**Farm Machinery**
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**Lecture - 50**
**Threshing Operation and Equipment**

Welcome students to my lecture number 50 which is Threshing Operation and Equipment. Well till previous lecture we have talked of the harvesting part of the portion when we are talking of crop production. And we also talked of high end technology used for harvesting of cotton. Now let us see: what is the mechanics behind threshing operations. The threshing could be for cereal crops for other root crops which have been taken and the crops which require the kernel to be removed from there in fact, all the crops do require like this.

So, see in this particular lecture we would like to understand: what is this threshing operation. And what are the different equipment available in the country and outside which are meant for this particular purpose.

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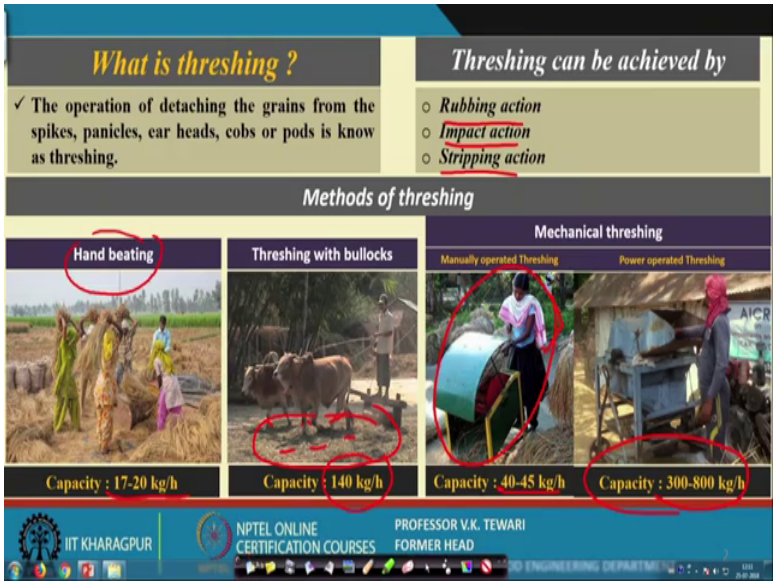


Well what is threshing as such what do you mean by threshing, you have seen that the plants which are there when they are harvested the ears are there and then the (Refer Time: 01:22) attached to the ear head. Now when what is to be done to remove them you can hand by use your hand and just strip them off, you can rub them and try to remove

from there various aspects. So, the threshing what are the ways by which threshing is achieved. You can see here by rubbing action by impact action and by stripping which you can do it we are trying to at detached that this is where.

Now, what are the methods? You may see that why we need to have the primitive methods which are here as compared to the methods which are modern. But it is worth you must know what 50-60 years back our forefathers used to do when they wanted to thresh a particular crop. So, you can see these the first is the hand beating or this in this the capacity is very low you can see definitely a low capacity people were there available. And there is using you can see that they on a particular hard location here they are beating by these small bundles and the capacity is 70 to 20 kg per hour this is a intensive operation definitely. Then what they thought that the animals, the animal have weight and if they move the end the animals move on the land you can see here on the land where they have spread the harvested crop.

So, once it they move on to this by their weight and movement through their legs this trading by trading on to that lot of material will be detached from there. It would do the same action of rubbing when they are moving on that so the whole crop will be created will be cleaned. Well let us not go into details of the efficiency of this job, but and these were the methods available during those time. Then slowly the threshold mechanical methods have been employed you can see the mechanical method. Now here you can see that in capacity of this one is 140 kg per hectare very high because, what they do is they spread a large amount and then in a bigger circle these people will be 2 or 4 will sometimes will be operating in this circular manner.

And then after 1 hour you find that lot of material is taken care of so that is why you if you compare this method this method. So, much come to a manually operated threshing machine. Now see this one here so here you can see the capacity is 40 to 45 kg per hour only, but then definitely the reduction is human being. So, only one person is employed and then he is in a position to get about 40 to 45 kg. Whereas, in this method you do not get 17 to more than 17 to 20 kg and not necessary that per person or so it requires so many people have to do this operation then you will get.

