Farm Machinery
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Lecture - 58
Machinery Selection and Management Part- I

Welcome students to my lecture number 58, which has been named Machinery Selection and Management Part-I. Now in this series of lectures which I have delivered over the several 57 lectures, we have covered several aspects of farm machinery design. Now it is very imperative and very logical for you to understand as to suppose you have to have a selection of machine or you want to manage a big farm.

And what should be the machines required, what should be the number of particular equipment required, how you should go. What should be the criteria of selection, and why should be a particular criteria given for that. I think this is, this question will definitely come to your mind. And as an independent entrepreneur, now today is the age of entrepreneurship.

Supposing you are interested to go for having a large farm, and want to select machines, and want to manage those machines for a certain crop rotation. So, when you will have this you must know what are the operations. And what are the machines available in the market. And what are their capacities. What are their timeliness operations which are to be required in particular crop. Depends upon what sort of crop rotation you have taken.

Depend of what type of crop you have taken in the crop rotation. So, I have come within to you here with certain level of selection and then management. It is very imperative to understand what selection is, why selection is given. And what are the parameters which are followed and what sorts of consideration we need to give for selection.

And then ultimately managing these such that these are manage between the time required from finished of a crop or a start of a crop to finish of a crop. And the start of the second crop things like that. And the time required for each and every operation which will be required during the process of and the growth of the particular crop. How would the crop rotation that we are talking of.

Because our aim will be to get have a certained set of machines; which are be effectively utilized. And we should be able to get maximum out of the machines which we have invested in. Any entrepreneur would like to get maximum out of what he has invested. Because maybe that we will if you set up machines you will have to go to the bank for taking loan and then he will have to pay the interest as well.

So, he must choose and manage these machines in such a way that here he is in a position to repay the loans as early as possible within the time limit so, that there is no obligations, are there no legal problems, started with equipment etcetera. So, I think this particular lecture will help you to understand; how we should select a set of machines for a certain crop rotation, and how we should manage I have put it in part I and part II.

So, let us see what we have in part I and part II we will talk of each and every to be with a particular equipment we will talk of every aspect of the cost involved and the selection management. And here will talk of the selection depending upon the availability of the equipment etcetera.

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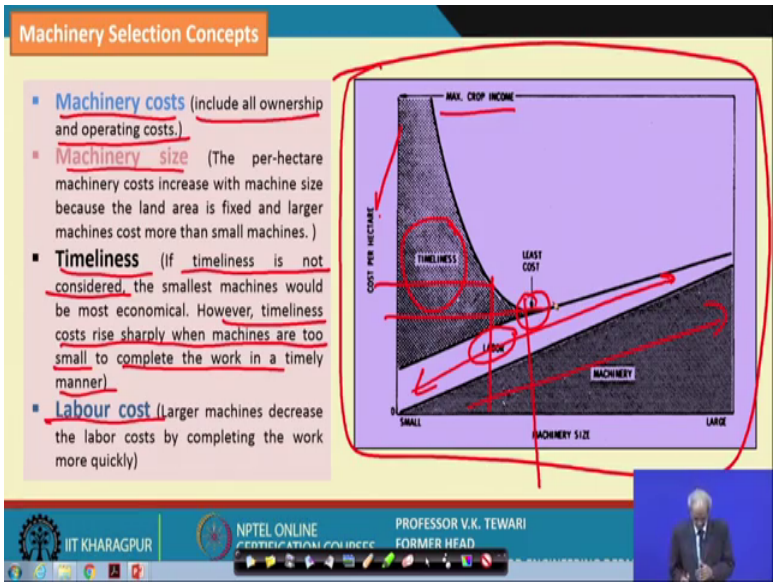

So, now what is the selection concept? It is very essential to understand that in crop production what is important. As I said earlier that cropping intensity is one, we the higher the cropping intensity higher will be the requirement for finishing the operations well within the time. Because the time the climate gives you certain advantages and it also gives a certain disadvantages.

That means, if the climate is not favorable then you will not have the equipment and you are not have the operation done. So, you must look at the climate depending upon the zone or the window available for you. The time window available for you for completing the operations you must try to finish that. And that is why we need to have certain concepts in this selection. Now what are these concepts? I have just put them in nutshell, well in the in various books and literature you will find lot of discussions given.

