Farm Machinery
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Lecture – 13
Types of seed metering devices and their operation

Well students as we discussed in the previous class; we discussed about how the seeds are placed, what are the various methods of placing; where what are the locations at which they should be placed. And, what should be the spacing which has to be maintained, what are the various equipments or the devices which are available. And, how the various operations are conducted just in the basic aspect of what we have covered so far.

Now, I would like to go into slightly details of the seed metering devices, because these are the ones which are very important devices. Here is your ingenuity of designing this system, if you want to design a good quality seed metering device, electronic operated one or a sensor operated one, which will just meter the seeds at their desired depth and desired location, and desired pressing etcetera. Then, you will find that the unit will be a economic one, it will be the best unit which we are looking for and all that.

So, here you need to look into the design of such devices which are already existing and what are the places where there could be chance of redesigning or thinking of in innovations; let us have a look at these.

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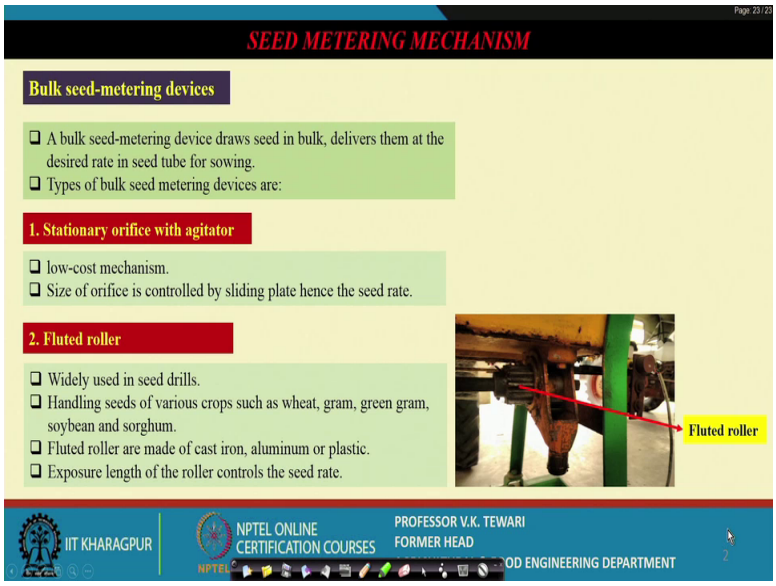

Bulk seed-metering well these are now the devices which are called bulk seed metering; that means, the in the hopper, we have the seeds placed. And from there now we are going to use the seeds, take the seeds either two at a time or three at a time or one at a time like this. One of the methods is a stationary orifice. It may happen that in the seed when you have the seed you can have agitator, because once the seeds are there they will may be it will be difficult for the seeds to flow. So, there is need to agite keep agitating the seed bulk so, that there will be motion of these seeds. And, if there is a small whole say for example, if you this is what it is there is a small hole and this is operated in fact, by a location.

So, these are the seeds over here seeds. And, if this the saw this is orifice, which we are calling of orifice. So, this orifice, if you have orifice like this simply change the position of the orifice and then you can get the seeds one way of doing it is. It is say that sliding plate. Hence, the seed rate could be changed, depending upon what you want. But, this is the most you could say a crude way of a sowing the seat. There has to be a proper channelized and better method of doing this operation.

So, we have other types of metering devices, which are fluted roller type. Now, this fluted roller type is given here. You can see this is the fluted roller just like flutes, as if there are flutes here and these are the groups there are certain groups long groups here. And, this can be pushed inside this part where the seed is going and it is going through

the tube here. This is the inside the hopper, now hopper is here from the hopper through the seed metering mechanism, then it will comes into this and this is where.

Now, this seed widely used in seed drills. In all the seed this is one very which is very popular and very widely used type of a metering mechanism, various type of seeds. Wheat gram, green gram, soya gram, soybean, many type this is one which is used fluted rolls are made of cast. The material of construction of this it is very important to know, they are made of cast iron aluminum or plastic.

In fact, because the seeds when passed through this there is every possibility and most of the time we do find, where there is damage to the seeds when they pass this. So, what we want is that there should be some softer coating on to these flutes many the plastics, which are made of plastics or maybe some coating onto the plastic itself as some designs are coming up some manufacturers utilizing these. So, that there is minimum damage to the seed because one of the seed is damaged, it is it does not matter whether it is goes there in soil or not because it will definitely not germinate.

So, it is important that the seed reaches to the location in the soil at the proper depth in good condition. So, there should not be then exposure length roller control with the seed drill yes, by the change of this exposure length. This is the exposure length or and this exposure by changing the exposure length, we can which is exposed to the seed here. When we push this inside, then that exposure length we will talk of the seed rate changing the seed rate if you want. There are other with ways of doing this, but this is one of the ways in this particular type of metering mechanism let us see what is the, what are the other types?

