Farm Machinery
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Lecture – 32
Farm Machines for Interculture Operation

Welcome, students to my lecture number – 32, Farm Machines for Interculture Operation. Well, it is essential to tell you that so far we have been talking of the preparation field preparation and then we talk of the seeding of this and we have seen different types of seeding equipment which are available and their operation and their different features etcetera. We have talked of their performance and the advanced level which are they are developed at our place, then we have also talked of the testing of some of these equipment whether it is a tillage equipment or for a seeding equipment.

Now, the biggest many minutes which is there in the crop production is weeds and we will talk of that today. See, the we call interculture operation because between the crops you have seen that the crops are shown and if you go back to the ancient time when we were talking of sowing of the seeds people were having animal and they were never had even the plow. So, earlier they used to throw away the weeds, throw away the seeds and then whatever seeds and weeds are coming in fact, they would like to try to clean by manually or through other some means of clearing clear creating one row by which the crop grows.

Now, these were the things which were then quiet ancient when nothing was there. Slowly people developed a small plows, they wooden frame in which a small steel blade you can say and that was used behind the animals and power of animal was used. Now, that in fact, that became a multipurpose tool because that was used for your preparation of the field, as well as even for seeding as well as for interculture operation; that means, cleaning the weeds. Now, what are these weeds? Supposing in a paddy crop you have which you have a wheat plant, so, I will call that as a weed because I have not shown wheat in paddy. So, I will call that as weed.

So, in fact, it is said that unwanted plants in a wanted crop a or weeds. So, weeds are those which are not wanted in a particular crop and in fact, when we go into the details we do not have a wheat grown into paddy or paddy or wheat which I give an example,

but what exactly happens is certain types of weeds are there and those weeds grow because they have affinities with certain crop. And, this affinity is say for example, in paddy one type of weed will come up, in wheat another type of weed will come up in the same field. So, this is a very interesting.

Now, we would like to remove them, why because, they also compete with the crop with the plants and take away the nutrients. So, we would like to remove them and clean the them, so that they do not compete with the plant and our plant gets the maximum nutrient from the field and it grows. So, that is the job which we which is known as interculture operation or cleaning of those weeds. So, we will see today what are the different types, what are the different mechanisms, what are the different ways by which we do these operations through this slides.

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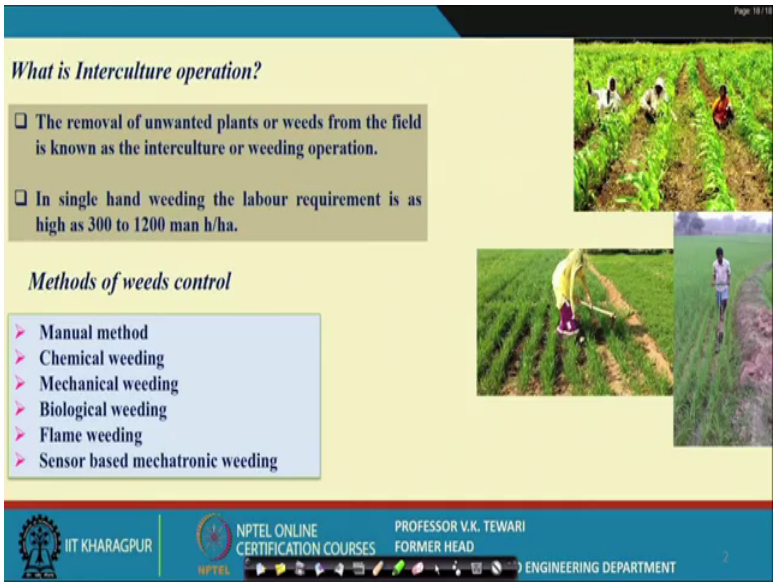

Well, I as I said the interculture operation; removal of unwanted plants or weeds from the field is known as inter culture or weeding operation. Very commonly known as weeding operation, you must have heard. The it has been seen that depending upon the infestation which is there as low as 300 man hours to as high as 1200 man hours per hectare. This is from literature I am telling you that so much of man hours are involved for weeding operation. Since it takes was 25 to 30 percent of the total energy and even the cost involved on the total production of a crop is of for weeding itself and this is a very arduous task, it is very human manual intensive, human intensive operation that is why

the this menace has to be controlled and that is why we call control of weeds interculture operations.