But then we have concise into certain pin point parameters which will help you to understand the selection process. Well machinery cost, machinery cost includes all ownership and operating cost, this is what is important. What is the machine cost? Because cost is the as an engineer you must be concerned about cost. In fact, is an engineer a good design will definitely talk about good economics. And definitely it will also thought of good ergonomics; that also for people say that the machines should be designed in such a way that it is safe to operate at the same time it is less costly and gives us the maximum output.

So, we at cost talking of the machine it cost. Then machinery size yes very important, we must know which machine is required? What should be the size of this machine? What is the form that I have? Why a particular size is required? And if I have a size what should be the power source with that? Because within the time window available I have to complete a particular given operation, so size of the machine. Now why: because if you are talking of size of the machine for a given area in the higher and higher the size of the machine the cost will go.

But if you are, if you are talking of say larger machines cost more than small machines that is true. But then once we are talking of a given area then larger machines definitely we will talk with respect to small machines. But then you will have to have what is the capacity of the small machines? How much they will be able to do? And there is the importance of timeliness comes into picture. Because if the timeliness is not considered which of course, is a wrong a hypothesis.

We should not think of a timeliness not considered. If you talk of that then definitely you are not a good manager or a good entrepreneur to get maximum out of a particular crop. Because we have to think of this timeliness we must take the window which I am I repeat time window for the operation. Otherwise it will yield into lower yield, it will give you

less time and then all the everything will go favor. So, we must be very careful about this. Timeliness cost rise sharply when machines are too small.

Yes, when this means if you are taking of the window within that if you are thinking of the number of machines to a small machine will we have a small capacity. So, then to complete the work in a timely manner; yes, you will have. So, once you are talking of and which is a must. They have sets of the that timeliness operations is must number one.

So, then labour cost, how for is the labour cost coming to picture; one must look into this. Because today we are talking if you talk all over the world; the labour cost has increased and the even the availability of labour has become scares over the period from last 30-40 years as we see. Because there are other opportunities rather greener pastures we have these people are going and earning more so they would not like to come here.

Of course, there are many things which I have talked that in some of my lectures in the early stages of this particular series of lectures. So, I will not like to repeat that, but then this is essential to say that labour cost is as a parameter. Now if you check this particular crop which I have given you here. You can understand here that cost per hectare, cost per hectare timeliness is wearing like this.

Then labour cost you can see the variation of the labour cost in this fashion here and then the machinery here. So, you can see that the crop in connection crop income; what is the maximum crop? How it is varies? See machine as the machine size increases you can see here. That if you talking of the machine size over here then you can say that this is the cost per hectare and timeliness operations maintained.

Now the moment you are talking of at this point least cost; now here it is that will least cost here you have to you will maintain everything. And then you will be in a position to maintain the size of the machine and the timeliness operations and also the optimum labour requirement. I hope you will be in a position to understand that. So, with this my basis of selection we have to proceed; irrespective of what is the crop? What is the crop rotation you are taking?

Or what is the type of entrepreneurship you are thinking of? Whether you thinking of a large orchids, where fruits are being grown or a plantation crop, cash crop, or any other crop which your thinking or cereal crops special cereal crops or your thinking of crops,

which are under shed crops?. So, depending upon what you are thinking I think you will have to consider this as the basis happens is for selection.

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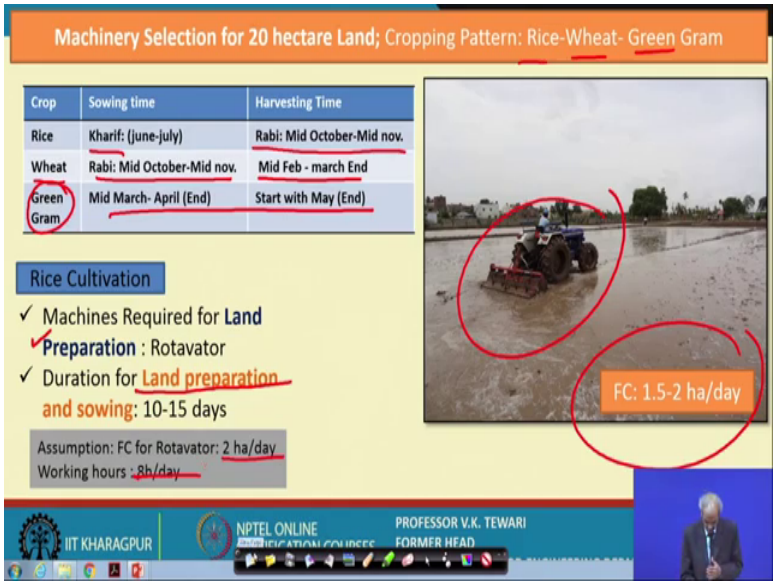

