Farm Machinery
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Lecture - 30
Vegetable Transplanting

Well students we have discussed about the different types of seed drills and planters, now in the series of those the where equipment. We would like to discuss today about Vegetable Transplanting. Now, this has taken in the last 7-8 years or so about the mechanization in the horticulture crops and particularly the vegetables. Here we see that the various operations which come into play for this vegetable, is the field preparation which anyway we know how it is done and what are the equipment available? The second is the planting of this or seeding of the vegetable crop.

Then third is weed control, then fourth is about the pest control or any other insect control and spring etcetera and then harvesting. Of course, when you go for harvesting and if it is a root crop like potato or you can say carrot or onion so, you can you can use any one of the devices which have been develop. And check; whether how far they are use useful and compatible with the requirement of the crop. Now in this case here, we would like to talk about the particular one type of vegetable transplant which we have developed. And, which you might have seen available in the various parts of this country as well.

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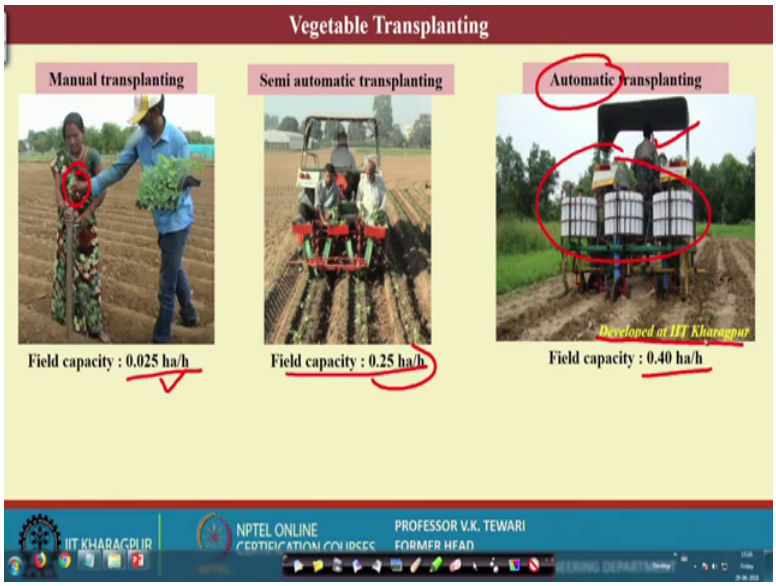

See the various ways by which vegetables are done, manually, you can you know that manual how do we do either; we have this vegetable seedlings or vegetable seeds which are sown or vegetable seedlings which are created and that can be sown. As it is sown over here, as it is sown in this case, that there is a the dibbler sort of a tube here in which this is being sown. At the then the field capacity of such unit of course, definitely when such units are manual, they will be very slow and the output will be very less. You can say it is quite obvious 0.25 hectare per hour.

And then field capacity here, field capacity when it is a semi automatic transplanting etcetera to drawn unit. Where you have the people there are two persons who are sitting here and then you have the seedlings which are grown and they are being manually put into the into the hopper and which is connected to the to the farm. And that is why they are being put into the farm, even here; then you find a higher capacity is compared to this and definitely is the requirement of doing these. So, that you can do this the operation faster and you can save time and you can cover more and more area.

Now, unit similar unit which has been completely automatic transplanting here; the human being is not involved except that the driver is here, who is after everything has been created the whole seedlings have been created. And the system has been well set; the tractor driver has to simply operate in the field the way he does operation this has been developed at IIT Kharagpur and where you can say, that the field capacity is 0.4

hectare per hour. Here what exactly we do is that there are various methods by which you can create the seedlings, we will see how they are: Classification of seedlings for vegetable transplanting.

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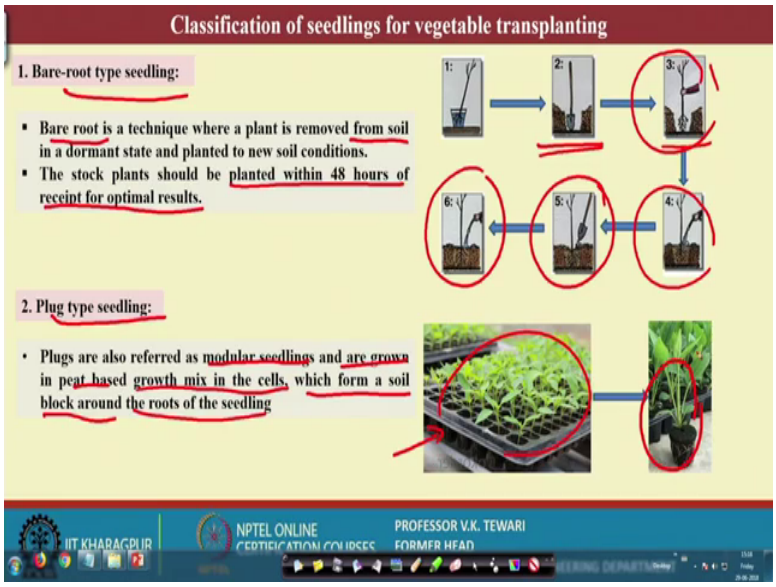

Now there could be seedlings, the way they are prepared. See bare root type seedlings, where the there is the root is very bare root the root is here and a plant is removed from the soil. So, the bare root means; the there is no soil in that root. So, we can see, then the stock plant should be planted within 48 hours of received for optimum result. Actually what do we do that the moment you have these they should be planted as early as possible otherwise a because, just like fish out of water similar situation here.