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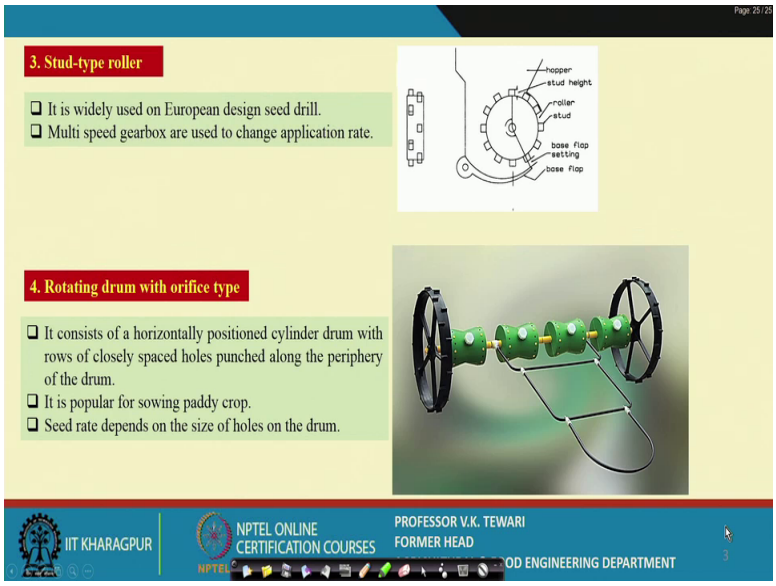

Stud type a very simple one being used to long, now here the whole this is the hopper here and then these are studs these are studs over here on the periphery of this roller. And, then these steps they pick up the seeds in between like this. And, then the setting flattering in a flap is here and this base flap then they will be cutting and then here the seeds will fall. This is the side view of this particular stud you can have a look at this, but these are not very used. In fact, it is just like as if putting or arresting that much amount of the seeds within these within these studs here there.

So, within the height of the studs over the ruler whatever is the amount which is taken from the bulk or the whole hopper and then it will seed. It is definitely not going to give us a single seed maybe a bulk quantity of seeds, but they are not very much in use in fact, more refinement of such concepts have come up we will we will see in the later course.

Second one, drum type of orifice type drum with orifice type. This is one device which we call as drum seeder. In fact, here as we have seen that if you can sow the seeds in proper rows, maintaining a certain seed to seed distance and plant to plant distance, we have every advantage of getting a good crop. Now, in case of transplanting particularly for paddy, we have seen that either we throw these seeds in the puddle soil, puddle soil means the soil has to be well prepared for transplanting of paddy and then we will do the thinning operation and then we get the crop. But, then if it is a transplanted one we will definitely get a good strength good stand of the crop row to rows and hill to hill.

But, we if this is a very tedious operation. We have found that the amount of energy required in transplanting. In fact, we have done this right from transplanting. The first operation is that you have to grow the seedlings in a proper location, then they remove the seedlings cut the seedlings brings bring it to the machine, and then put in those in terms of trays and then operate the machine.

So, the total amount of energy we have founds it is quite high. Although, we do not get much seed weed infestation in such crops this is there, but then we are losing lot of energy and we have in fact, scarce energy available for such operations. And, that is why this particular device which we call as drum cedar. This has been very popular for last 10 15 years is very much popular all over the country and various designs have been have been developed and evolved at IIT Kharagpur also we have already designed.

Here, what happens is in each of these drums. In each of the drums here the holes are made, these holes are made, at in this location these locations and then this is the one where the seeds are filled seeds are filled. Here what we do the seeds are first soaked in water maybe about 24 hours or so, and then slight (Refer Time: 09:28) when they come out of that those type of seeds should be kept inside this put inside these. And then this is pulled in between the in the field itself in the puddle field, where there is some amount of soil and mud is there, we would not like that there should be ponding water just like in case of transplanting, but here we would like that there should be very little amount of water and muddy. So, that when the seeds fall there they should be in a position to stay and then grow over the period of time?

But, this has the beauty that it is giving you the same row to row spacing plant to plant spacing and even we have found that there are to 2 about 20 percent increase in the yield. So, compared to the energy spent in transplanting and this is found to be very effective. And the farmers are taking a in a big way they are going for this as an alternative for transplanting well, it remains that there are seed weed growth slightly more in this case, but even then it offsets the energy which has been used in transplanting. And so, this device is very much popular in various parts of the world it is known as drum seeder.