When machinery section for say see for example, we have taken a small example of 20 hectare land. Cropping pattern is a rice, wheat, green gram, this is what we have taken just for to given a idea; about the selection process. Maybe we will talk of cost in the other part of the lecture. But then this we have considered a given cropping pattern. And therefore, we are talking of about 300 percent cropping intensity.

We are definitely talking of 300 percent cropping intensity which is very essential for having more production. And then with this we what should be the equipment? What should be the optimum number of equipment? And optimum size of the equipment which we have to do to go for the market and to purchase? Now, for say for example, we have taken rice, wheat, and green gram. We have taken rice, wheat, and green gram.

So, for rice you can see here that the Kharif and Rabi season this is the harvesting time is the sowing time. Similarly when you take wheat this is the time when we are talking of sowing of this, this is a time when we are talking of harvesting of this. And in between then we get this time for the green gram the third crop. So, depending upon what you have you may think of multiple cropping as well inter cropping etcetera, which I am not taking at all.

We are taking a very simple example of just a if you have a 20 hectare land and you have this cropping intensity. You can think of different type of crop where you can have inter cropping and come out with more output. And you can think of a higher cropping intensity that way and more output, we are not talking of that. We are taking just simple case study to explain the whole thing.

So, for rice cultivation the machines required for land preparation this is the first operation which needs to be done. So, what is the that? We are thinking that well the land is not a fallow land. Now here we must come into we must understand this part that; the land is not a totally land which has to be reclaimed and then go for crop production. We are assuming that this land is available and it is a land which is already cropped maybe some time back and now we want to select the machinery.

Had it been a case of barrel land, or a land which has to be reclaimed then I have already talked of such equipment etcetera which is required for land reclamation and what are the machines required so that you can bring it to the level where you can think of cropping. So we assume this part, so duration during this land preparation; well since this is paddy it has window about 10 to 15 days or so you can think of this window.

And because this is the month of particularly; if you talk of the nation region where we have; and in India where we have lot of rain which starts sometimes middle of June to August or so September. So, we can think of that we have enough water and it is possible to take up this about, 10-15 days for land preparation. You have 20 hectares of land; so depending upon what you have. And we know that you see this is what we here we have shown here the with rotavator.

Now we want the rotavator has been found to be one of the best equipment of late which helps you in churning the soil as fast as possible. We are not going for opening the land first with the mole plough is plough or then we cultivator and then going for it. But it has been found that if you go for this machine I think this is giving you within less energy to gives you the a good quality of the work done.

So, depending how much time it takes and see the field capacity has been found to be 1.5 to 2 hectare per day and you have over 20 hectare. So, depending upon this analysis as a as a engineer you must look into, what you should be doing? See assumption is that say

about 2 hectare per day, the tractor with a mole rotavator is completing to hectare per day and the working hours or 8 hours per day.

Well depends on the farmer and depends on the entrepreneur. If you think that he can start the operation early morning and go up to slightly later evening; then you can have more than 8 hours also and complete at a higher speed of operation. But then taking a reasonable value for calculation for communicating to you that how you should understand this 8 hour per day. Now let us see how we go to a particular type of equipment.