So, you should plant immediately as far as possible the moment you have taken a bare root of a particular seedling of a vegetable crop. Plug type seedling; these are ones which are very common. And which are being used and which have slightly higher longevity as compared to the bare root type of seedlings. So, here plugs are preferred as modular seedlings and are grown in peat based growth mixed in cells, which form a soil block around the roots of the seedling very simple.

Because, in a in either in a cup or in a paper pot you can put these seeds. And then you can show the seeds and the seedling can be created. And this seedling then when it grows for a certain duration of time may be 2 to 3 weeks or so. And then, that can be taken and

can be planted in to their location or transplanted into the location where you want. You can see here what we have shown a process by which you can see the first thing here.

The second the here there is nothing here you can see how we are putting these, the third one you can see that the seedlings have come up. And then, after that there is some watering then you can see the situation over here the situation over here and ultimately then the plant is growing. Now how what happens? It is looks something like this; you can have a look at this that something like this will be the condition of the trees.

You can create the trees like this and then once the trees are there either you can take the trees and then you can put a wherever you want to put the transplanted or something like this you can see. Now this is a very old, old means; slightly older than what you can see, but then if this is the requirement for a particular crop. So, depending upon the type of crop, vegetable crop, you have, you have to you have to allow the seedlings grow into the nursery.

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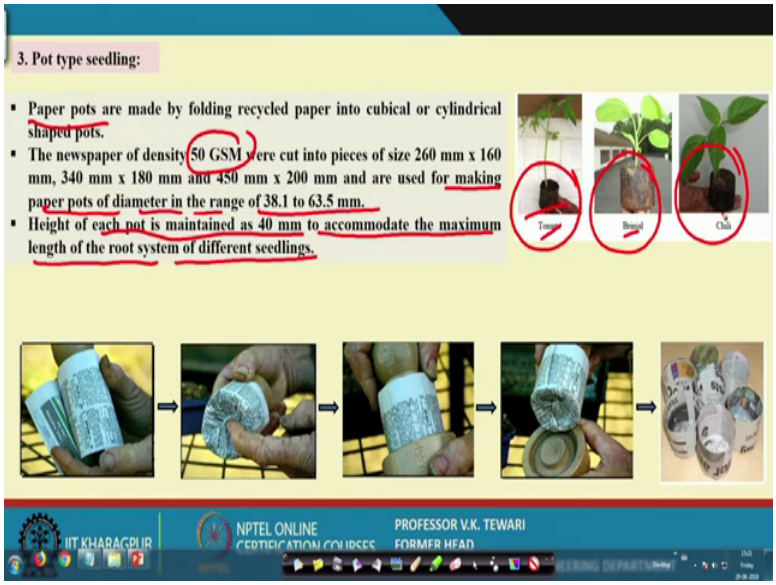

Pot type of seedlings; this is what exactly I was telling you that some of the some of the crops of the horticultural crops. Some of these vegetables are on pots, paper pots as I said either you can have a cup or of any material here you can have a pot of newspaper or any paper here.

You can see for a tomato they have created one, for a Brinjal they have created one and for chilli they have created one. These are the some examples which you can see, how it looks like when the whole thing is ready. Now, this soil portion here, which is a mix of course, definitely you have to create in such a way that it has some a level of nutrient with it. When it is fixed because then, it must get the initial nutrient from the soil from where it is housed.

And then later on it will start taking from the surroundings so, this is very important. Well the height of each pot is maintained at 40 mm to accommodate the maximum length of root system of different seedlings well. The these are some of the requirements and well it is not a binding, but you can see that the you can see here, that generally paper pots of diameter say 30 in a 38 it is given.

So, about the 35 38 to 64 65 millimetre could be this size here and generally a 50 GSM paper is used. Because then, that will have certain strength and it will be able to hold the soil. So, that when you fill this while inside that it will not simply break or go away, but then it will be able to sustain for certain duration of time. And then, it will grow along with that, later on it will you can remove it because, this will this will come out. And then you will have these seedlings just the way they are created here for the three crops of tomato, brinjal and chilli.

Well, these are some of the processes by which you can create, this is a process shown here we could not it is it is not a very big process that I need to spend. So, much time on talking about this but these are the something which automatically comes, when you start creating such cups of the paper.

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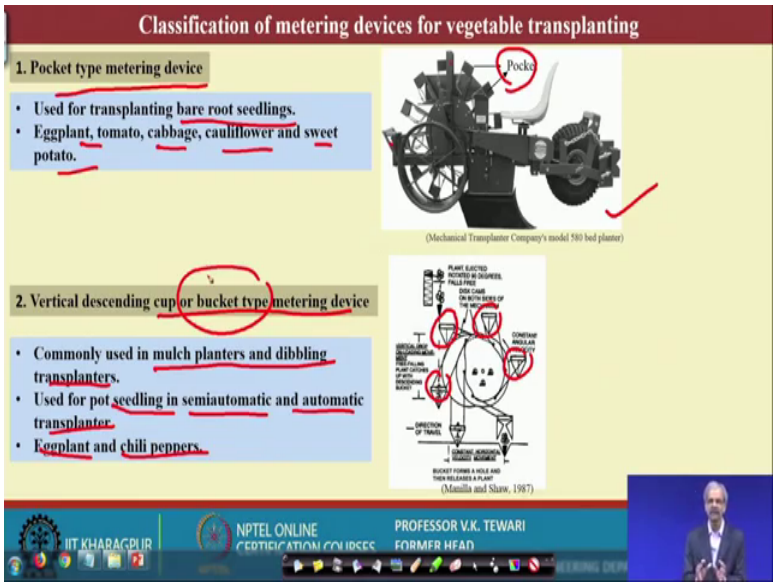

Classification of meeting; for vegetable transplanting well, as a such classification you can say that there is no hard and fast rule for classification of this. But then the different types which are available on that basis we can say what are the ones which are available. Yes you can see that pocket type metering devices used for transplanting of bare root seedlings, say tomato, cabbage cauliflower, sweet potato, like this. So, this we have taken from literature, you can see that these are the pockets, there see the pocket which are created here.