Now, then power operated when you use a power operated system where full completely power and only feeding is done the capacity has gone to about 300 to 800 kg per hour.

So, the system remaining the concept remaining same the technology has changed over the years. And now we have all types of threshes so let us see what are the different types of threshes which we have at present with us. And how to use them and for what crop they are used and why?

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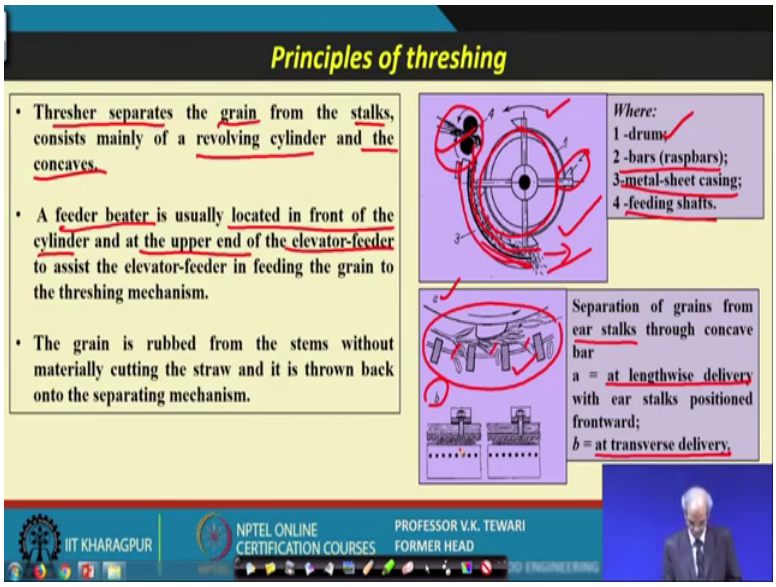


What is the principle of threshing, as such I said that these are the basics of what exactly when you want to detach, but they needs worth understanding the principles of threshing which takes place here. Well it is worth going through what short notes which I have given here; will help you to understand it later when you have this information in front of you. Separates the grain from the stalk the thresher, separates the grain from the stock here; mainly consists of a revolving cylinder and the concave. Well if you talk of this what exactly is this you see this figure here on the right hand side. There is a drum here, then there are bars here, then metal sheet casing and then feeding shaft.

Now, you see what are these; this is the location where the material is fed. Then this is the drum this is the whole drum which is here a direction is shown. And this is the aspect which we is talking of a metal sheet casing which is there and the material is coming through this; so what we do when this is rotating. Now these are the, this these are the rest parts which are there they are certainly protruding out of the cylinder. So, what they do when they it rotates at a speed definitely when material is entering from here this material will enter into this and get pressed and while it comes out it will get beaten up

during the process. And it comes out from here definitely it will have the grains removed from there.

So, the feeder beater is usually located in front of the cylinder and at the upper end of the elevator feed; this is what it is. Then here is the one which is coming out, how does it do? See this is the mechanism which has been shown here; that when the crop is moving through this, these small obstructions will allow to remove this kernels from this location here. So, separation of the grains from the ear stalk will take place here. Now at depending upon at lengthwise delivery and a transverse wise delivery; so this is when we are giving a lengthwise delivery and be when we are giving a transverse wise when in this fashion.

So, these are the two methods by which the threshold will take place. So, as such the basic principle is only to see allow this material between the two surfaces and which will have varying space and as the space changes and the speed of the drum which has parts will go and hit at different amplitudes and different frequency then it will get detached so this is the basic principle.