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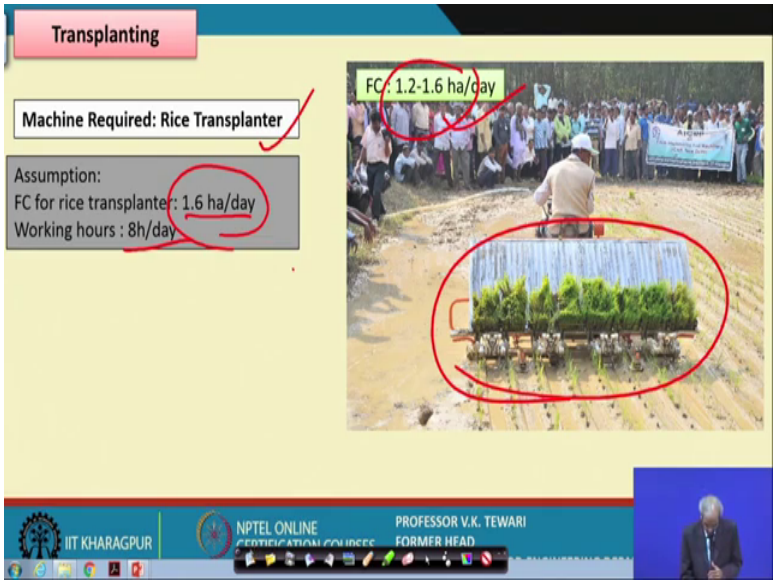

Next transplanting well, I will not go into details of what transplanting is, and how it is done. Because I have discussed in detail in my earlier lectures; that for every area a certain portion of the field is kept for rising of the seedlings or you can rise the seedlings separately. And those seedlings can be transported and the then use on the transplanters.

We have used the transplanters and I am pursuing that as a machinery in the selection method we have these different types transplanters available with us. And which can be use a 8 row transplanter, over or 6 row transplanter depending upon what is available in all that. So, the we assume this part that; yes, it is available. This machine required is a transplanter we are assuming that machine is available to you, so machine is available.

Now what is it is hectare per day? How much is the capacity of this? Well 1.6 hectare per day. We assumed it varies from 1.2 to 1.6 hectare per day. This operation maybe I have discussed if have you seen my earlier lectures we have discussed length, about how to prepare the machines? And how prepare the seedlings for the machine? And how to operate?

We I will not going to give you more details about this. But then what I am I am concerned here is the capacity of this. So, what is the capacity and what is my requirement. So, we are putting about 8 hours per day, 8 hours per day and 1.6 hectare per day here. Now, when we have this machine how do you go about completing your requirement so let us see.

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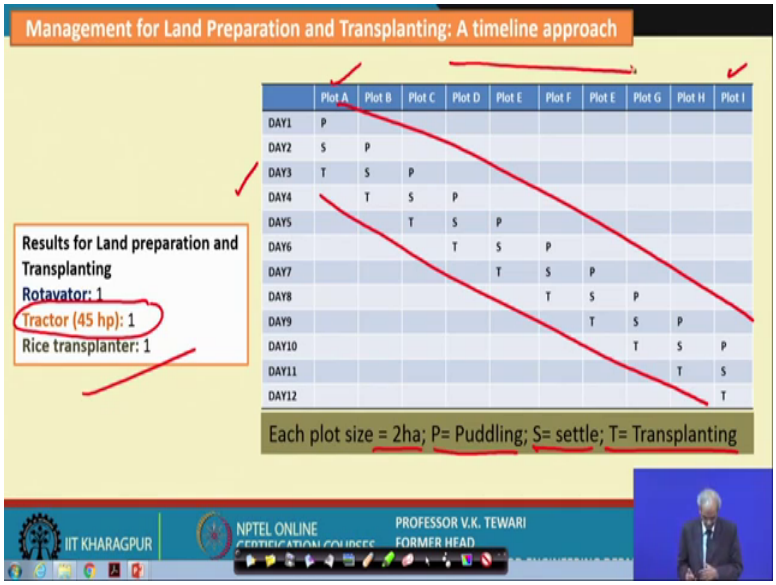

Well here a matrix has been created for you and this is worth understanding. Well you may not get this information elsewhere, but then I thought we have created a matrix for you. Which will help you in understanding, how do you complete this operation? How do you finish the operation within the time window which has been given for you for field preparation as well as for transplanting?

So, assuming that you have already taken care of the seedlings or you have got this seedlings from somewhere and the seedlings are ready for you. Now, it may happen that the seedlings may be grown in such a way; that since you have a large area of 20 hectares. And if you have taken one equipment say if you are taken one tractor that we

have talked off that we are going to take. The result of land preparation and transplanting now, when we take together; we find that we have to take only one tractor 45 hours per.