And in these pockets these seedlings are kept and the when this rotates, it will be simply falling into the location of the furrow where, this will be actually put, similarly, vertical descending cup or bucket type metering mechanism. Here you can see that, this is these the cups which are there these are the ones. So, vertically descending they will be descending means, when you rotate. So, commonly used mulch planters in dibbling planters used for pot seedlings in semi automatic and automatic transplanters, eggplant and chilli peppers.

So, for these some of these, this bucket type of cup or metering device is used. So, these are some of the devices which are available well, here I would like to say as an engineer you must use your mind and try to come up with something very simple. Say for Indian conditions or a smaller unit which can help for small grounds or small fields. And for different types of crops and if it is possible may be a multi crop situation or multi crop

metering system will be better one for this. So, we wanted here to show you; the various types of vegetable planters and their planting mechanisms and the types by which we create the vegetable transplanters.

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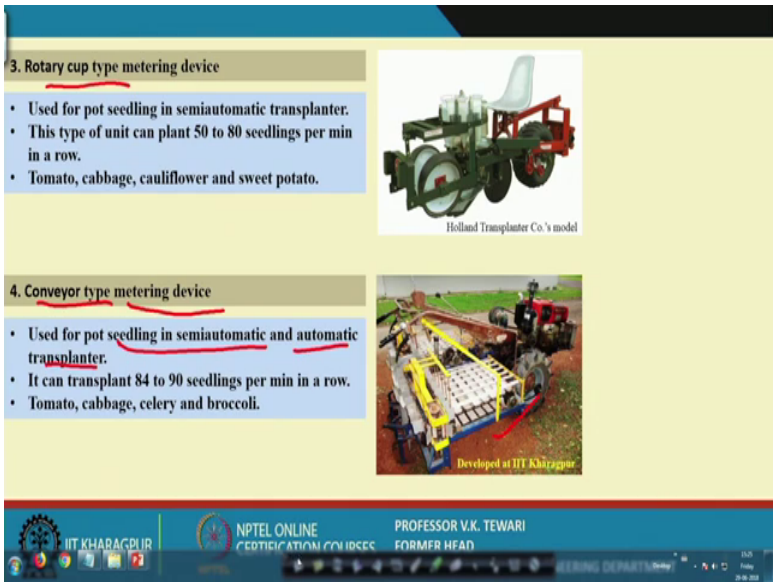

There are other ones rotary cup type metering in a device, the conveyor type metering device, pot seedling semi automatic. Automatic; transplanted the way, similar things that we take for the c drills, there also here also you can have a rotary cup type metering mechanism. And a conveyor type of metering mechanism these are some modifications or you can say that some of the changes that they have made. At different locations, depending on the type of the crop, depending upon the size of the crop they want to maintain the seedling size of the seedling which they want to maintain for showing.

So, at IIT Kharagpur we have developed, a tractor run unit as well as a poverty run unit also. But then, this is only a concept that we have developed and we are in a position to show this. Now, for large scale; development of these large scale modification of all these things, I think well, one needs to have a trade off between whether to have more units of tractor drawn or units of poverty later one. Because each has own limitations and they require the cost etcetera keeping into view the cost and the amount of area which is to be covered etcetera into picture.

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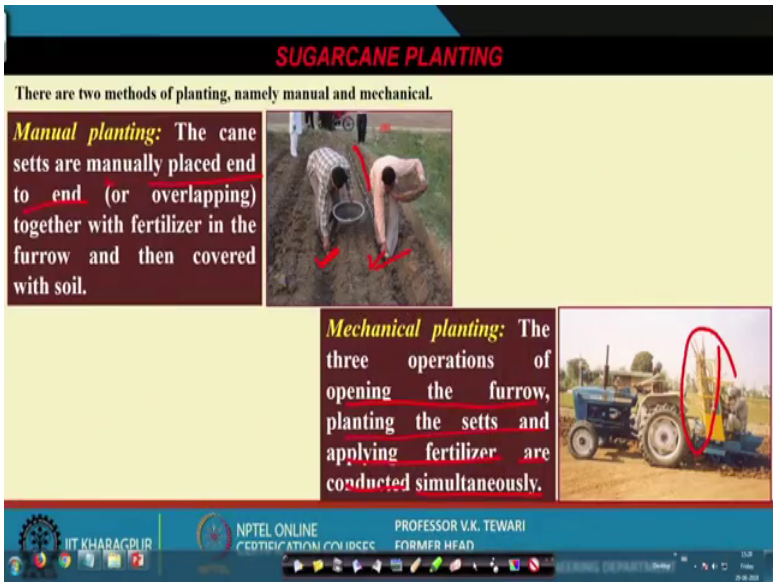

Sugarcane planting, now this is one thing which is very important you know and we do have lot of problem with sugarcane planting you must have also seen that sugarcane height of sugarcane is so big. And then transplanting of this and then how do we plant, how do we harvest this is a very big problem. And very big machines are available, various machines have been imported from outside for harvesting of this because, this is a big problem.