Remember, that it is not possible to totally eradicate the weeds that is why we always talk of methods for controlling the weeds; that means, within the period because the crop has about 60 to 90 days of crop or 120 days crop. So, within the those period we will not allow them to grow at the same pace at which the crop is actual crop is growing. So, we will control their wills we will remove them and then again they will come up back then again we will remove them in between. So, we do about 2 to 3 weedings over the course of the length of the crops growth period and that is why we are controlling them. So, we cannot eradicate, but we control and that is why we call weed control.

Now, what are the different methods? Well, one is definitely the most simple and known to everyone is the manual method; that manually I go to the field and see that this is not the right crop which is which has been grown. So, I will take out that plant. So, those manual weeding, manually they take out. Everything you can have a look at this that manually a manually these people are you can see that they are manually removing these sitting in a seated posture.

And, it is very interesting that this particular operation along with another operation of transplanting which I have said you in my previous lecture that these are all dedicated to the ladies these. You can see here and now within equipment of course, you can see here that a man is here, but then with this operation the arduous one are all left to the ladies. Well, with due respect to everyone then and with due respect to them because they have been doing this and in fact, if you see the statistics today the number of people in agriculture operations of human particularly male persons is decreasing whereas, participation of female is increasing in this case.

So, the third one is the second is chemical weeding. Yes, chemically what we can have those if you can take a selective type of herbicide or a weedicide the chemicals which are available and spray that then the plant will not die, but that particular weed will dry because it is a selective type. It will have taken for that particular weed only and that is why the selective type of herbicide. So, if you take a selective type of herbicide or weedicide or a chemical that is called chemical weeding. So, spraying that will clean these weeds. Those will not be totally removed, but definitely they will again emerge

after about 3 to 4 weeks or so, by the time your crop has grown and so, the which will be you can say that trumped or there which will be virtually removed.

The next is a mechanical weeding. Now, you see that chemical is one way where while chemically is killing the weeds, but then it is also being deposited in the soil and it also creates problem for the soil. So, we would not like to have more of chemical and that is why mechanical weeding is in found, where we have the mechanical linkages used for designing in the machines and equipment which may which will be able to do this job.

Another way is that biological weeding, sometimes you can see that some of these I will trade details slightly later, but then some of the bacteria which is there which grows. Now, if you can use that because of which these the weeds will be they will take the weeds kill these weeds by that particular bacteria. So, this is another way of biological controlling of this which are used in some of the crops here. You will not find this in very widely used, but these are being used in some of the crops particularly you flowers may be some of the cash crops some locations in the world they are being used.

Then other is a flame weeding. Of course, I just wanted to mention here because flame weeding is one where we burn these small weeds which are by the side of the plant itself. Now, this well you are burning them. So, you can understand that you have to create that the flame etcetera. So, creating the flame and all that, but this was one method which may be about 50 – 60 years back some people employed and clean these weeds. So, because anyway we are controlling them, but then this is no more in vogue and not in vogue at all and that is why you will only find in the books, but they are not in practice nowadays.

Now, another one is the one which is involving high technology we are talking of use of more and more technology into the agricultural equipment design which are going to give us a minimum input cost and maximum output. The use of technology is definitely going to reduce this and this is what we call precision agriculture. So, when we talk of precision agriculture we are talking of using advanced technology, so that the inputs which are giving in the form of machine time, in the form of fuels, in the form of you can say the total use of the whole machine etcetera are reduced you can say that more and more nutrients are being utilized by the plant and then we do not have these losses.

So, losses are reduced and we can use as much as required. Suppose, you want to give certain amount of nutrient say fertilizer nutrient for the growth of the crop then we should be in a position to identify how much is that and then only we should apply. So, this precision agriculture of late for last 10 to 12 years or so, has taken because then we are thinking of economizing on this maximizing the output and minimizing the input.

