etcetera are there already for those, and the ground is also not very good or you can say filled up with

a lot of stones etcetera possibility of a stones etcetera are there. Then in that case I think hoe type furrow openers there are 2 views which are shown here are the ones which are generally used.

This is how it looks? In fact, these are the 2 locations where, you will have the seed or the fertilizer tubes, which will enter into this or this and their location here which is connected to the frame of the machine equipment.

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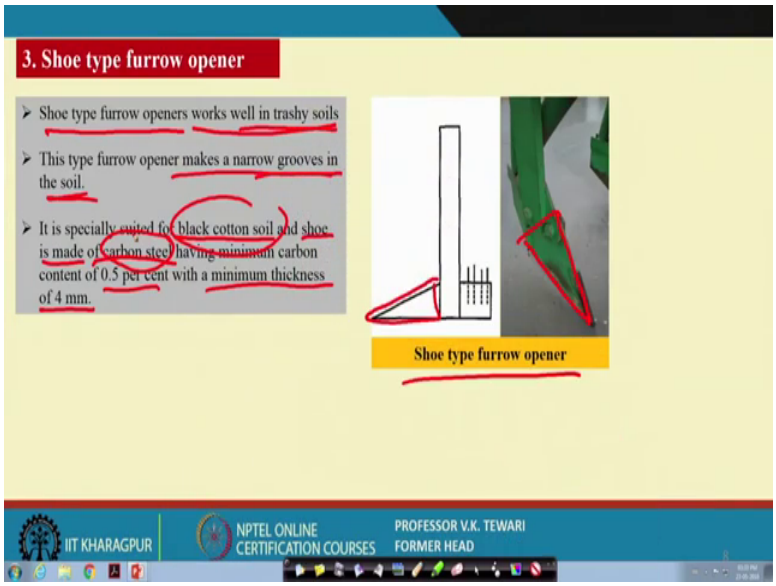

Shoe type furrow opener; now we had seen a hoe type furrow opener: HOE is hoe and when you put S SHOE is shoe type furrow opener well, what are the different shoe type furrow openers? This type of shoe type of furrow opener, shoe type of furrow openers works well in trashy soil conditions, very important see whenever we are talking of the replacement. And, use of this or selection of these furrow openers, you have to be very careful as a designer.

Then which one you are choosing under what condition? What is the condition of the soil? Whether the soil is well prepared or the soil is just harvested crop is harvested and then you are talking of cutting the just leaving the cut harvested small trashes and on that you want to see what you want to do. So, you need to look into this. So, such shoe types of furrow openers are work well in trashy soil conditions.

A lot of trashes etcetera are there, makes a narrow groove in the soil, it is makes a narrow groove you can see that the condition of this makes a narrow groove you see here, it looks very nice in the photograph here. So, it makes a narrow groove very. So, that it does not disturb the trashes etcetera they remain there, but it makes the groove for the seed to fall over there or if you want. If there is a fertilizer also connected there then maybe side depending upon, whether you want a band placement or you want side placement or whatever you want you can have this.

So, the beauty of the design here is that it makes a narrow groove in the soil well. It is basically suited for black cotton soil well, we know that black cotton soil, because there are very bigger cracks etcetera and then they are very hard. So, under those soil conditions such shoe type of furrow openers, which will go slightly deep and then cut the slit and serve our purpose. These are because they required to be hard enough, they are made of s a carbon steel yes, now it is very important shoes are made of carbon steel having minimum carbon content a point 5 percent.

See this is important, because under the black cotton soils where, the requirement is the requirement of strength is very important. So, from that point of view I think this hardening of the material is essential. And that is why, that is 0.5 percent carbon must be used, and, the thickness and with the minimum thickness of these to be about 4 millimeter of this material which is there to make the shoe type furrow openers; so better for trashy square conditions, for black cotton soils.

And since, these are good, they must be for high carbon steel or at least 0.5 percent carbon steel material must be used for the shoe type furrow opener.