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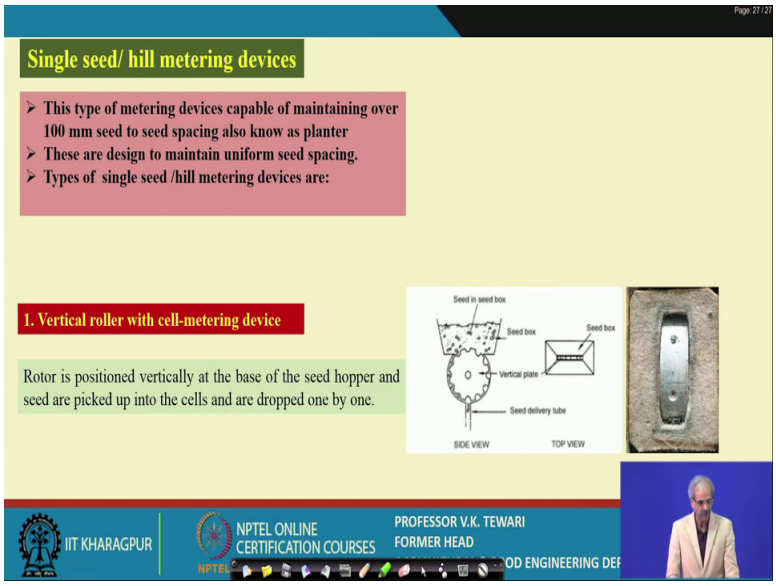

Single seed hill metering devices; sometimes we would like that either seeds single seeds are metered or 2 or 3 seeds in one location we call hill in one location there could be 2 3 seeds. So, when we want this to happen, we have some devices which are met see the beauty of these devices I just go through this for your information, capital of maintaining over 100 millimeters seed to seed the spacing was known as planter.

Well we are in a position to maintain this, what is the beauties we are in a position to maintain the seed to seed distance. This is the thing which we require particularly, when we are talking of planting, various methods are there one of the methods if you if you recall the stud one, the stud is there the stud type of metering mechanism there within the consecutive studs whatever is the amount which is coming up. You can say that this has if the stud is put in such a way that that is that; that means, there is only one seed comes then fine.

So, similar concept if you see a vertical root here, a you can see here the side view you can see that this is the seed box this is the seed box here and this is the vertical roller which these so, here the this vertical plate will have these small holes. Now, these are on the periphery. So, as this rotates as this rotates here, they will be picking up the seeds within those cup sort of things here and there the seed will move into this and at this point of time, this will be sown the seed delivery will take place, this is a very simple one.

And in fact, good for very small seeds like mustard jute and things like that this is one if you have a look at this is developed at IIT Kharagpur. And, we can show you that how does it look like in the actual situation? And, this is how it looks like? Yes. So, the top view, this is these are the locations where the seeds could be placed these are the seeds, which will be there in the hopper and this will rotate and we get the in a desired spacing etcetera.

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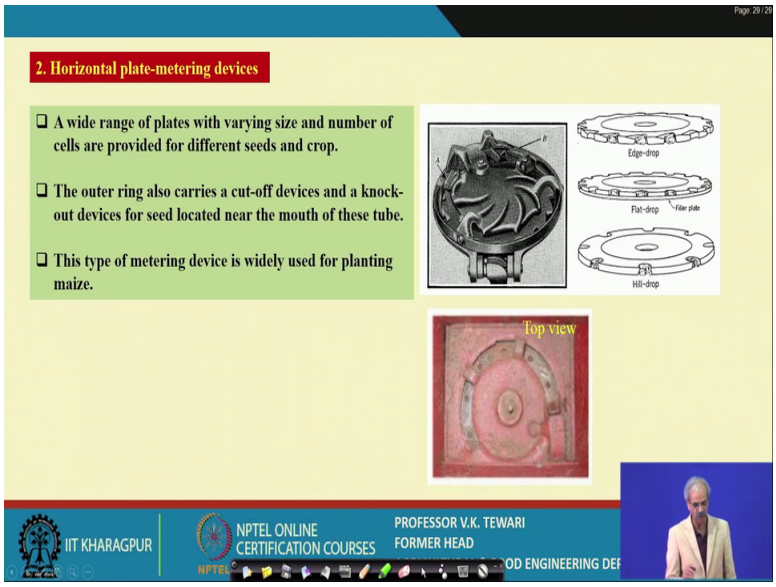

Horizontal plate-metering devices; now we had talked of the verticals and the horizontal plate metering devices. It may happen that, in the same seed hopper you have a horizontal plate. And, that plate could have seed holding cups or seed holding locations and that rotates. Now, question is when the it rotates in that, it may happen that the seeds may not fall. So, there has to be a de device that that device will allow a certain amount of seed if I want 1 or 2 seeds, that they avoid should be then they it should have provision that it will wipe off the other seeds. And, only take certain seed and then it will drop the seed at the pro proper location where it is. So, exactly that is done in case of this horizontal plate metering device.

See this is the is the horizontal plate here, the hill drop, the flat, the edge drop, these are the different portions of these which are given this is the top view of this. See with varying size and numbers of cells are provided for different seeds and crop. Yes,

depending upon this seed plate could be taken for different seeds the seed we know the seeds could be of different sizes shapes and weight whatever.

So, for all these you can have different types of these seeds. The outer ring all carries a cut off device and a knockout device as I said earlier, that when you have the on the seeds lot of seeds coming up on the on the plate, lot of seeds coming up then you would like that they should be cleared and only 1 or 2 seeds as they desire, they should move. And, when they move and come at the location where it has to be dropped, say hill drop you say supposing at this location, if this is the location there should be a device here a positive device which will simply drop it or it will knock the seed down into the delivery tube into the delivery tube it will knock.