Now see the selection basis, I am not giving any calculations such that the calculations have done inside when we are talking the field capacity of the machines. So, when we talk of this and the timing which has been created you can see this plot the way it has been planned over here. You can see this P is talking of the puddling operation, S talks of the settling, because when you prepare the field you have leave one day for complete 24 hours for settling of that soil. So, that you can do the transplanting operation and T is it transplanting. So, this P S T matrix gives you a clear idea.

And how the plots are you can see that plots from here to there are the plots these are the number of days. So, with this matrix we are in a position to give you that each plot is a 2 hectare plot that has been thought off. So, with this matrix we are in a position to complete with one transplanter and one 45 hours for tractor the whole area for the paddy.

Now this is. In fact, a timeline approach which we are calling or a timeline matrix which have been created which will help you. Depending upon a suppose you go for a 10,000 hectare farm then you this will help you. This is a model that we are going to give it to a simple module which will help you in understanding and then you can modified this for greater requirements and larger area requirements and larger selection of material etcetera etcetera.

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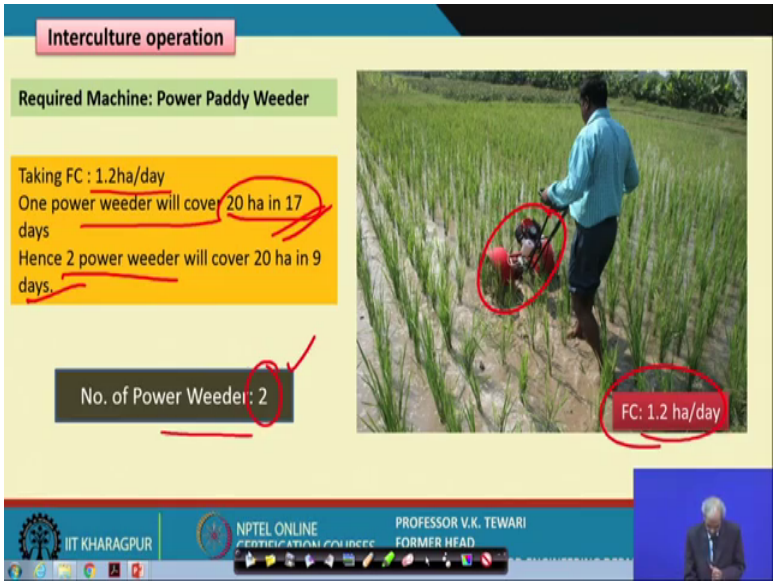

So, the next operation is the intercultural operation. Now here simple machines are available these are small machines which are available tractors well I am not talked tractors here. Because then if you have to talk of tractors, we have to go into the sentiments of the farmers. Because the farmers do not want to put a certain area left and then used for allow it for tractors.

And since we have the small machines available which can help us with the intercultural operation. And as such it is worth for noting that as such in transplanted paddy we do not get. So, much of weeds we do get some times, but then I think these equipments is a good capacity of about 1.2 hectare per day. They can covered whatever is there and these are the ones which are right available; so, depending upon the capacity which is 1.2 hectare per day.

One power weed will cover 20 hectares this is for 17days. So, what we can do at the most you can have two such machines to cover in about 9-10 days of this. And this window is available to you because as I said earlier that when you are transplanting there will be a differential gap between the date of transplanting, and the time required for the for 21 days or when it the weeding has to be done.

So, you will find that this will fall within that. And if you have two such machines which are for a machines, but it will be able to survey purpose. One can also do the job, but then it will take about 17 days slightly higher time. And which may not go in favour because the seedlings would have grown, the weeds might have grown larger, in some of the plots some of the later plots which we thought of which we have given in matrix. So, that is why I think it is worth select a two such machines like this. This machines which are available in the market and can be procured depending upon this capacity.