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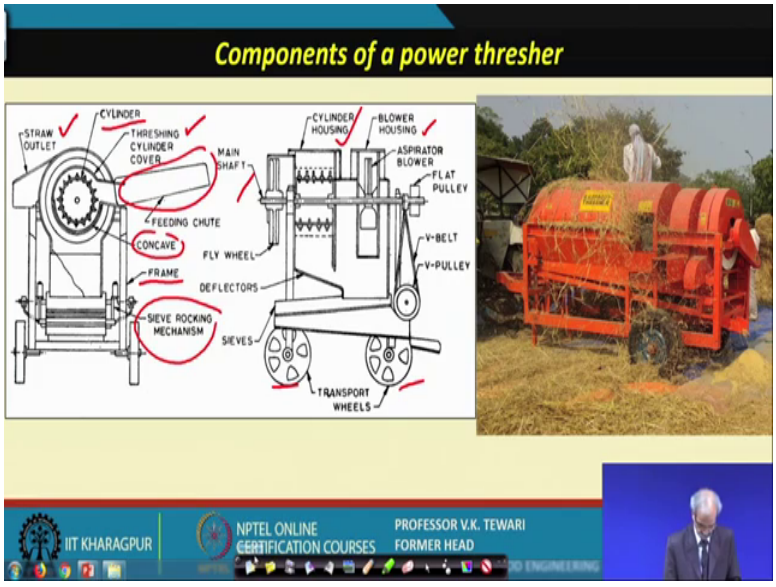


Components of a power thresher; now certainly we have come to we do not want to go into other details of manual another's. What we have want to show you: what are the various components of a thresher? Then you have seen that the basic component if you talk is that the threshing drum is there then you have the for putting it inside or the input

location, where you can feed the crop. And then there is a concave which will be which will be utilizing it is length and width such that the whole crop when it goes through that it will be pressed and then threshing will take place. Now what are the components, it is worth we are going to some of the details which will help you we have shown the diagram here.

Now, in the threshing you can see the cylinder which is center if this is the cylinder which is shown in this center is the cylinder which as shown in the center here. Then the threshing cylinder cover, there is a cover for this which has been shown here, then the outlet straw outlet is this side, and this is the feeding chute this is a feeding chute here. So, the feeding is taking place with this, this is the concave here the concave, and then the sieve rocking mechanism; which will try to sieve this material clear it. So, that the grains and the shaft small shafts will be separated and this is the frame of the whole thing as such this is another view of the similar thing here, the main shaft is shown over here, the cylinder housing is shown over here, blower housing is shown over here, and the transport wheels are there. Which are the transport wheels which are shown in the diagram here so a component of a power thresher.

Now, mostly because of the availability of large machines and availability of non availability of the human being now we have all shifted to the power thresher and these are the equipment which are very largely being used in all parts of the country. So, it is worth showing you here the various components which you will know the principle we have talked off.

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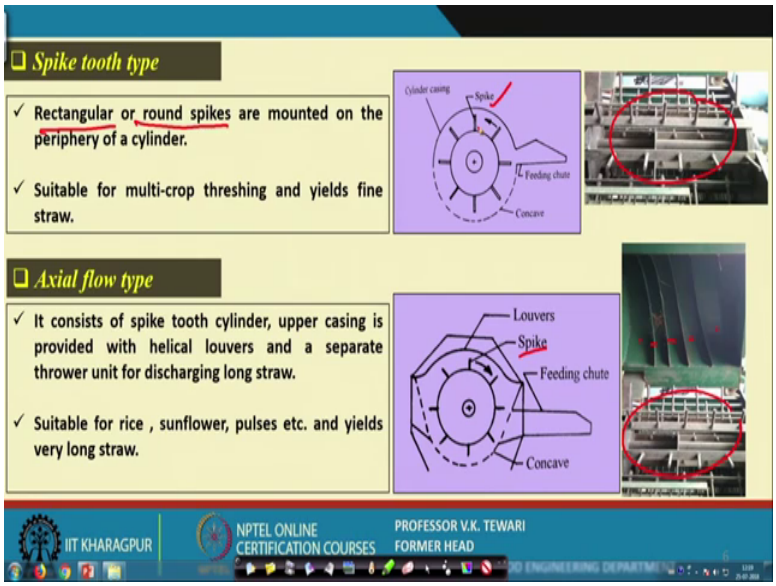