In that in that case the sensor based mechano mechatronic weeding is an equipment which we have developed at IIT, Kharagpur and, also some locations people have developed different types. So, we will show you the one which we have developed at IIT, Kharagpur also and now let us see some details of these in our subsequent slides.

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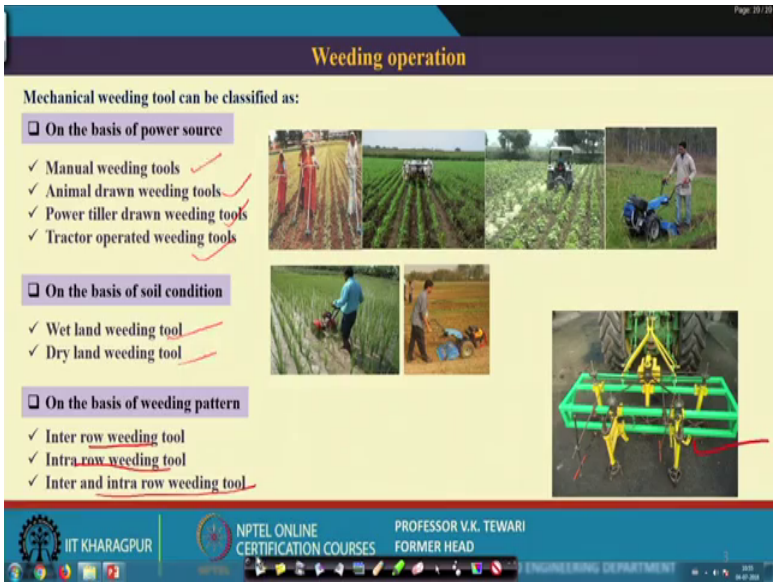

See weeding operations. You can see here that they how the different weeding operations are on the basis of power source. Well, we say that how do you classify them all human being is involved, but how do you classify them. Now, you can see at each location that human being is involved, here the animal is there human being is there, here machine is there tractor is there, but human being are also there, here also there is a machine, but human being is there. Now, this is one which we are talking of mechatronics which will we will discuss later.

But, then you can see here this is a small machine which has been used this is another small machine in lowland condition and these are the particular ladies which. In fact, this is a device which has been given to them and they are operating here otherwise this was

to be done in a stooping posture and all in this cuttings posture they were trying to remove this. So, you can understand the total output per day will be very less and it is very strenuous job.

So, on the basis of power source manual weeding tools are graded, then animal drawn weeding tools, then power tiller drawn those which are power tiller drawn you can say here, then tractor operated weeding tools you can see the tractor operated ones here, power tiller drawn operated ones here, small machine operated once here.

On the basis of soil condition, what is the condition? Have a dry land condition or wet land. See, particularly for wetland we are talking with respect to paddy production. So, we have this. So, in paddy you can see that which are there and that being that is very very arduous because the manual when we are talking about the ladies, these ladies have to stand in that water and then remove each and every weed like this otherwise the yield will be reduced and that is why the lowland weeding. So, for low land we are talking with respect to paddy and the dry land different types of dry land weeders are available. These are some of the types which are shown over here, then on the basis of the weeding pattern.

Now, as let me tell you that the total weeds which are available in a particular crop they are all over the whole crop along with the actual crop. Now, but if you go into the rows in which the crop has been grown you will find that you are finding them in between the rows as well as between the row itself; that means, plant to plant in between the rows and in the row itself. In the row itself is known as intra row weeding. So, intra row means between in one row there will be one plant here another plant there third plant like this. So, in between there will be weeds.

Now, it has been found that 80 percent of the weeds 75 to 80 percent of the weeds are there in the in the in between the rows and about 15 to 20 percent are there or 25 percent are available in the intra rows. Now, in order to have a tradeoff between the yield loss and how much are there in this, we do not particularly if the different methods do not employ for weeding in the intra row weeds.

But, then as I sold I told you that there are methods by which we can also do inter row weeding as well intra row weeding and inter and intra row weeding tools. So, this is the one which we have developed it is here which will show you in an different lecture all

together. But, these are the different types of the conditions in which these are operated and you can see that animal being also used here.