So, this plates which are which could be of different cell sizes depending upon the crop which we want to do and we will have two main important items; one is the cut off device, the other is a knockout device, cut off device will brush up the extra seeds and knockout device will knock not the seeds exactly at the location where it has to go into the seeding tube.

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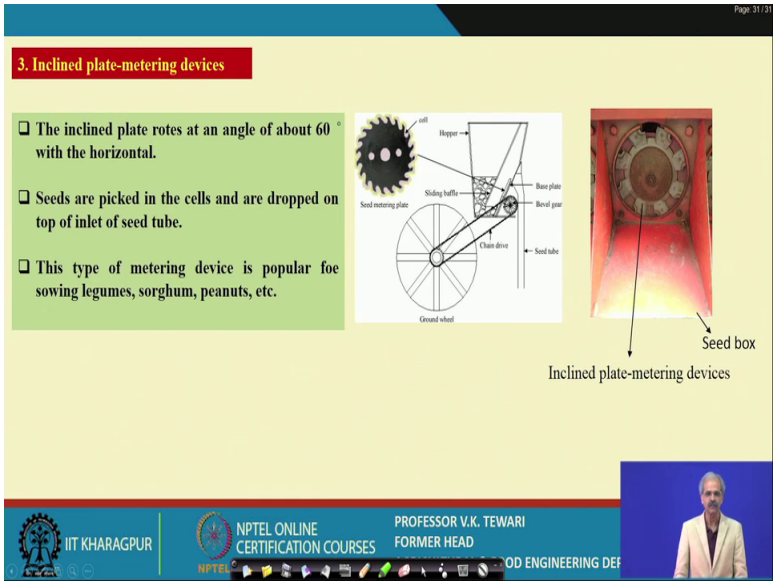

Inclined plate; this is another one, we had seen a horizontal plate. Now, inclined plate each of these devices have their advantage and disadvantage, you will find that in case of a inclined one here it is very simple, if it is inclined there will be smooth movement of the seeds true definitely, it will be true maybe the construction is also simpler as clear as

compared to that maybe for bigger seeds you will require a different arrangements as compared to the other one. So, have a look at this.

The inclined plate rotates at an angle of 60 degree with the horizontal. They are kept at are maintained at an angle of 60 degree with the horizontal. Seeds are picked in the cells and are dropped on the top of the inlet seed tube very simple as generally it is supposed to have here is the seed here, there is a metering mechanism because the on the ground where we are taking the power for this. The this type of metering that is popular for sowing legumes sorghum plants here there is a mistake for.

So, this is good for these seeds slightly bigger seeds it is good for that and the device is very simple, this is the seed metering plate, the seed metering plate here, where the cells are there, this is hopper here and from the ground field we have the bevel gear arrangement. Because, we know that this arrangement from here to there has the there will be change in the direction of rotation of the metering as shoft as compared to the direct rotation which you get from the ground field.

So, now there are certain things we see that certain amount of seeds should fall. And, we are taking power from the ground wheel. And, we know that this ground wheel is of sow of different level, it may not be smooth level at all it is just like a flat ground or so, so there could be some problems we will discuss that slightly later.

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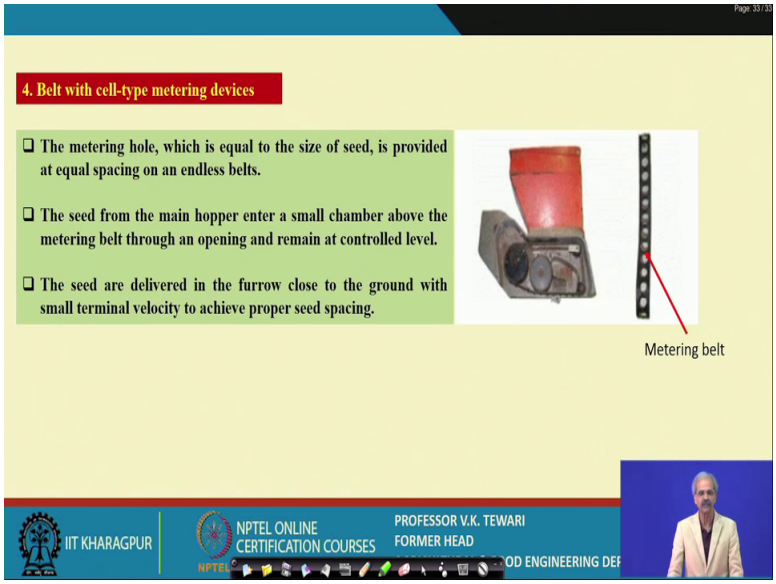

Belt with cell-type meeting device, this is another device and a very popular one it has been used in very good machines, precision machines, because there the idea is that whatever is the seed. Whatever is the type of seed shape of seed size of the seeds, you can take those seeds and have belt running a belt running in the sow hopper itself there could be a belt running in the hopper. And so, you see this is the hopper here and there is a belt.