Earlier we used to do manually, but it is not possible for the very obvious reasons that we do not have people, we do not have people for single cutting of these, we do not have people available for this. So, we need to go for mechanization of the sugarcane planting and harvesting both. Now you see that how these are done? Let us have a look at how they are done, manually, the manually the cane seeds are placed and end to end. Now the way they are shown you can have a look at this the so, they have been shown here manually, they are the canes are cut into a sizes about 30 to 40 centimetre or so.

And in which there will be at least two buds also and then they are planted manually the way it has been shown over at these two locations here. But then since, it is manual method if you if the area is less and people are available why not go for manual method; it will be cheaper for the farmer. But then people are not available when we have large area to be covered then, there is no other alternative than to go for mechanical means and so, mechanical planting. And mechanical planting there are various types, various

variations of the machines which are available. One variation is shown over here; you can see the whole cane which is being cut.

And which is being carried just like a hopper. And below the hopper there is a cutting mechanism so, what happens is there when they when it is moving, they there is a cutter which cuts and makes a small sets. And those sets you can see here, that the opening the furrow, planting these sets and applying fertilizer.

Now the are conducted simultaneously, in the mechanical system of course, I said that these are the metering system. But then what do you do? Because once you have a furrow open, then the sets have to be put in that and then you have to cover. And then put certain amount of fertilizer or insecticides to say save these. So, these are the things which need to be done in a mechanical system.

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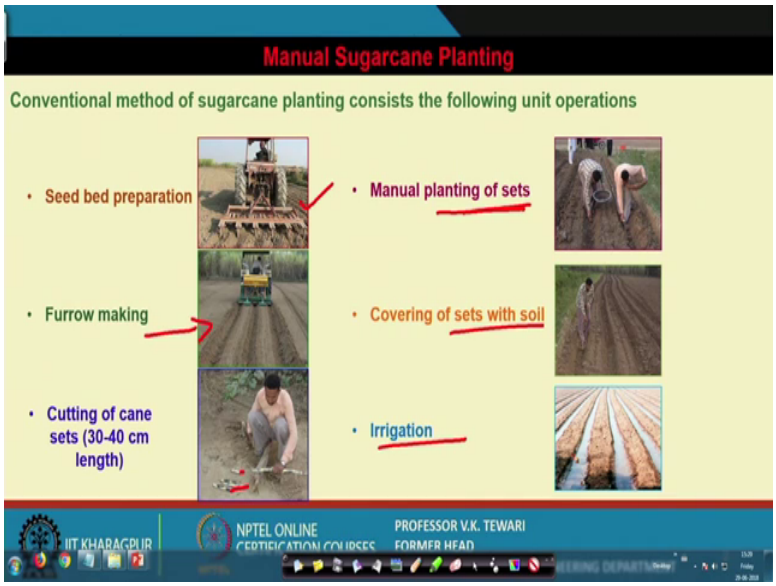

Well, look at what are the various methods of for different operations, you can see here, seedbed preparation is the first job. Which we have discussed there is no need point telling about it, but seedbed preparation, furrow making yes, you have to make the furrows we have seen that furrow making devices earlier. And hence, the furrow has to be made, the then cutting of cane yes, the cutting of cane manually the person is doing manually. He is cutting the cane into the small pieces where are the buds are there. And after this manual planting of these sets now, as it was shown earlier, again we are showing here.

These two locations manually these sets are being pressed between the furrows. And then covering the seeds with soil, now manually being covered either you can have a small spade or a something a device something like that and you can cover the sets which have been planted. And after that you can give some sort of a insecticide or fertilize fertigation, if you want to save the seeds from any other any other damage etcetera, and then, of course, the irrigation; where in the channels irrigation.

So, that it will help in growing of the sets. So, this is the method which is being used for a manual system manual sugarcane planting. Now, you can see that the steps are show tedious, you require people to do and a you require more people when you have large area. But then we need to go for mechanization of this so, we have done at IIT Kharagpur, we have done a device for this. And in fact, we have tried a slightly innovative way of using these and let us discuss as what they are?

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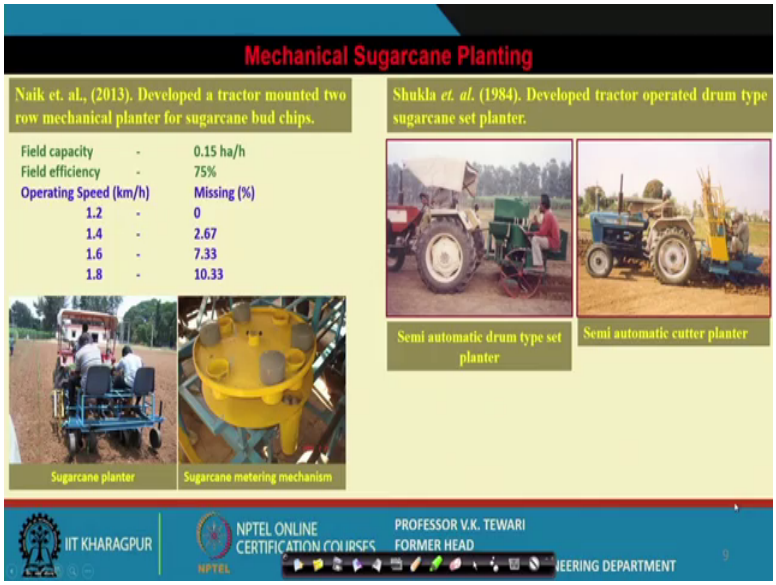

See in mechanical sugarcane planting; well, we have given you here just for information. Please understand that these are informations which will help you in understanding as to what are the different types of equipment and machines available in the country. And being as is used at different locations because, they then you will have an idea, we which one is good, which one is not good and which one is most suitable and all that. And that will give you an idea to have a new design, which will help a larger community of the farmers from across the country.