So, this is these are the different types of equipment and this is these are the ones which are used all over the country and even in all countries you will find these. The more advanced countries you will find most of the tractor drawn units, but in the Asian countries and other countries where there are small fields etcetera then we would like to get all these which will be available.

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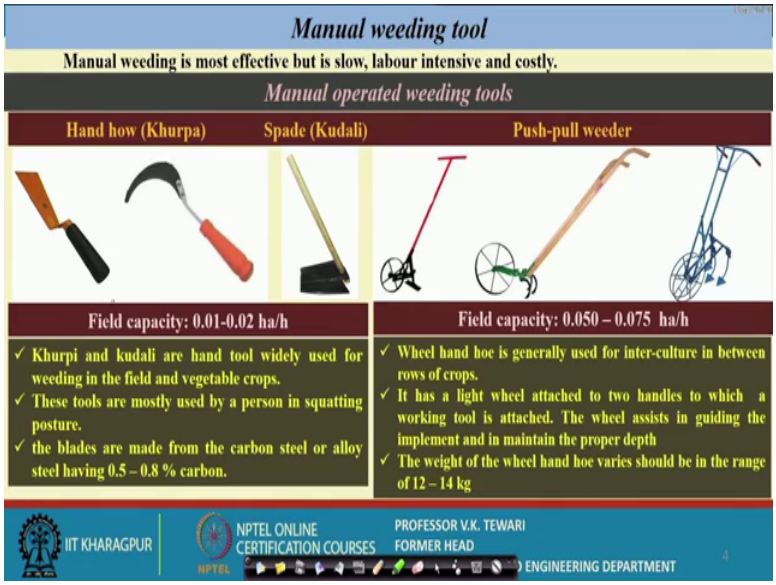

These are the tools, what are these manual tools? It is worth as an engineer you must have a look at it since you are whether if you are a PG student you must have seen at UG, if you are UG student this is first for you. And, those who are working industries and other places it is worth having to know the different types of these tools many of the industries mechanical engineers are working even sometimes electronics engineers are also working in some of the tractor industries.

So, for them I can tell you that for them this is new information they are not seeing these tools. So, they worth showing them what are these in fact, all the manual operations. What we want to emphasize here is that the capacity is very less the capacity of these is less because they are manually powered; that means, human being power is used for this.

So, let us have a look at this, you can see here that hand how these are the ones which are used. So, man the these are the hand this is the handle and this is a these are the place where it is cut and this is place where it is cut. This is a spade; now, this is one of the most you can say this robust and very all rounder you can say device which is used for various operations you will find this for weeding, you will find this for even preparing the field, you will find this for preparing bunds and so much.

So, most dynamic you can say this device. Then the push pull weeders now some of the devices which have been developed in order to change posture, as I said that this is a very arduous and drudgery involved operation because you have seen that either the ladies were bent or in a squatted posture in one of the photographs. So, in order that you have a standing posture because from agronomics point of view we know that if you have a standing posture you can do the work better and for a long duration of time; that means, the output will be more. So, some devices have been developed some about 30 years back or we have also developed at IIT, Kharagpur and other locations.

Now, we would like to show you those. This is a single blade here this is a 3-tine blade here, this is also a 4-tine blade here different types of these arrangements have been done by different designers, but everybody's aim is to see that it fits the requirement of the person or the ladies or the gents whoever is operating this. These devices are known as push-pull; that means, you cannot keep pulling, but they are pushed short distances then pulled. We will show you what is the mechanics behind this in the next maybe lecture, but then here I want to see you that these are known as push-pull weeder, either it is in the low land or in the upland both conditions they are known.

And, the of course, the capacity of the manual ones are over here they here the capacity has slightly increased in this case and these are very light ones about 10 to 12 kg or so. And, the material of constriction of these are in fact, very local materials where some sort of a heating is given to strengthen these materials, do not use very spare very sophisticated materials are used for this but, then still there have been very widely used for last 50 years or so. So, worth having an information about what they are and where they are used.