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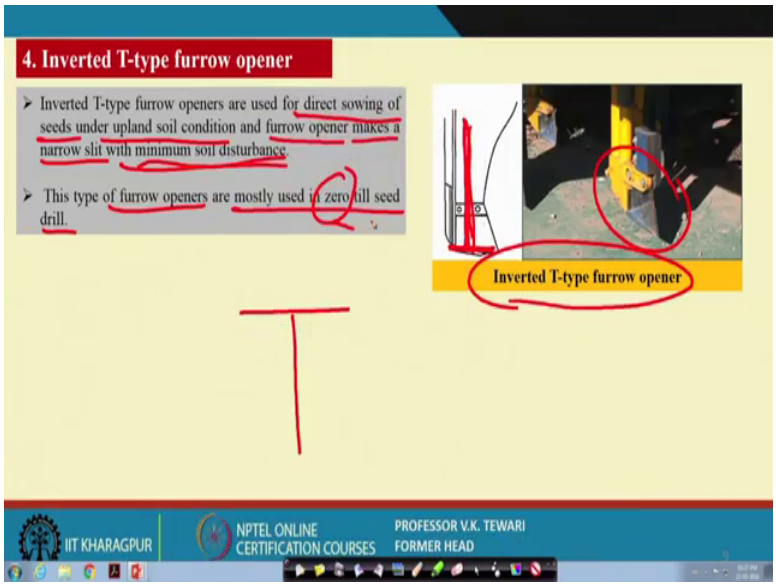

Inverted T type furrow opener well the name itself says that inverted T. So, you must have seen how would T looks like? So, a T is this is a T. Now when you are talking of inverted T, you see the condition here. That, we have virtually this is the condition of the thing over here. If, you see this tip here, this is the inverted T. So, that you the idea is you will remember these and maybe the designer have thought of in this line and has given inverted T type furrow opener.

Direct sowing of seeds under a planned conditions well, sometimes under dry land conditions when we have been talking of not much of is moisture content in those locations. There are good for direct sowing of seeds under upland conditions. And, furrow openers makes a narrow slit, this furrow opener makes a narrow slit with minimum soil disturbance. It is a similar like shoe type of furrow opener where, it makes a narrow cut in trashy soil conditions.

This is not in trashy soil conditions. It should have a proper soil condition upland soil condition not a lowland condition. That means, not lot of moisture condition, but definitely a convenient and congenial atmosphere condense condition of the soil, then these are good for good to be used for direct sowing of seeds. So, direct you cut a narrow slit and then put it there, without excessive disturbance of the soils it is written here minimum soil disturbance.

And, these are generally used for 0 till drill see such type of furrow openers are mostly used in 0 0 till drill. Actually, you must have seen that about 15 20 years back. This particular 0 till drill made a Havoc, because one of the best what are I mean soil conservation methods equipment, which can be used under conservation agriculture. Because, there are you need not you need not you need not use or cut the soil too much or you need not prepare the soil. So, much immediately after harvesting, if there is sufficient moisture is there you can utilize that moisture and just use this seed drill just 0 till drill.

The name itself says you see the name itself says the 0 till; that means, your tilling is this simply 0 simply opening of the rows or you can slits in which the seed can be there and such openers. So, inverted T type furrow openers you can see a photograph I have shown the photo this T type openers are using 0 till drills.

So, there is need to con to understand, that where these furrow opening will be utilized or used it is very essential.

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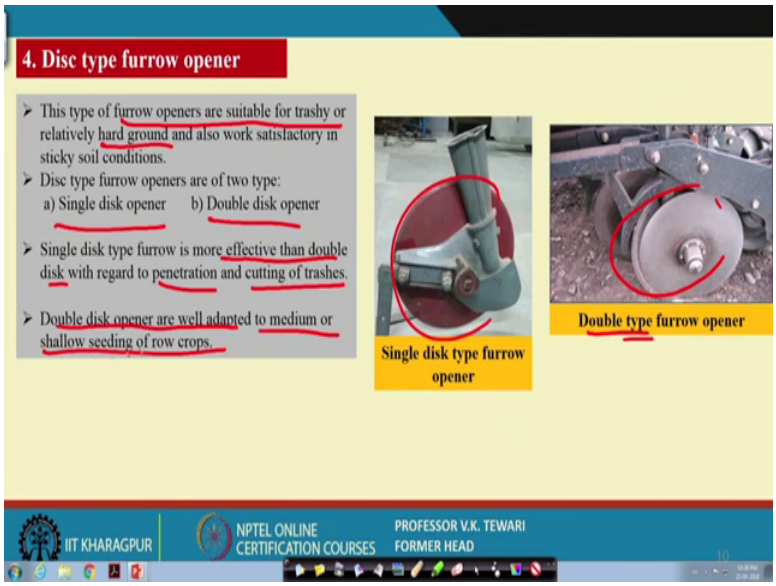