So, there is a belt running here, you will see the belt early here, which is the metering belt with the holes here. So, you can have these holes, which will help us in using these for different types of seeds. If, you have one type of seed, you can use it if you have slighted different types of seed take a different belt and the this gives a very precise we have to proper monitor the speed of this.

In fact, such these such a devices do have infirm having sensor based arrangements where we can inform the operator, whether the seed is falling or not just like one is stand here seed drill, which is used which uses different type of belts. Just you just have a look at what are the main important things? Say the metering hole which we are talking of this meeting hole easy is equal to the size of the seed.

And, it is an endless belt yes of course, an endless belt as I described here, that you should keep on change that moving and as and when the seed is trapped and comes to the location, it will be knocked off at that place in the seed tube. The seed from the main hopper enter a small chamber above the metering belt and opening and remain at the control level. Yes, this is what it is. And, then seed is delivered in the furrow close to the ground with terminal velocity to achieve proper seed spacing. Very simple as I explain this is one very important and very innovative device for metering of seeds at a precise location. You can call as precision seed drill also.

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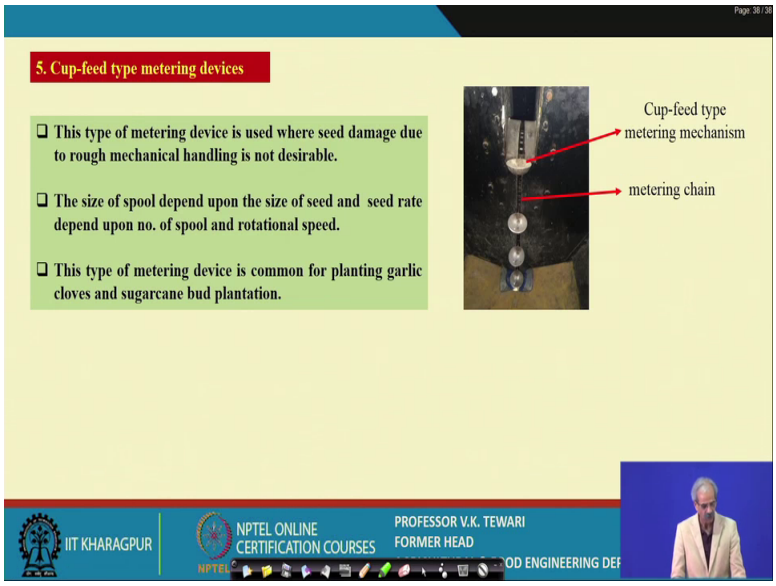

Cup feed metering mechanism well, we discussed earlier that this particular device.. The way, we have seen that when the in the hopper, when the seed either the seed horizontal plate or inclined plate or any other arrangement or you have a simple hole constant hole, or a variating very varying hole, arrangement is made you can do that.

But, we have also seen in the previous one, that we can have small cups made of that, which we can cup feed type. That means, cups are there these cups will pick up from the hopper, they are also on the periphery of the periphery of the drum you can say or a plate and that plate rotates as per the rotation of the seed metering shaft and then they will keep pick up those. This has been used in fact, I had worked with this in somewhere in 80s and dit developed a cup feed type of metering mechanism for paddy and can be used for any other say urban seed as well.

The off let this has also become very popular and people are using this type of a device a cup feed type. Here you can change the size of the cup depending upon the size of the seeds and all that. So, generally used it is being used for well is planting garlic, cloves, sugarcane and bud planting etc plantation etcetera. I mean these are being used for some of the special seeds if you want you can use this device, because this another device.

So, you have seen over the this discussion that we are doing that people have tried depending upon the seed, type and size, etcetera various types of devices, which could be used in these metering in these equipment and for ultimately for giving a good health of

the seedling, which grows and then goes into a good crop and we get a good yield all these arrangements are for that.

And more and more innovations are coming up, because there are problems in these devices or the equipment when they are running in the field, we will talk of this slightly later.

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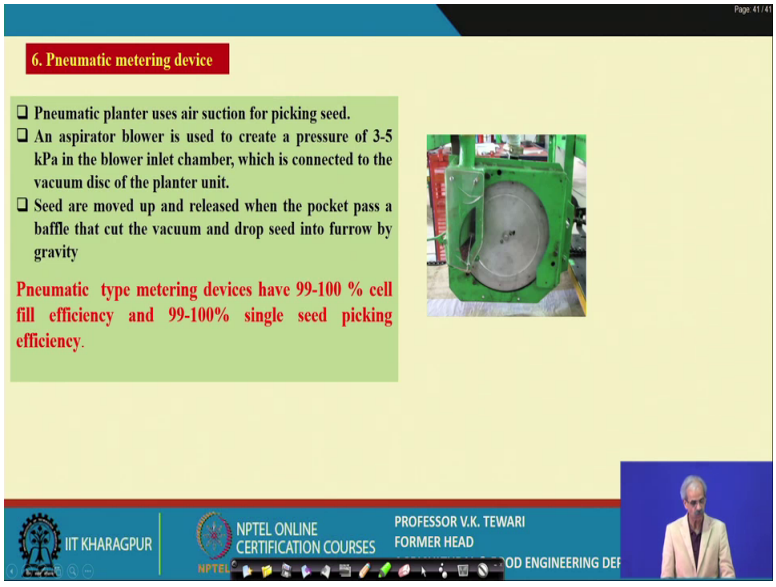