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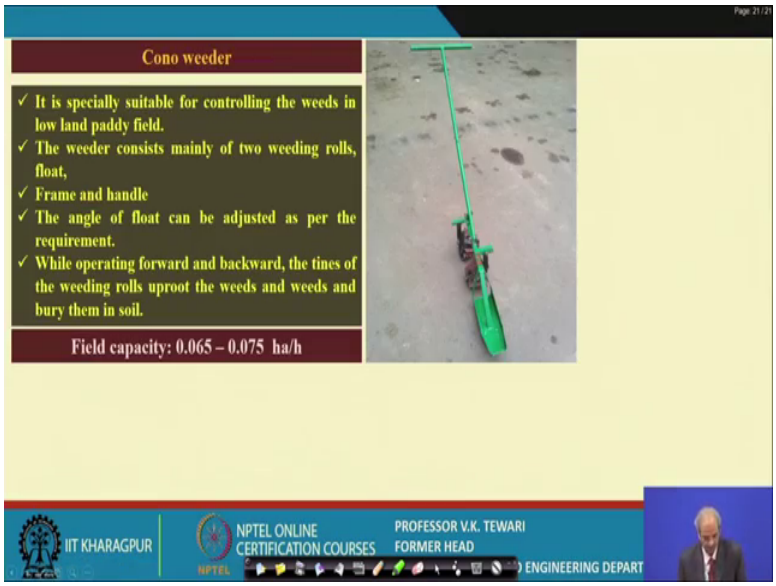

Cono weeder. Well, this is a device which is generally used for lowland conditions because particularly for paddy. So, you will see that for paddy we use this thing and since these also a push-pull type of device, but then it has the two different types of cutters or the cutting element which is there.

Now, you can see the cutting element you can see here that these one cutting element this is another cutting element there are two cones and they are in fact, just opposite to each other these cones and they are sharp edges on that those sharp edges. So, that when they move when you move to and fro then they entangle the weeds and those weeds are uprooted from there and once they are uprooted and they are floating by the sun they will simply burn and then they will go away. So, this is how operates in the field condition maybe we will show you the operation of this.

And, the capacity is also slightly higher because we are operating in a standing posture. Here there are arrangement by which you can change the height of this crop because the person can hold at certain location a taller person will hold at a different location. So, there arrangements made in this design so, that the he can adjust to his way and then he can operate the device.

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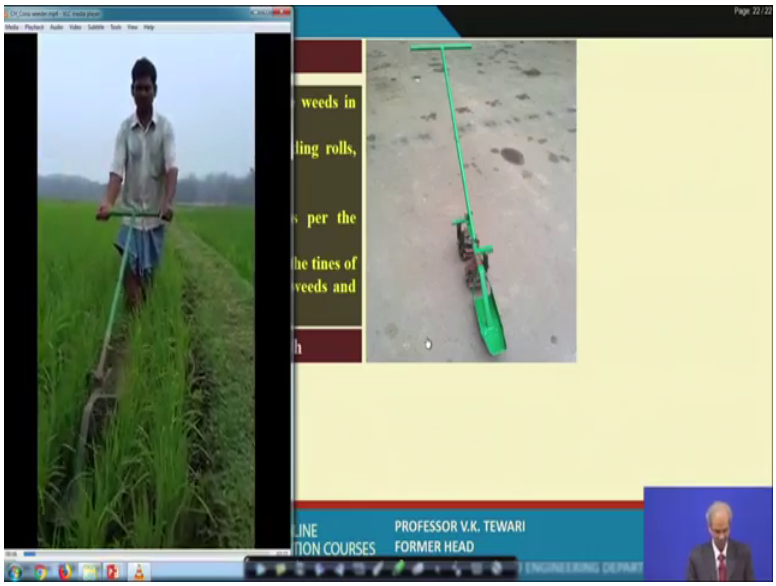

Now, let us see how it operates. Yes, you have a look at it you can see how it is operated push and pull. This is the way it is push and pull in the actual crop condition this. So, it is operated now this is done by a male person which is being shown to you here and it can be done by anybody male or a female person, but then this is how it is operated in the field. It is a worth showing you here.