Well this type furrow openers, this is a another aspect because many a times you would like that cutting should be deeper, in some conditions of soil trashy trashes are there, and you want to cut those stresses. So, these types of furrow openers are used. This type of furrow openers are used, these furrow openers suitable for trash conditions. And, relatively hard ground. Well, this could be a single disc opener could be a double disc

opener. And, it has been found that double disc openers are well adapted to medium or shallow seeding of row crops well you can see that one we have shown here, a double type of furrow opener and a single disc furrow opener.

Where single disc is more effective, than double disc with regard to penetration and cutting up the trashes this is to be understood these furrow openers these will be like this and then they will cut here. So, trash cutting will be minimum here. But in case of the first one you see that, when it moves this rotates it will it has the sharpening on the edges, it has sharpening at the edges and then it will cut the trashes.

So, that way it go penetration will be better and trashes will be better cut in this case than in this case, but you can see that for medium or shallow seeding then this w ones are most suited.

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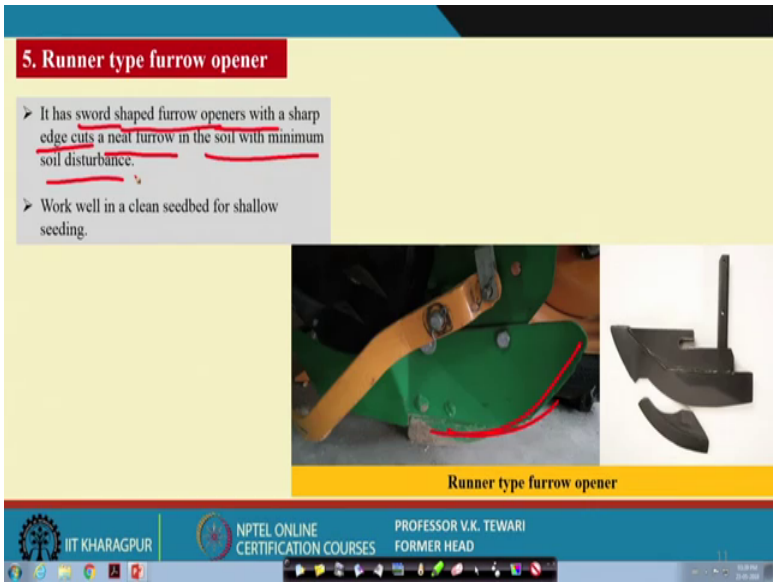

Runner type furrow openers well runner type I have shown you already that this is you used on a pneumatic seed drills you can say furrow is. So, sword shape furrow just like you see, you can see that this is a sword virtually sword furrow with a sharp edge cuts a neat furrow, in the soil with minimum soil disturbance this is what it does these are generally used in generally we have shown in the such devices being used in pneumatic seeders.

Work well in clean seedbed for shallow seeding yes, because we do not want this seeds to go very deep. So, for shallow seeding these are used and the sword type of shape as it has you can see here also.