Threshing cylinder, now it depending upon the threshing element and depending upon the crop; we need to have some changes in the threshing cylinder or the threshing element which is connected because some of the crop will require more force for detachment some of the crops will require lesser force for detachment. So, for that we need to have different types of so we have given you here some of the different types which are being used in several equipment so it is worth noting here. I will just go through them and have a look at this see the hammer mill type where you can see that on the right hand side drummy hammer mill type where they are beaters the now when it rotates it will beat and hammer it.

Similarly, this the syndicator type where cylinder a cylinder consists of a flywheel. Now you can see this is the flywheel with corrugations which are there and then the you can see virtually like a you can say that chopping knife as you have you might have seen in case of our chaff cutters. So, if you have seen in chaff cutters similar situation is here and through a concave so this is a syndicator type of design which is there. Now let us see what are the other type of designs which are there before you come into details of this. Spike tooth type; well the you can see here the spikes you can see here the spikes are given here then the louvers are here the spikes are here Now, this rectangular or round spikes now depends upon what is the type of this spikes which are used. You can see the diagram has been shown here the actual has been shown here photograph of this to understand better.

Similarity the louvers which are shown here these are the louvers which are shown here and also it is a similar type of this. So, the axial flow type of thresher this is an axial flow feeding chute is here it actually material feed through. And then this is the type now when the material is fed through this the beaters actually these spikes bit against the material or the compressed material and then detached. And the whole crop is fed axially. So, depending upon what is the mechanism of the system which you have of the cylinder as well as the type of the you can see the detaching element or threshing element which we call to very precise. We need to pick up and we need to design in that whole design of the thresher.

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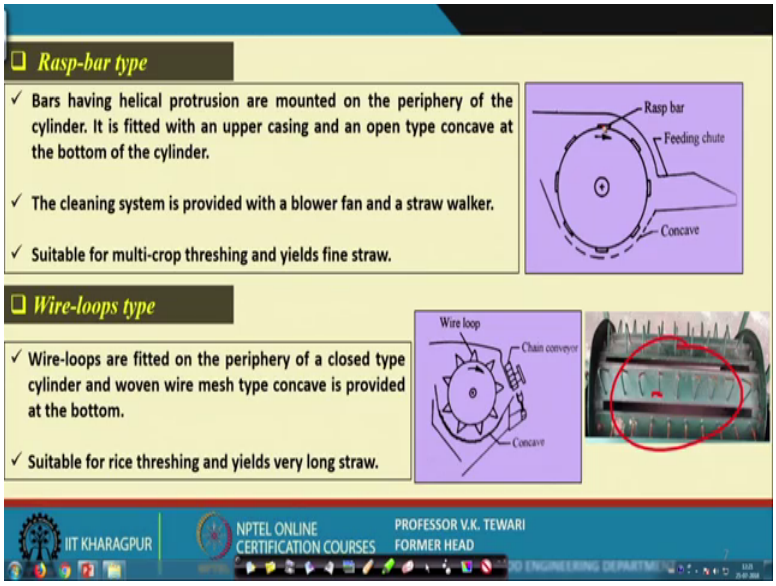


Rasp-bar type well the rasp-bar type you can see here that the rasp-bar type there are bars which are there on the cylinder there will be bars wooden bars which are there and they are known as rasp-bar or the cleaning system is provided with a blower fan and a straw walker. The other things remaining same in fact, here all these are different types of the cylinder which are used the wire loop type sometimes the wire loop; as you can see that there are wire loops in this and rasp-bar is here.

So, these are the different types which are being employed you can see that this is the diagram which has been given this is the wire loop type here and this is a rasp-bar type. So, the rasp-bar generally bars wooden bars which are there on that and these two these are the different types of cylinders which are used for threshing for different types of

crops. When you call some thresher may be single crop thresher, but some are multi-cropthreshers. And now in fact, multi-cropthreshers are being utilized more because and design has been also made so that it can take care of all types of the crops; well we will talk of the that slightly later.