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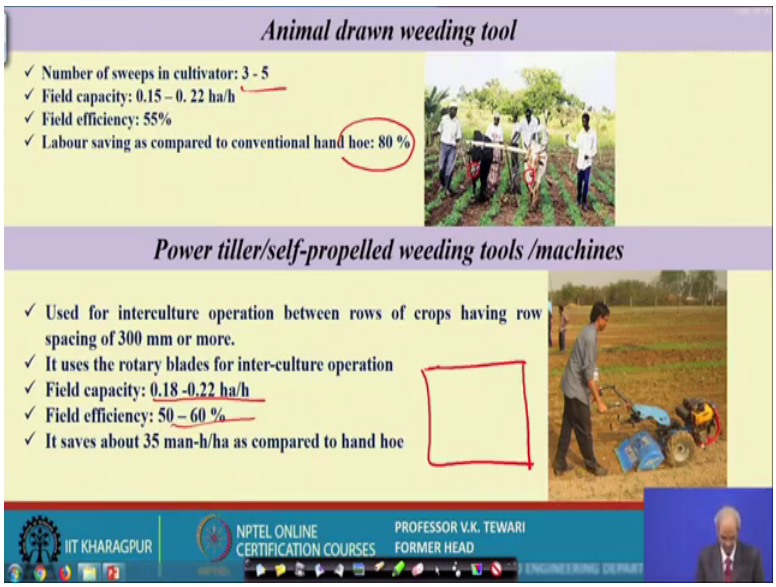

This keeps on going on in fact well, animal drawn weeding tools. Now, see once you go to this now we will tell you some more details about these when you have animal drawn

weed. So, the animal number of sweeps in cultivators you can see here that 3 to 5 you can have 2 to 3 in between and then we have you can you have to see that in the mouth of these animal and they are closed otherwise they will eat the crops the that is done here.

And, labour saving this about eighty percent as per the hand how or by manually when you do about 80 percent of saving is done here. In power tiller per self propelled weeding tools, now power tiller is used power tiller or small powered machines are used like this. Whereas where it is possible and smaller a in fact, the rows are wider then it is easy to use. Here the field capacity is you can say very high field capacity 0.2 hectare per hour and field efficiency about 60 percent. Well, you can see here that the field efficiency you of these machines do not go about more than 60 – 70 percent at the max and for particularly weeding in this case.

There are many losses in that and there first one is that we do not do between the in intra row between the rows. We do between the rows, but we do not do in the rows. So, in the rows we are losing. So, that is why we cannot. So, we cannot say that the field efficiency is more than 80 – 90 percent or so, because some of the weeds are left and when it is done in fact, a quadrant is use about 1 meter by 1 meter or 0.5 meter by 5 meter size. Something like this is a quadrant here either 1 meter by 1 meter or this and this is thrown into the crop at one time and counted number of weeds are counted and later on when the weeding operation is over we count them.

So, you will find that some of these which are between I mean they in the rows they are left and that is why you do not get more than 60 sometimes 70 percent or so at the maximum value. But, then these some of these devices they self propelled weeding tools etcetera they save a lot of man hours per hectare. You can see that this much compared to a how it is saving. So, the we have to use some of these because as I have told you in my previous lectures that the human the people available in the agriculture are diminishing here and that is why you have to go to the technology and hence you go to the equipment. So, we will have to use these small tools and devices for doing this particular operation.

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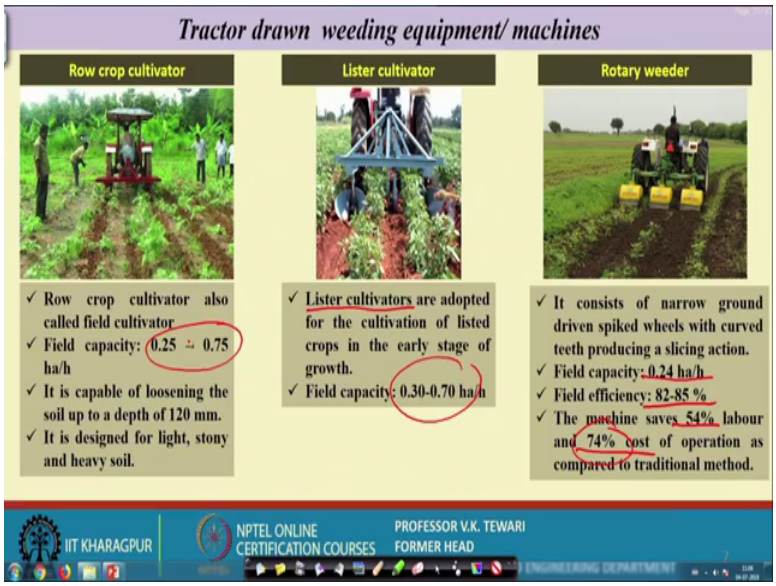