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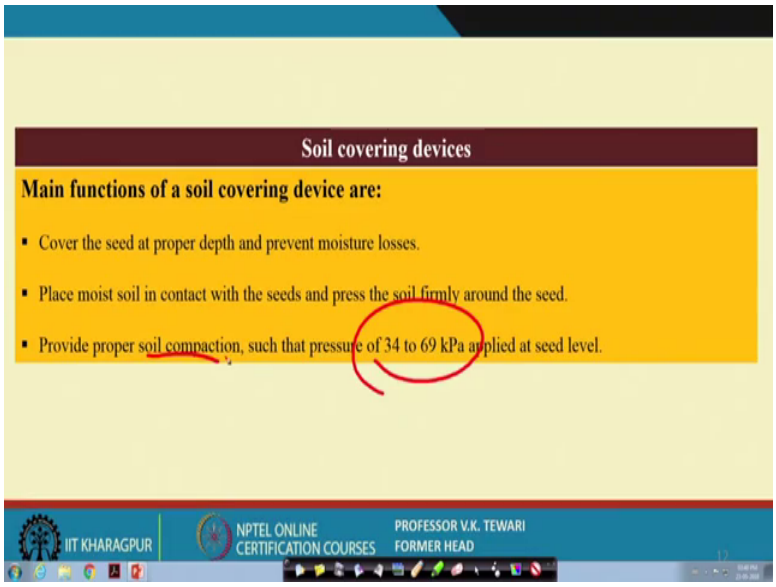

Soil covering devices, another important function of this is well covering see once you have put the soil. The seeds onto seeds in the soil condition at environmental condition or the congenial atmosphere in which the seed has been placed. And now it must be properly covered. So, for covering there are various types of devices the aim is that it must be covered to an extent that, it while grows or there will be mechanical impedance which we call as resistance soil resistance for the emergence of the seed. And that value is about 34 to 69 kilopascal of the soil compaction we that need to do with all the different types of devices.

We will have a look at these devices.

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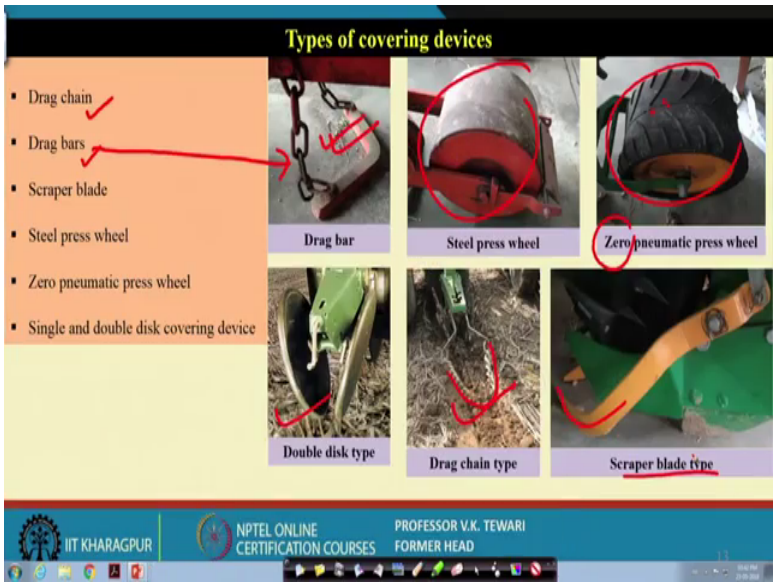

Well these are the different devices very simple and very easy to understand here you see, the drag chain type is here, then drag bar type well drag chain type; I am sorry this is this is one drag chain type, this is drag bar type drag bar type see this drag chain, because this is a chain here and this chain is covering. Similarly, double disc types double disc types are also once we can double disc type, which covers the already seeded area and these are in the seeded lot of trashes etcetera are there, but a still it will cover properly.

Now, steel press wheel press wheel these are the wheels, which are used in small vegetable planters. And, where you want them to be pressed and generally these are put on both sides in the front as well as at the back of the see back of the hopper in which in the row itself you will see this indoor, when we show you in the field conditions, you will show you will see this for yourself.

Then 0 pneumatic, this is a 0 pneumatic in the press wheel here, the covering here. In fact, the this portion is actually rubber or plastic shows that, it does not have any press around that it is lighter as compared to the other one. So, that is why we call 0 types. And well the scrapper this is the one which is their scraper blade type it is scraps. In fact, it will simply scrap the material and the soils and then cover this.

So, these are the different covering devices which are there, each has it is own advantage and disadvantage, but as an engineer you must have look at the condition of the soil and the condition and type of the crop in which we are doing. So, still press type 0 pneumatic

and singular double covering type. So, these are the devices which are generally used in all of this, you may think of a new device also where it could be lighter a still it could be doing the job of pressing as well as covering. So, you may think of that as a designer.

Thank you.