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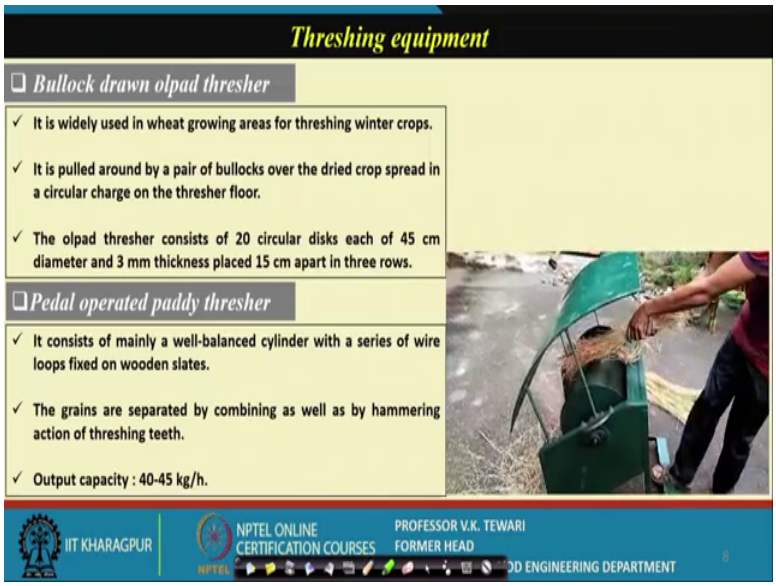


Threshing equipment well as I said here we have talked of the threshing equipment we have talked the threshing equipment nothing, but how the thresher. Now how do you operate this? What are the say for paddy? you can see here that a paddy thresher is shown in this diagram and we will show you how it works. So, so you can see how this is working the person is holding the bundle small bundle of these and just changing it. And there is a cover you can see there is a cover on top to so that nothing will be thrown off there and every material will fall on the in front and you can see this is a pedal operator.

That means, a person will be operating I have, but the output is also very good 40 to about 45 kg is the output. And this is one which is very widely used because you do not require any power; except the human being human power. And these in fact, these are the ones which were largely used in all parts of the country in India if I can say that and then slowly the when the capacity became more and the output is more and we want to thresh more in less time then the power threshers came into picture and already been used now.

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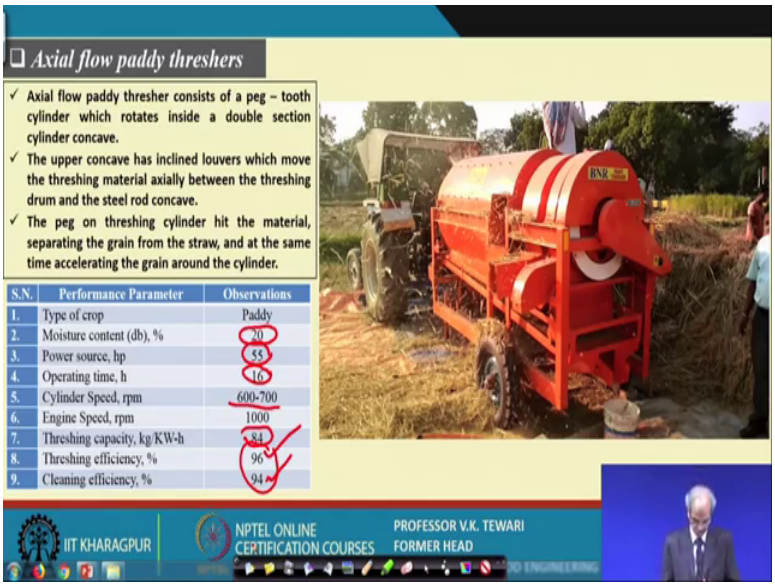