Now you can see here that some people have developed these machines which we have kept here. This is a sugarcane metering; this is a sugarcane metering mechanism sugarcane planter here. Semi manual, a semi automatic as I told earlier, then semi automatic drum type, there in the drum we are putting the sets here. And the semi automatic cutter planter type which I had shown earlier. So, these are the ones which are develop different locations and purposely we have given you here with their references. So, that you can have a look at this and read more about these a units.

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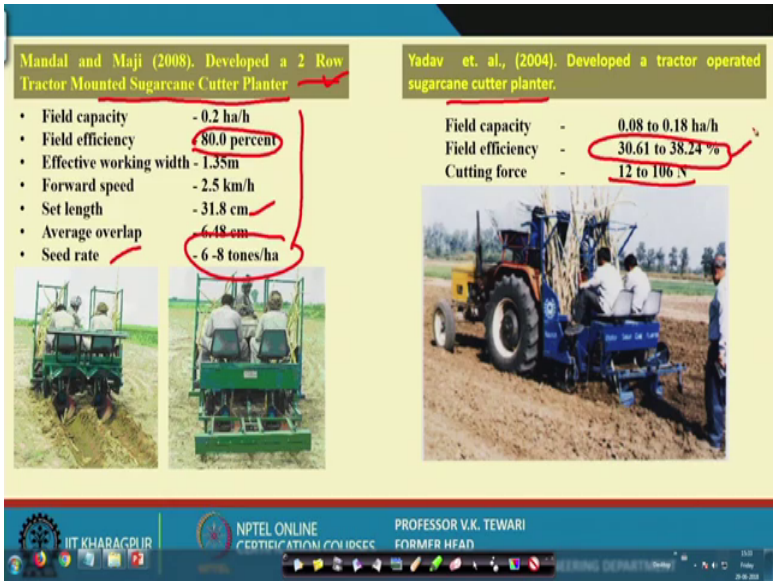

Well, these are some other ones you can see here how they are being used. See tractor one mounted sugar cane cutter a planter a two row device which is here, their filled capacity the details are also given here. You show that you can appreciate how much area they cover what is their field efficiency and what is the working width and what is the set length, how much is the set length, how much overlap they maintain and how much is the seed rate about 6 to 8 tons per hectare that you require here.

Now you can imagine you have to carry so, much of the material 6 to 8 tons of this material. Now this is one big problem because of which people are in looking for better solutions. This is another device which is also a sugarcane cutter planter here; wherein we are cutting we have measured in the cutting force. And the field efficiency is you can see this much only about 30 to 38 percent 40 percent field efficiency you can imagine what why should you go for it.

Now here field efficiency was 80 percent just two row here. Now, here field efficiency is 38 percent and well. Then and the cutting force required because you need to cut these they scenes of into various types in the sizes different sizes, which you want of the sets before they are being planted into the furrows which have been opened. So, these it is give you an idea as to what is the field efficiency, what is the total weight required and the things like that. And; which enables you, to go for a design, a new design, now we will show you what we have designed here.

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Well, there are certain other things which are talked of sustainable sugarcane initiative. Now this is one which is new a concept which has come up you might have heard of rice the system of rice intensification SRI for paddy. Where in a single seedling is being used in case of paddy. And that the concept is that if one single seedling is placed you have to similar distance, then it will get lot of space. And for having a better growth etcetera that is what is the thinking and that is why that SRI system is very much prevalent. Particularly, in the trial and agriculture and it has proven very good very good yield as well.

And that is why people are also think at designing SRI type of transplanters. On a similar concept the SSI which is sustainable sugarcane initiative, now what is done in this initiative is you can have a look at this what is given. This SSI technology aims at providing practical options to the farmers in improving the productivity of the land, the

water, labour and all the agricultural inputs at the same time these gives ok. Reduce the overall pressure on water resources and contribute recovery system contribute to the recovery system ecosystem. And useless number of seeds well you have seen that so much tons of this material has to be used. So, you can if you use that, it is possible that you need not to carry so much of tons of loads per hectare for reseeding for sugarcane.

So, this is another important less water and optimum utilization of fertilizer and land to achieve more yield while we are we are targeting at a higher yield we are not going to use a very big size of sets or sugarcane. And handling of this so much of load to the field so, the idea here is that you have buds, you know that the buds are there and this bud, bud chipper is important. So, you have a bud chipper by which you can take the buds. Bud chips which are even here you can see that these are the buds which have been chipped.

And after they are prepared preparing nursery, you create nursery for that. So, this is the beauty of new system which is thought off, that you can create a nursery for that. And then you can see that this is just like that nursery has been created these are the house these are the locations where you can put these chips; but chips which have been there because, these from here the plant will come up. Then you can grow, now see this is the seedling this is how it looks like. So, the seedling will be like this and then you can transplant the seedlings at your location. Here the in the SSI system, we see that a better sustainability less amount of material to be handled.

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And then everything can be economize this is the idea in SSI which is very prevalent nowadays finding out the similar concept. These are advantages of course, there are certain advantage of SSI as I explained earlier that you do not have to cut the might carry so, much of material and transportation etcetera; will not be required for that.