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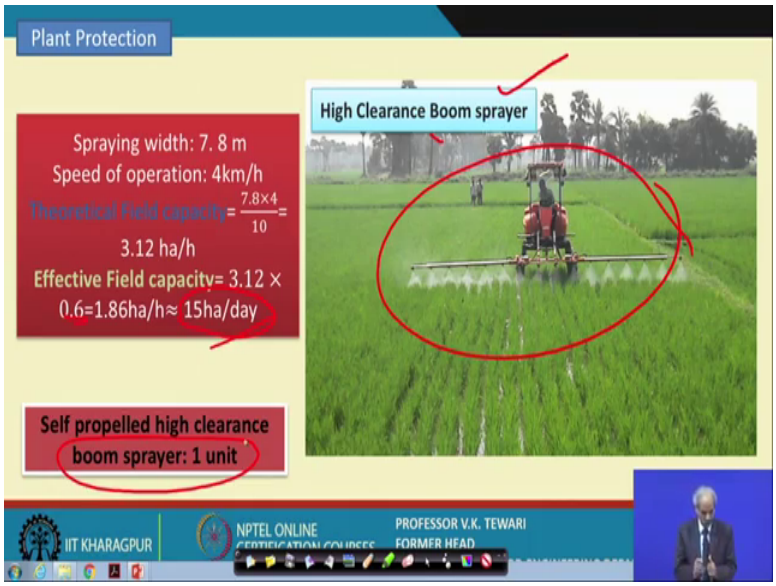

Well plant protection equipment. Yes you might have see that plant protection equipment which is very widely used by our farmers with backpack type of with single nozzle one. But then when you are talking of a 20 hectare land you will have to have such several numbers. Now, there are equipment available you can you can think of hiring those equipment. For example, the one which we have shown you here is a is a high clearance boom sprayer which is available and which can be higher.

But depending upon what as an engineer you think of selecting whether you want to have this or you want to have it on rent basis. Because it will take about 15 hectare per day so roughly within and a taking about 60 percent of it is capacity, you can see the efficiency. It will cover about within a one and half days or so. So, it will be able to cover the plant protection depending upon the intensity of the plant protection required. Sometimes you may not require, if you have gone for organic crop production possibly you may not require.

And a simple device like backpack sprayer may be able to help you that. So, depending upon whether you would like to have this unit own the unit or you can have on rent basis very depends on you and I leave it to your judgment as an engineer. So, self prepared high cleared machines one man purchase one unit you can have one unit

But then the you must know that the operation and the requirement is just for one and half days during the paddy season for the 20 hectare. It is possible that you if you have if

you own this machine is possible that you can rent put it on rent to other people and custom you can use it on custom hiring. So, you will also think of earning some money you are thinking of this aspect. So, this is the plant protection part

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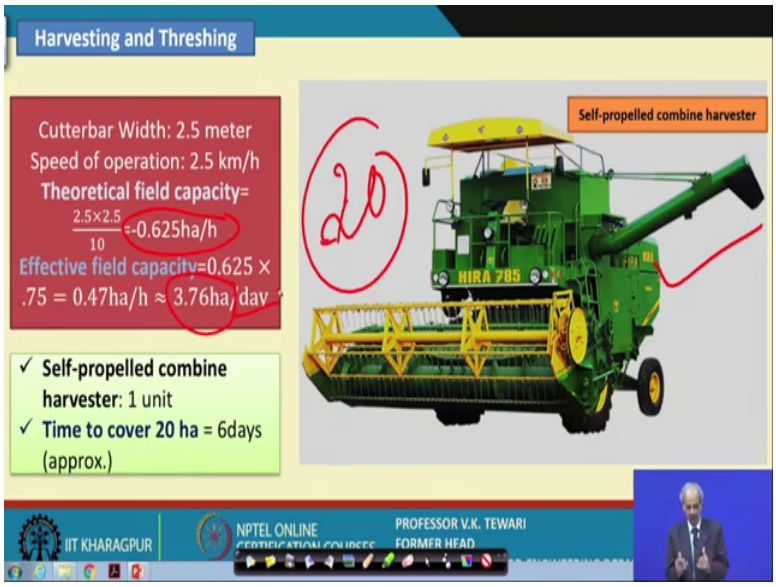

Now harvesting and threshing; this is another aspect of the production system when you are having the machines. Well when you talk of the harvesting and threshing there are various aspects various options available to the farmer. You must have seen tractor drawn rippers are available, then self propelled rippers are available, where human being is simply walk behind them, is doing you might have seen. I have already shown you in the lectures of harvesting when I when I talked about that lecture

So, I will not talk of those details; with what I will talk here is the combines which are being available in that on every part of the country has. And these combines are available or custom hiring basis if you think of having these equipment. See the capacity of these the capacity of this is about so, much hectare 1.6 to 5 hectare per hour. And roughly you can see here that about 3.676 hectare per day it can cover. If you are thinking about 25 percent of it is efficiency.