The axial flow paddy threshers now some of the paddy threshers which are there and which are axial flow. So, this sort of axial flow paddy threshers consists of now you can see here paddy thresher consists of a peg tooth cylinder which rotates inside a double section cylinder concave. The axial flow this is important the upper concave has incline louvers the upper will incline louvers which move the threshing material axially between threshing drum and the steel rod concave which is there. So, this is the aspect of what happens inside the axial flow paddy threshold. Actually here we want that because you must have seen that the whole crop of paddy the we after the crop and the grains are removed this the straw portion is used for many operations for (Refer Time: 16:49) people like use it for their houses and all that they are made.

So, may in several parts of the country especially in the eastern region they are being used for this that is why they would like to have this. And in this axial flow thresher the material is through I mean given axially and then it comes out with the actually you can see that the straw is separate and this is separate. Now let us have a look at this how it operates then we have certain performance of this I will talk of that slightly later, but then let us have a look at this. Now let us let us see how it is being used actually. You can see that the whole crop is being moved and see the grains are coming here the chaff is coming on to the other side. So, this will help you to understand the whole concept of this particular device or the equipment; which is now largely being used by the farmers

in the field itself. What they do is that they will harvest the crop and keep it there and from there they will be in a position to take it from there.

So, some of these work which we got we have done at near IIT Kharagpur in farmers field condition and the performance of this we have kept here for you to know for example, see the moisture content at which it was serviced about 20 percent, power source was 55 horsepower tractor. Then operating time about 16 hours and cylinder speed is varying between 600 to 700 revolutions per minute, this is the rpm of that the threshing capacity is about 84 kg per kilowatt hour so this is the capacity of that. Threshing efficiency what is the efficiency of threshing it is 96 percent and cleaning efficiency is 94 percent. So, you can see that this particular equipment which is there get's us a fairly good idea about the work which it does and it is very popular in fact.

So, the and the concept I have as I have show told here that the concept is very simple and these are the ones which are helping us in getting threshing efficiency of this order and a cleaning efficiency of this order. It is important to tell you that these equipment are available we are we have told you the mechanics; now we are telling you the equipment which are available which is essential and how they work. So, you must have a look at this that is why the actual demonstration and actual field work which they are doing is shown here.

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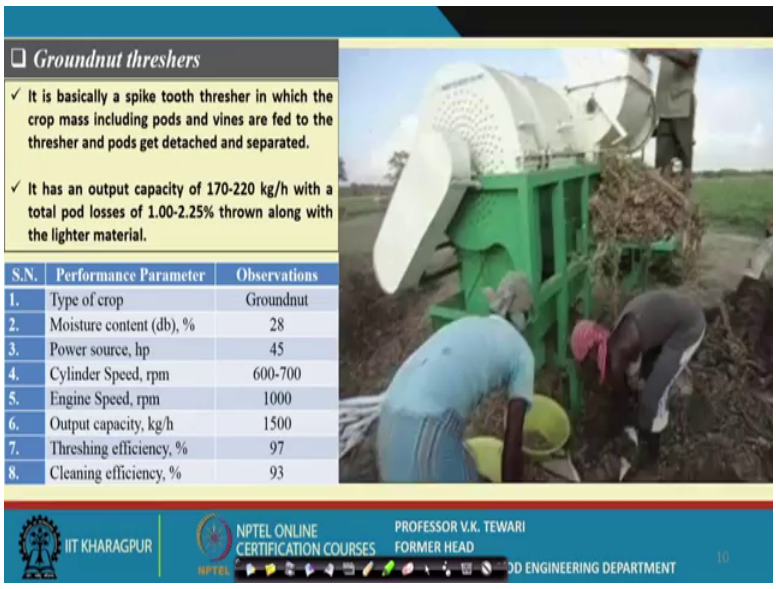

Groundnut thresher actually these we have talked of the cereal thresher now groundnut you know that it is a your crop and then it has to be no sorry this is this when the groundnut is coming into this in the bunches and when they are to be threshed when they are to be removed how to how to take them and how to thresh them. Well you see here the it basically is a spike to thresher, now the one which is used for this is also the same type of thresher and the capacity of this is about 170 to 120 kg per hectare with a top pod loss is about 1 to 2.5 percent. And see this performance of one of these is given over here maybe that we will see how it operates one of the such threshers.