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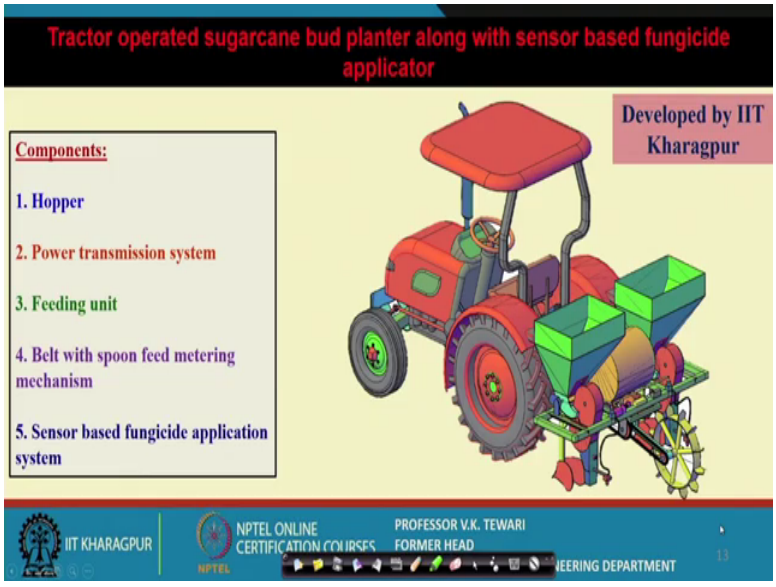

When we have developed at IIT Kharagpur, a device which has a new and we are also talking of these buds, now you can see that these, we are we have device in machine, where we can cut this a small buds of a required size. We have not chipped it, but we

have taken certain about 20 22 to 25 or 30 mm size of the bud we have cut. We have designed a machine for cutting that and then after that we can use the machine for planting. It has solved a great many problems and then we will show you what it is.

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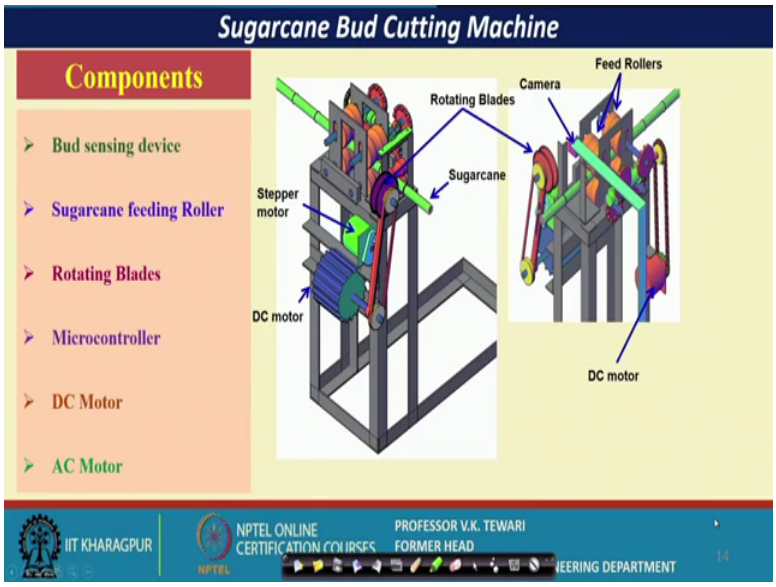

Now, this is the machine which is there for cutting of the buds.

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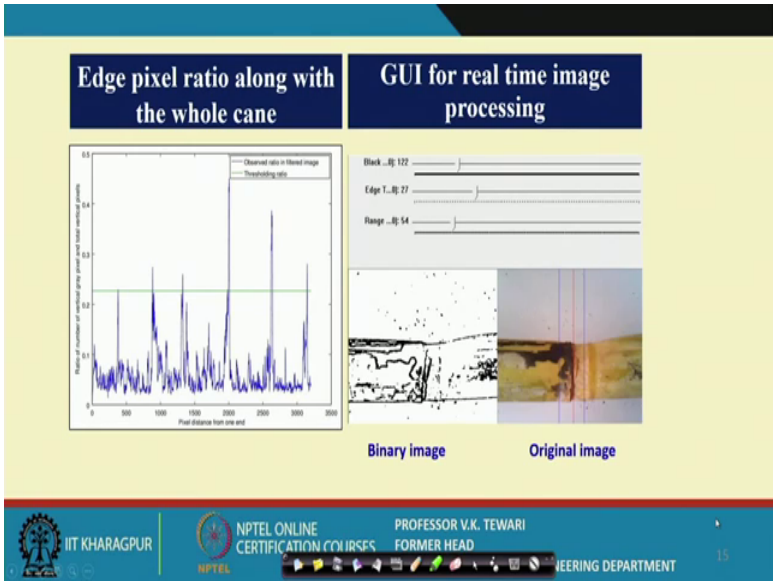

Here the some of the research which we did and the GUI, which has been created we want to show you here because it is a patent pending for such a machine. That is why we may not be able to tell you the details of this GUI, but then we are showing that we have

these machines. And it is working we will show you the operation of these the machine which we have developed for cutting up the buds as well as for seeding of the sugarcane.