Now, if you see it has hardly 4 days four hectares per day it can cover. So, about 5 days we will it be in a position to this machine will be in a position to do your all 20 hectares which you have. And then this for if you want to have this machine the cost of this machine depending upon the size etcetera varies from lowest 15 lakhs to about 20 lakhs

22 lakhs and so on and so forth. So, this is here also we will request you to have a judgment and have a question mark with you whether you want only if you seen and finish operation of this 20 hectares in just 4 for 5 days.

And then rented if you want to own it or you can get it on rent and get your operation cleared and then finished. Now, question is that; if you have these machines for is a set of machines which will be required for your total operation, you must also think of earning from them when they are not in use for example, the tractor and all that. We would also like that we should have a trailer also sometimes you will require that this particular trailer should be required for transportation of the material.

Whether it is the green or you are talking of the whole crop a several things you would require this as well many a times. Sometimes you would also have small pumps etcetera it should be required for the hectare for this large hectare of land, which we are not talking of that. But then for irrigation you do require those things you may require drip irrigation if you thinking of or you may require the pumps etcetera which will be available. So, some equipment some money you have to keep for that as well we have just given only operation wise.

That means, from the trading operation to harvesting and threshing, but then inter culture operation etcetera we have covered. But you are not covered the irrigation part of it, but then for irrigation also we required the pumps and housing those pumps and the pipelines etcetera; you will have to consider for that And accordingly if we consider this total aspects of selection of the machines for sale 20 hectare model farm, then as an engineer what we get?

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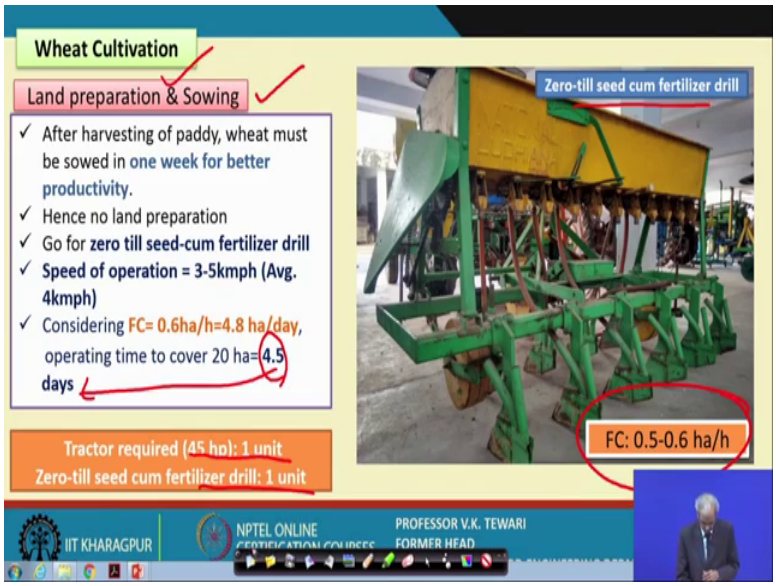

For wheat cultivation now; this is if for paddy now we have talked of the other crops. So, for wheat cultivation then what are the machines? You can see here that we have talked of these machines, but we lend preparation and sowing of course, there is nothing to worry. Because, we have already talks to about 4.5 days or about 5 days we are in a position to get this machines because it has a capacity like this. So, zero till seed we would like to take the take the moisture which is already available and then do this operation.

So, it is worth having this equipment and utilize the window which is available and the moisture of the soil. So, immediately after paddy is harvested you can think of wheat cultivation. And you this will be again as the power source and drill unit has to be purchase. Do one drill unit, which is zero till seed cum fertilizer drill, needs to be purchased for you.