Now, these are the tractor drawn units. Well, tractor drawn units various types of tractor drawn units have been used by different locations and you can see that what are their names etcetera you can see row crop cultivator. See between the rows how this tractor drawn unit is going and it is cleaning this very nicely. It is earthling up doing earthling up because you create some sort of a when you do this cleaning of the weeds you also create remove the hard crust after three weeks of operation.

Generally this weeding mechanical weeding or this weeding is done after three weeks of the sowing of the seeds we call the three weeks 21 days of after sowing which is done. So, generally a crust is created and that crust is to be removed. So, the plant starts breathing and that is why the first you can see that these operations by lister cultivator. You can see that by lister cultivator here this is lister one is used and then you are in a position to clean this.

You may this is a rotary weeder. Rotary weeders are used 3 rows. You can see how these used in a black soil. So, you can see this that these machines are available which are faster and then they are giving us better output etcetera. You can see that field capacity is here the weeding efficiency has increased here because in a position to do more and of course, a lot of labour saving and cost of operation you can see about 75 percent as compared to traditional method. How much is the cost saving this we have we have to see here field capacity is also higher here and also higher here.

So, we can see that as and as we are going towards mechanization and machines higher machines we are in a position to save lot of labour as well as cost. We are not displacing the labour. Please understand here that we are not talking of displacing the labour. What we are talking is we are talking of how to use the technology, so that we can do the jobs in faster duration of time and then you we should be in a position to take more and more crops from the same plot. So, that cropping intensity is higher and the output is higher and that is the main aim.

So, no question of by mechanization we are in fact, trying to create more and more job opportunities. There could be several aspects of job opportunities which are there and which will be there if the equipment and machines are being used more and more into agriculture. Of course this requires a different change in a mentality and mindset of the farmers as well because the farmers of the particularly in our country in India here 60 percent of the people are small land holdings. So, they need to come together at least small groups can come together, so that instead of 1 hectare if 5 farmers come together there will be 5 5 hectare crop 5 hector field.

And, there at the machines can be used it will be economic to use that or in a custom hiring basis these machines can be utilized. So, a mindset has to change, but then this is the necessity of the country and it has to be done other than in order to produce more and more to feed lot of people growing population on the world.

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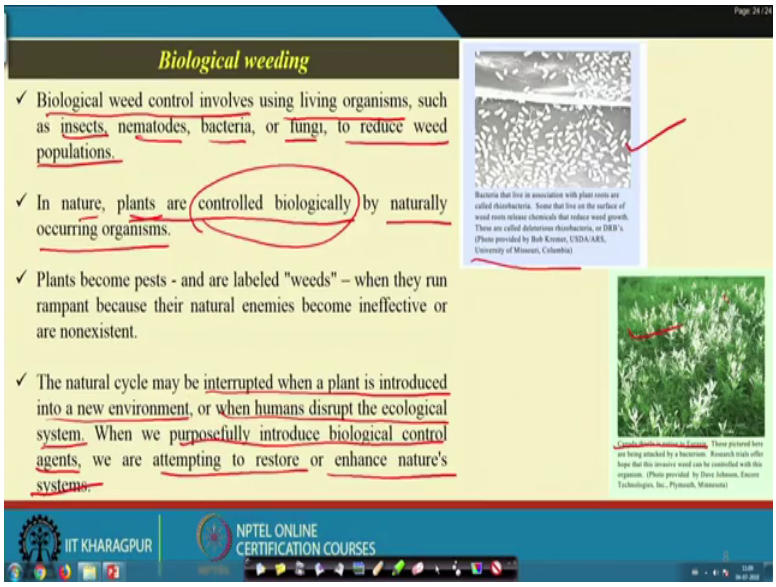