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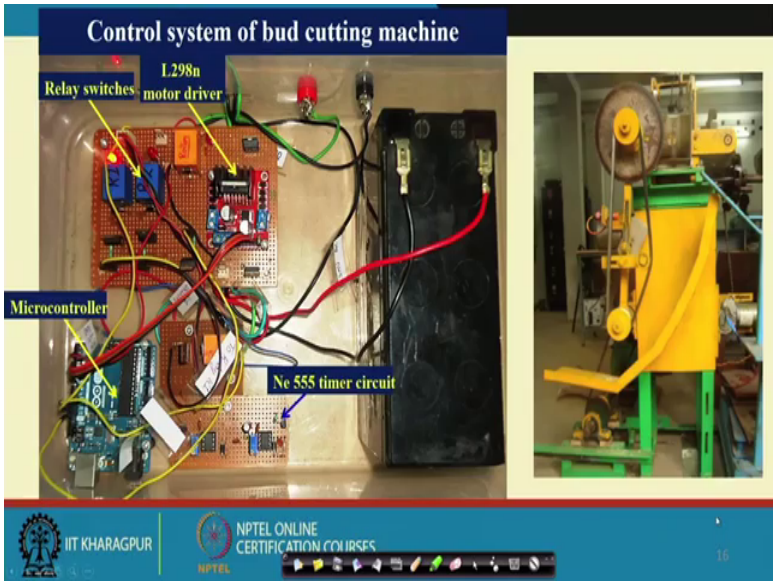

Now, here in the control system the bud control system you can see here more details of the electronics portion which we have used a microcontroller, a relay switch, then motor driver and the various other components which are used in the electronic system. Of this control system for bud cutting machine now, this is the bud cutting machine here; you can have a look at how it works.

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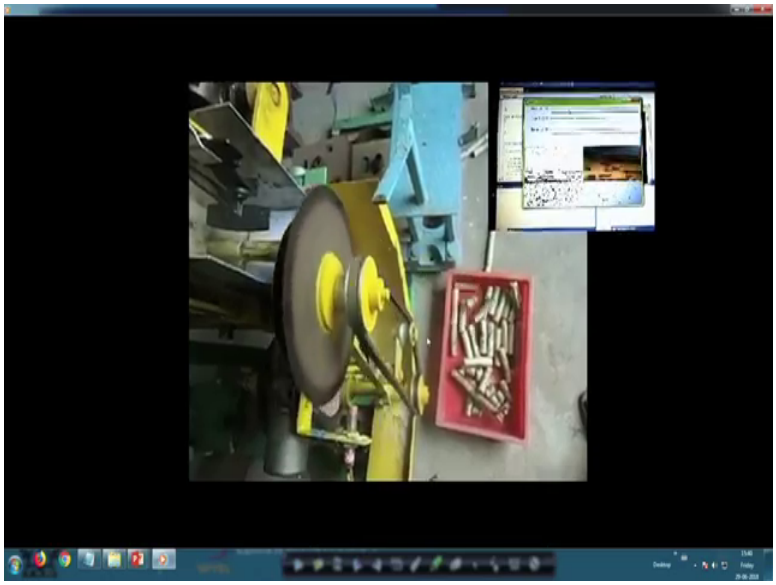

Well you can have a look at how the bud is cut, here you can see that on this side, we have seen you the GUI image process you can see the image of the bud is being seen here. And accordingly, the cutting machine, cutting portion cutting blades or cutting those butts of the required type which has been designed. So, you can see here the digital image processing of the item as well as you can see here the cutting which is taking place.

Well you can see, you can see that the system is working well and it helps us that very fast you can cut these seedlings, the these buds out of the cane. So, you do not require so much people for cutting it manually. So, this device and automatically these cuts as per the requirement and then once you have completed this part you can use it for the machine for taking it for.

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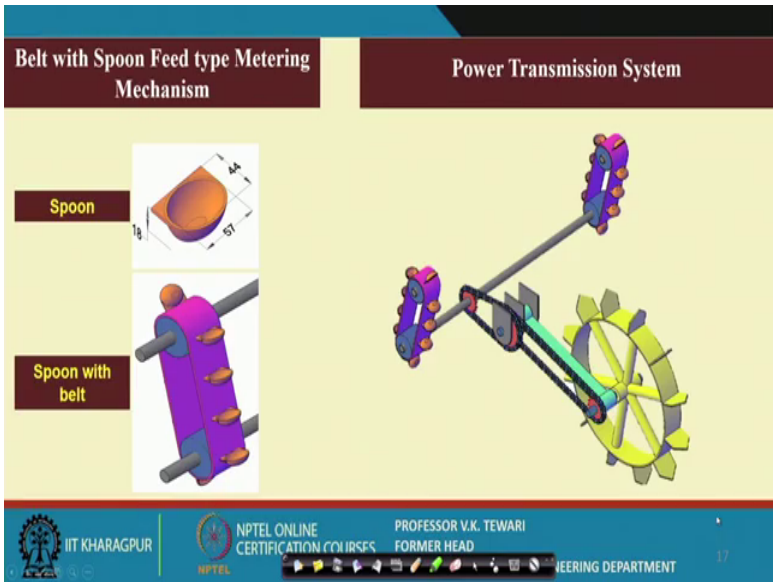

The some of the details of this system which we have the spoon which is being used here, this is the spoon which is being a spoon type of mechanism which is there, spoon with the belt this mechanism which is there. And this is the power transmission system which we have designed for our machine which I am talking of.