Just you see that whole pod or with the whole crop is given over here and you can see the whole operation of this. It is a basically a spike to thresher in which the crop must include pods and vines are fed to the thresher and pods get detached and separated. So, pods get detached we are not talking of the kernel which comes out of the pods, but pods are separated it is hard later on it get separated and capacity is also very high 170 to 220 kg per hour per hour.

You can have a look at it as well as the loss is a very minimal the maximum is going out to about 2 to 2.5 percent. And see the operation the output is so high these are being used extensively in the area where groundnut is grown and this is one which is used in a farmer's field condition at near IIT Kharagpur. We thought to show you this which is which in which helps and understands you will be able to understand the working of this in the field. The whole concept this you can see the whole thing is given that it is in a field where we have taken and how the whole crop is being threshed.

It is a operation now say for example, this moisture content is about 28 percent moisture content power source is about 45 horsepower is the power source which is connected to this. Then the cylinder speed is about 600-700 similar the engine operated the engine speed is 1000 rpm. And output capacity is about 5,000 kg per hour threshing efficiency is 97 percent and cleaning efficiency is 93 percent. So, you can see that these crops which are which worth growing and because you get more revenue from there such equipment are available. We have groundnut I have just talked of groundnut sowing machine also and this is a groundnut thresher.

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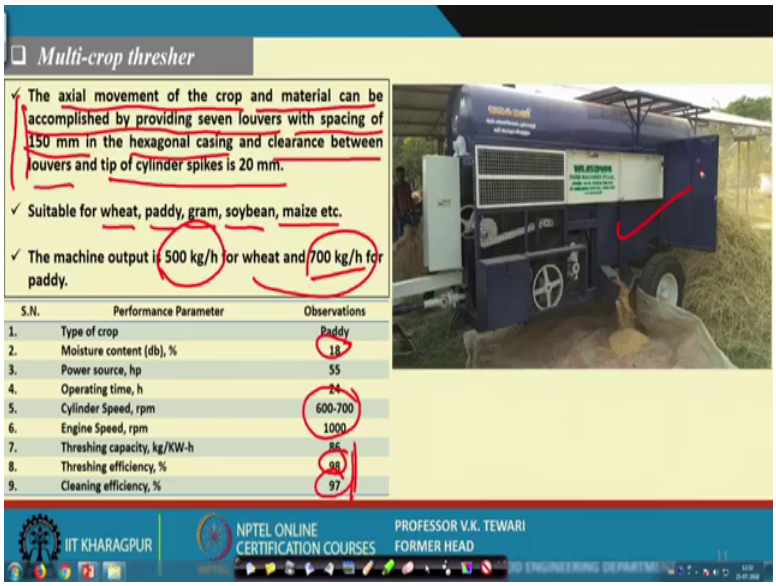


Multi-crop thresher well I said while we were discussing I said that there are threshers which have now been being made with certain changes; in the threshing element you can have you can use for different crops. For example, this can be used for crops like suitable for wheat, paddy, gram, soybean, maize, etcetera. You can use it thresher multi-crop thresher these are the crops which are used the axial movement here. The axial movement of the crop and the material can be accomplished by providing seven louvers with a spacing of 150 mm. In hexagonal casing and clearance between louvers and the tip cylinder is 20 mm this is the basics of this. So, this is the way in which the actual threshing takes place and good for this.