Biological weeding, as I said here biological weeding actually it is worth telling you, but not very much followed in this country and all that, but then this biological is what exactly is doing see. We have talked about the pest and the weeds etcetera what they are, but then how you do it. See, in nature plants are controlled biologically by naturally occurring organisms. Yes, this is very important. So, when there is a deficit of those in the natural cycle may be interrupted when a plant is introduced into a new environment. This is the thing which happens that and or when humans disrupt the ecology of the system.

Well, when this happens we have to be careful about that and there why. So, we purposefully introduce biological control agents which are attempting to restore or enhance nature systems. So, we can see that by we are by humans or by when you introducing plants at different locations you are creating an imbalance into the nature's ecosystem. So, for that you have to bring those because then here you see the control biologically, you can see the plants are in nature plants are controlled biologically. So, whenever there is a disturbance here you need to see that that is taken care of and therefore, we need to use biological weed control where the living organisms such as insects nematodes bacteria or fungi to reduce the weed population.

So, this is what exactly you have to do, because the ecosystem is getting disturbed when you do this or when human being are involved and since they are doing we need to introduce and you have seen that some of these ones which are going shown here in University of Missouri Columbia now. These are some of the locations where they have used this is in Canada some of the types which have been used here. The systems are being used and it has a future, but then there are various ways and various trade off you have to do when you are trying to use such systems. Not very much used in India so much.

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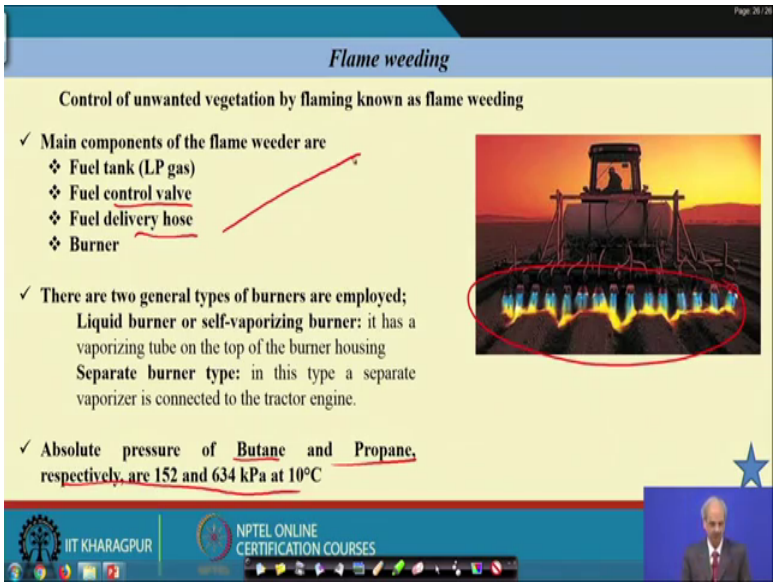

Well, flame weeding: this is another I said that frame weeding although we are trying to burn this weeds which are very close to them and in order to burn you see that. You will have to have the fuel tank, you will have to have the delivery burner etcetera and they are carry some of the sort burners which are used for which the smithy smith smithy people used to use for soldiering etcetera, those things were used sometimes.

But, then it would require a complete system you can see here what we have shown you here is a complete system. You can see here that so much this has to be created and you require a certain power of these units the gases which we require. You need a delivery system, you need a control system; that means, a complete sort of system has to be created. And, now of course, this system not in vogue very much in vogue, but for as an information to any person who is in agricultural engineering or who is dealing with the equipment and instruments etcetera you must have an idea that yes, this type of weeding also existed well in the books you may find, but not that.

So, in nutshell we have talked of the weeds which are the menace, which take lot of energy and which are which are manually intensive. So, what are the types, what are they different methodologies to use to remove them. We do not say remove we say control them, we have discussed this today and then if we have we will have the questions etcetera if you have anything we would like to answer you and I think we close this first part of this weeding operation here.

Thank you, very much.