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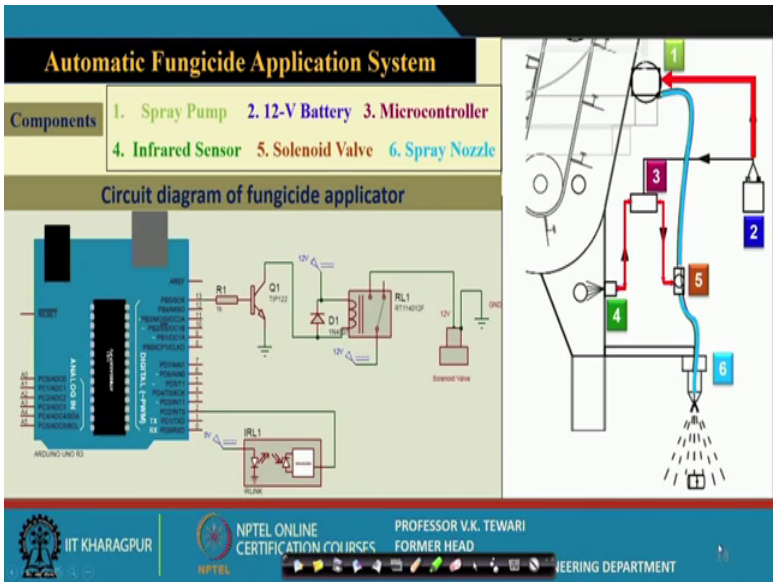

Well now, another thing which you we give here you can you can have that the automatic fungicide application system. We have also developed because you require that these the buds should be kept at a location and a some fungicide should also you put. Otherwise we have found that some sort of mites etcetera were a taking and that is why we have used this the electronic system, you can see the details of the system here where fungicide is being applied.

And you can have a look at this, what happens you can see here, from 2, there is a power from the battery goes here. Then you can see that from there it will goes to the solenoid and then of course, it goes from the infrared sensor. And then you can see here that it goes to the solenoid valve again and then finally, it will be sprayed at this location. So, you will be in a position to see that how the system works, this is the device and the details of the circuit diagram are given on this side here.

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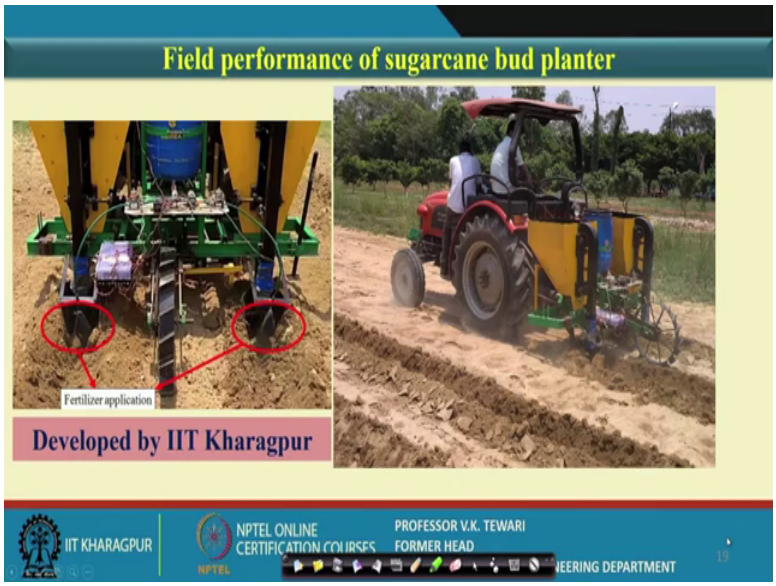

Now, we will also like to show you the system which we have developed and how it works in the field.

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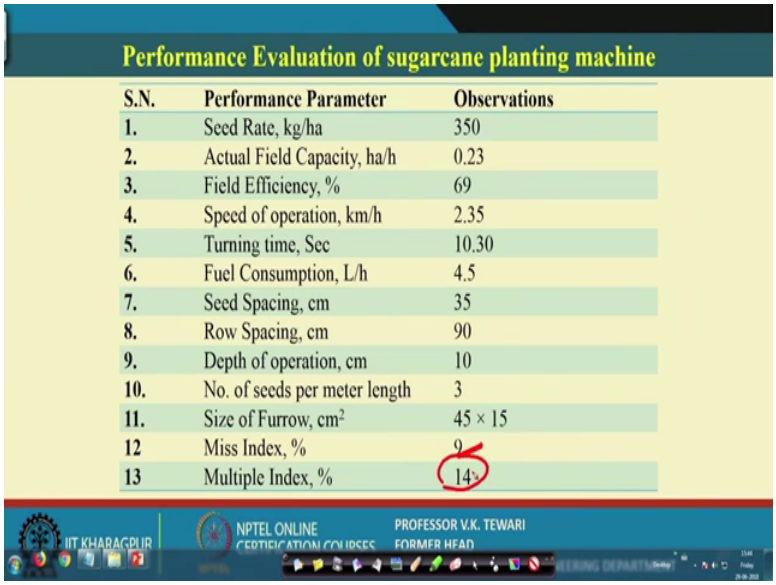

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So, the performance evaluation we will have a look at the video, you can see that how it works in the field as I said earlier. This is the one which I have we have developed and you can see that it has the arrangement as I said for fungicide also you can see that at the some location here. You can see here that the spray is being a spraying is being done yes, you can see that is spray comes out here, yeah you can see sometimes spray yes, you can see at both the locations here.

So, this spray is also being applied and the covering is taking place by gravity. You can see that as the whole machine is going forward the covering is taking place we do not we have not used any other machine for covering this. And this is well enough to take care and after some time we have found that the germination takes place well. So, this is the machine which has worked and developed at IIT Kharagpur. This is the field performance of the machine well we have certain; we have also given you that well this is a field efficiencies much better we have seen a system where field efficiency was about 38 percent or so.

We have a better field efficiency speed of operation is also higher, fuel consumption is well fuel consumption of a tractor and about 4.5 litre that per hectare if an. And we can see the missing index is very less you can see here missing index is less and multiple index is 14. Now, this is a large once you go for large testing and then multiplication of such machines over a period of time, you will find that this can be reduced and a machine can be very well

Thank you very much.