Pneumatic this is one important things, pneumatic metering devices. Now here we would not like to have you have seen that in case of the metering devices of either inclined type, or a cell type, or a horizontal plate there is a chance that the damage of the seat could take place, because there is a cut of device, then there is a knock device, there is a chance of that. Now, he here the accuracy and accuracy could be a problem. So, in order that we do not have to touch much of these particular seeds and pneumatic device has also been designed. And, this very much popular we have done at IIT Kharagpur also we have done this work and I am showing the same.

This particular planter is air section in picking the seeds. This sucks the seeds while it is picking the seeds from the seed hopper, there is a suction created. Now, this is created by a blower, which is used to create about 3 to 5 kilo Pascal of the pressure for sucking the seeds. And, in the in the blower in the blower inlet chamber, which is connected to the vacuum disk of the planter unit.

So, this is the connected in such a way, that when we are correcting connecting the when the seed comes at a particular location, it is a test because of the vacuum which is there. And, when the seed it moving seed here is moving at one location it can it can cut off the device, it can cut off this device and then the seed will fall.

Here the beauty is that this is this device will give you 99 to 100 percent cell filled; that means, all the cells will be filled up in the seed metering device we and then there will not be any missing. This is one aspect which has to be looked into by the designers, that the seeds which fall in all these seed metering devices there must not be any missing this is very important. And, we must get a single seed picking up and the efficiency of this system must be very very good. This is important for the designers point of view still lot of work is going on, how do we minimize the losses? How do we minimize the losses in the seed cells, I mean the filling of cells should be 100 percent filled.

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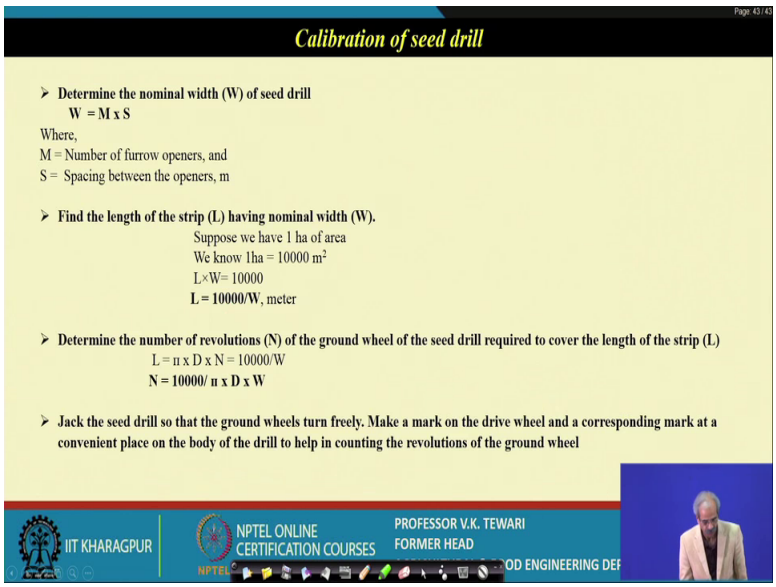

Calibration of the seed drill is very simple. Actually, if you want to calibrate a seed drill or if you want to calibrate any device before you take it to the field, you must have an idea. What do you mean by calibration? You would like to see that, if there is a seed drill the a metering mechanism is there and that metering mechanism is taking power from the ground wheel I have shown you earlier.

So, when the power is taken from the ground wheel, through a belt or a chain arrangement to the metering device between shaft. So, you would like that, if this rotates

for a certain rotation, what will be the number of seeds fall? Because, we have decided that we for a particular crop, in a particular area or say per hectare we would like that certain amount of kg of the seed must fall.

So, in order to get that, we would like to try this in the laboratory and see, whether it does or not. It is a different thing that when it goes to the field there could be other problems, because of which there could be some changes in the value because of the wheel slippage etcetera, which may come up in the seeds and which do come up and for that one has to take care of that, but then if you are not talk talking of that slip. Then we should be in a position to know that if I rotate the seed drill wheel what will be the number of seeds which fall?

So, you can simply see that, if in a hectare if in 1 hectare. So, much of so, much of area, because 1 hectare is 10 to the power 4 square meter hm. And, if the length of the strip is about W, then we know that this is the L which we require the length of the total strip you require if you have width like this. And, then drawing the total number or N ground wheel of the ground wheel seed drill to cover length of strip L, what will be the number of rotations N of the ground wheel? This comes out to be this you can simply work out there is nothing big in it.