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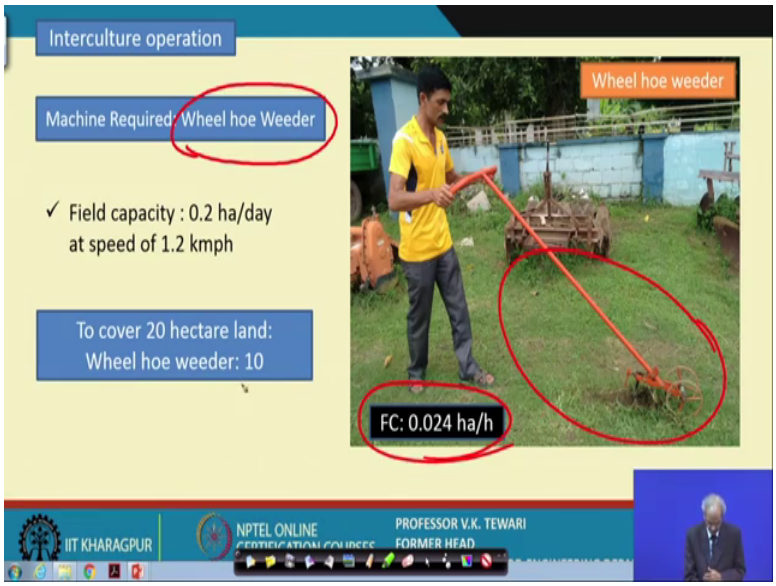

Inter culture operation, well inter culture operation we are talking here. Well there are equipment available, but then some are still in the development form particularly when you talking of tractor drawn unit or self propelled units. Some self a small self propelled units are available and tractor drawn units do required some considerations while were thinking of planting of the weed itself.

Which general the farmer will not agree and that is why what we want is. Then we have small machines which are there and I think there will not be a problem. You make question, that it is for it may not be you may not get labour for doing this. But then we can think of this small machines which has been shown over here I am which are the capacity like this it has been shown.

This can be used, but then you can always question that how you are now talking of a manually drawn such unit. Yes this is a tradeoff you have to have a tradeoff between what you want? And what you have? And how you can get the thing done? How much will be the timeline? What will be the cost involved? Because you has to also think of martial cost which you are getting So, similarly you can think of and having such units.

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And for either you could use the same the plant protection equipment or you can have unit like this which you will cover in about 60 are. So, everything harm on this then which combine. I think I will not discuss much here I can just say that; either you own it for renting later on, or you can have this machine for this operation.

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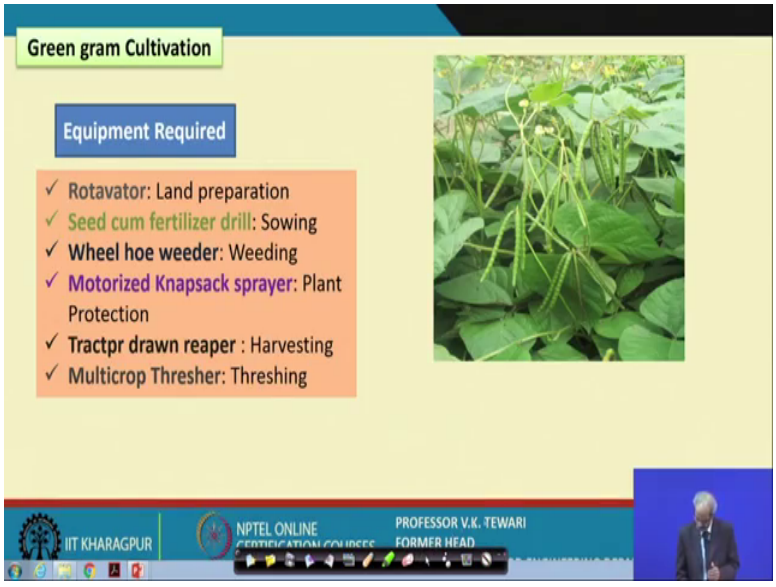

Then green gram the third crop which we are taking, well we have everything with this crop. What is we have talked of the intercultural for plant protection? And for field

preparation everything is required as in case weed for this also. Only thing is harvesting will be a problem and then threshing.

So, for harvesting and threshing well you can think of multi crop threshers which are available. You can also think of a tractor drawn ripper which is there yes, but then you are you think of the moisture content when you are trying to harvest this. Because there are losses which may take place, but then you think of and check what happens. So, with this I think we had tried to give you some idea about the crop rotation and equipment that you want to have.

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So, as such if you talking of the selection of the machines for 20 hectare, I think this is what we have given. Already I have discussed of this and the details are given in this table here. And for a, I said that you should trailer which will for transportation of the material maybe a you can think of a 10 ton trailer. And you can think of the irrigation equipment as well I think I have tried to give you some idea about this. And hope that if you have any questions, I would like to answer as and when required.

Thank you, very much.