Now a machine output is about 500 kg per hour very high and for wheat it is about 700 kg per hour. So, for wheat it is 500 kg and for paddy it is 700 kg per hour. Now for other crops well the capacity is not given, but then I can say that if you use if it is used you will get a reasonable amount of quality of the material the design which is here is such that it will take care of these crops. That means; paddy, wheat, grams, soybean, maize, all these crops can be threshed with this thresher mutli crop thresher which is there. It's operation the performance is also given here it, worth having a look at this for example, the cleaning efficiency is 97 percent. We had got so far the cleaning efficiency about 93, 94 percent in the other crops.

But it is a multi-crop thresher and we are getting about 97 percent cleaning efficiency threshing efficiency about 98 percent. So, its virtual doing the job and moisture content is about 18 percent. We had got 20 percent in the earlier case, but then we see that everything of the engine etcetera remaining same the efficiency of such a machine is very good. So, these machines and this equipment are already available and we are in a position to use this.

And you will have this equipment at your disposal what as an agriculture engineer you required to know is: what is the basic principles? And what are the crops which should be used? How much is the capacity of this? And what sort of benefit you can get out of this? This is what is important; if you want to design a new type of thresher which will take care of all exigencies and which will accommodate many other crops. Then this knowledge will help you, this is what I want to specify.

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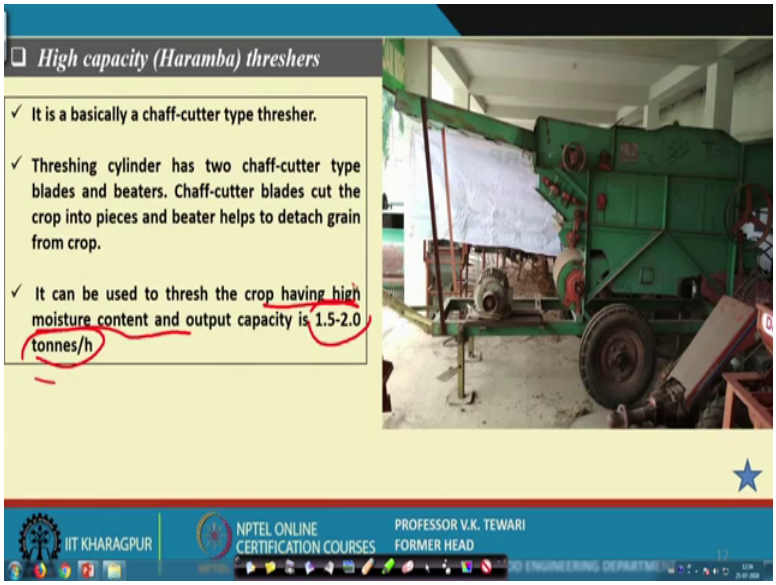


There is a another thresher where chaff cutter type of threshing elements are used which is known as the Haramba thresher which is there for long time and the output capacity is 1.2 1.5 to 2 tons per hour. So, this is very high capacity one you can see that this very high capacity one and having high moisture. In fact, the crop having high moisture can be used with this. Now what happens is initially as it is said here that the there are two chaff cutter type blades and beaters. So, blades this blades cut this and then there small beaters will try to thresh them off. So, even if the moisture is very high this is a beauty of

this particular thresher that even a moisture is quite high as compared to you have 20 to 22 percent moisture in the other case.

But here if it is even more than that sometimes it may have situations so there at this particular thresher will help us. And then the capacity is also very high the total capacity 1.5 to 2 tons; which is much higher than what we have seen. And the advantage is that they even if moisture content this is beauty that crop having moisture content having higher moisture content can be used. I think there we do not have the video of this, but I think if you see the working of this and in YouTube maybe you will get a working of this particular equipment.

So, I think with these concepts about threshing and the different types of threshers which are available and for the different crops. And what are the different threshing elements at what speeds they are used and what sort of performance they have; I think I have discussed in nutshell about the threshers. Now maybe that we will talk about the design part of it the later lectures. So, I know that you while you go through this lecture you might have some questions; which I would like to answer as and when they come. And I would like to close it here.

Thank you.