Jack the seed drill well, how do we get this thing then? Would the you can Jack the seed drill and then in the laboratory and take out the rotate for a certain number of durations take the seed drills. Maybe, once or twice do this take an average of that and then find out that if you have taken for 20 revolutions, what you get if it done for 10 revolutions, what you get? And, accordingly for every revolution, what you will get and accordingly you will be in a position to get. The seed rate which you want per hectare using that in per hectare. So, much of a number of rotations you will be required.

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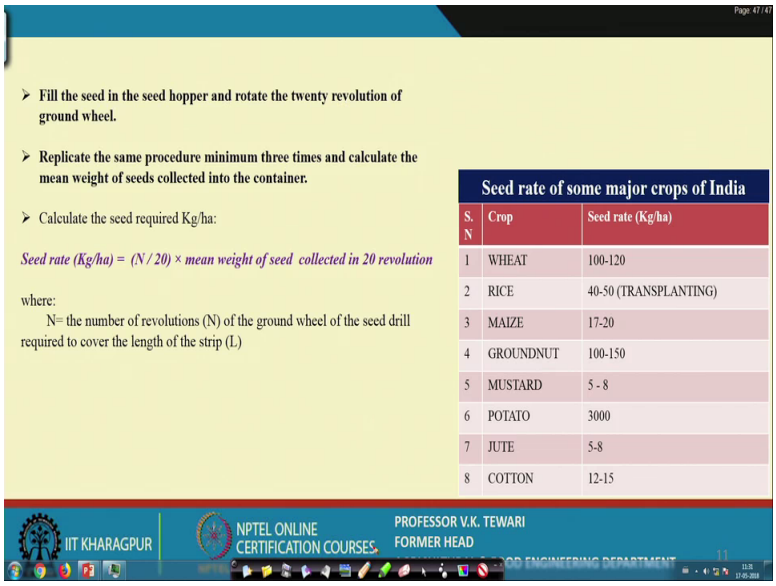

So, as a so, as I said you should be in a position to get these values. Here, we have given some of the seed rates just for the knowledge may be that if you go into more of literature and depending upon what crop you are going to sow, you will find from the literature what are the seed rates which are employed.

But we have given you for your ready (Refer Time: 29:40) that the wheat will have a seed rate of this much, rice as this for transplanting, maze, groundnut, this value, mustard, this is important the potato. So, much kg jute this, cotton this, there could be several others which you may get from literature, but this is what we wanted to show you that how to calibrate a seed drill and what are the general seed rates for different crops.

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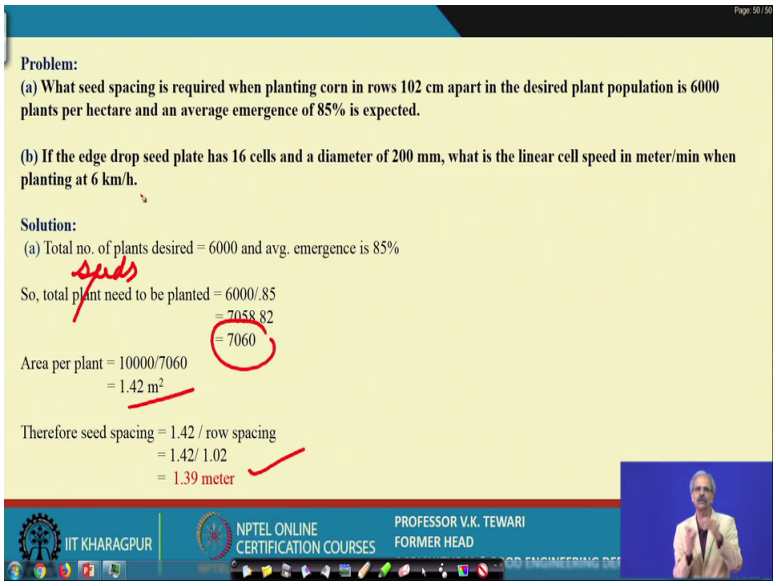

There is another problem, which we wanted you to understand, because we you have seen right from the beginning what is the meaning of seed? What do you meaning of planting? And, how many populations should be there? What is seed to seed distance? What is plant to plant distance etcetera? So, when you want to sow know this thing let us have a problem here. It is a very simple problem; we want to find: what is seed spacing?

When planting corn in rows 102 centimeter apart, in the desired pop and the desired population is about 6 000 plants per hectare. At, an average emergence of it is very important, what is the level of emergence that we need rotate eighty 5 percent of that. So, if this is so, we would like to what should be the seed to seed spacing is very simple you know that there is 85 percent emergence. So, you must know what will be the total number of seeds which has to be available with us.

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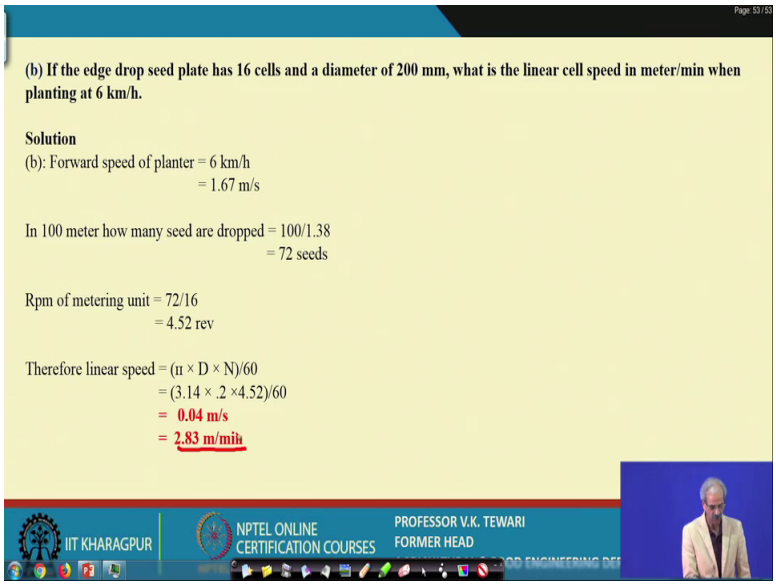

So, yes so, you will know that you require about so, much so, much of the seeds this is seeds, because a total number of plants we need to be planted no. In fact, you will have to have the seeds total number of seeds how that will required here. Because, we know that if you have 100 seeds then only 85 will germinate. So, the plants are if 6 000 plants so, accordingly how much so, we require this? And, the area of this will be then, we can find out which comes to 1.42 meter square area per plant. And, accordingly therefore, spacing comes out to be 1.39 if you calculate using this you will get the values.

Let us go to the other part of this. If, the edge drop seed plate has 16 cells and a diameter of 200 millimeter what is the linear speed in meter per minute and the planting is that is 6 kilometer per hour. Here, you need to understand, what is the ratio between the forward speed of travel of the equipment or the machine with the tractor drawn or whatever is the power source, and the metering mechanism the rotation of the metering shaft. So, we have to have a ratio between this we need to get a ratio between this then only you will find out this value, well here this is the linear speed. So, we want to we want to get the linear speed. So, therefore, the linear speed is about 2.83 meter per minute of the planter here well.

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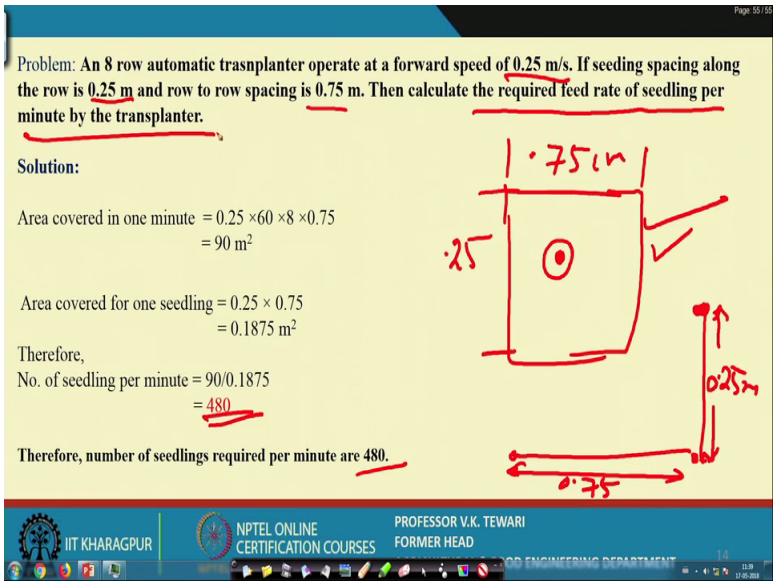

An 8 row plat transplanter operate at a forward speed 0.25 meter per second, if seeding space along the row is 0.25 meter and row to row spacing is 0.75, then calculate the required feed rate of seedling per minute by the transplanter here. Well, in this case we see here that 8th row transplanter there are 8 rows here and the forward speed is 0.25 meter per second. Seedling spacing seed seeding spacing along the row is this and row to row spacing is this. So, we can very easily understand that the see the seed has a certain area which it covers. And, that area could be if you take care of the distances properly and try to understand you will find that the seed is over here, and this to this is talking of this the spacing seed spacing and this will be your row spacing.

So, this being the information that you will gather when you go through the details of this seed to seed, if you are talking of here. This is a seed here a seed here and if you are talking of a row this. So, this to this distance is 0.75 and this to this distance 2 5 meter. So, if you consider the whole field you will get something like this. So, which will tell you that the seed covers an area of this 0.25 by 0.75 and using this you will get the seedling per minute is about 480. So, therefore, the total number of seedlings required per meter about 480 here.

The, calculate the required feed rate for seedling permit by the transplanter. This is another problem which has been given now question is that you have seen over the 2 lectures here, that we had talked from the basics to the location of simple seeds, single

seeds, to bulk seeds, to the transplanting, then we will pick up more designs of this and advanced designs or precision seeders that we have designed, we will talk of those in the subsequent classes.

Thank you.