**Farm Machinery**
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**Lecture – 26**
**Testing of Tractor Operated Seeding Equipment**

Well, students we had discussed so far about the seeding equipment, we discussed the design of the seeding equipment, then we have taken a 40 horsepower tractor and matching seed cum fertilizer drill that also we have design. Now, we would like to tell you supposing you are asked to test, this is very important you know that all there are several testing agencies all over the world. We have the bureau of Indian standards which does for testing of all the equipment in country, then the outside the European standards are followed, but then this is a important for certification; because then they the manufacturers should be in a position to sell equipment to the to the consumers.

And, because he has to maintain certain parameters certain strength parameters certain sizes etcetera of the equipment, it is very essential that they should they should be certified and tested. So, in this particular lecture I would like to tell you how to test a seeding equipment we have discussed all details.

Now, we will talk how to test a seeding equipment see what are the things to be tested. For example, when you test a person what do you do? When you test a student what do we do? We try to administer a test on you, a question paper and then, you write and then we would like to know how intelligent you are, how do you take up a certain answer to a certain question and things like that. Similarly, when we test an engine we would like to know what is the output of the engine or how much the fuel consumption it takes play takes and how much is the loading that it can withstand and things like that.

Similarly, for this seeding equipment we know that this seeding equipment is to be in used for seeding a particular crop or a different types of crop multiple crops. So, we would like to know how is this doing its job, what are the different components whether they are a strong enough or not, whether they are up to the mark as per the standards given, where the material of construction the thickness of the material or the size etcetera to a particular tractor or not. And then we would like to give a report because these a agencies would like that you test and give a report.

So, as an engineer you should know this and that is why we have taken this from the bureau of Indian standards for seeding equipment. Now, the details of this you will find if you go to the website of for the BIS you will definitely get all the details. So, we have not tampered with the language which they have written, but then I want to present it to you in a slightly different way, but same thing such that you are conversant with the system and then you should be in a position to do this task whenever you are asked as an engineer.

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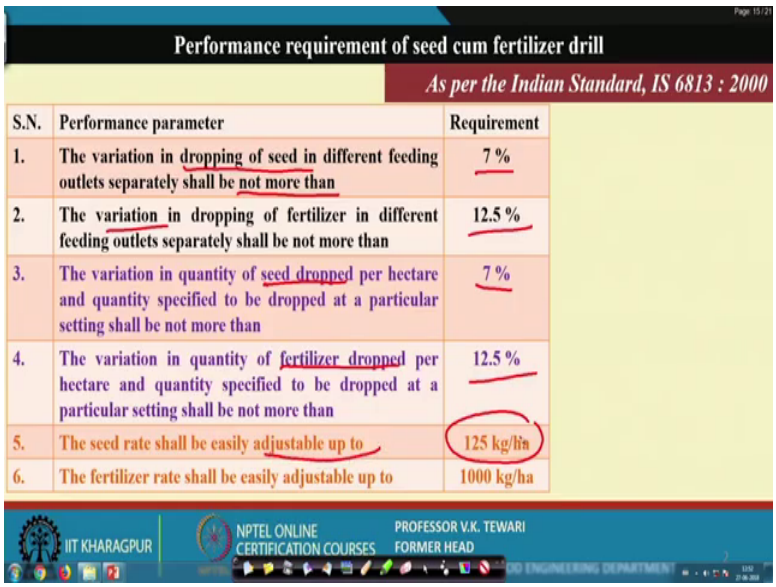


See, performance requirement of seed cum fertilizer drill. As per the Indian standards, we call bureau of Indian standards it is and so, here the variation, the parameters, what are the different parameters? You see here the parameters which are important are with respect to the seeding that how much dropping of seeds should take place, not more than it say not more than 7 percent. We want the dropping of seeds in different feeding outlet us separately shall be not more than 7 percent. The variation should not be there.

Similarly, for fertilizer the variation should not be more than 12.5 percent. Then the variation the quantity of seed dropped per hectare should not be more than 7 percent. Similarly, vary fertilizer dropped per hectare should not be more than 12.5 percent. These are the standard which are already given and we need to follow these. This similarly the seed rate 125 kg. You can go up to seed rate shall be easily adjustable up to 125 kg; that means, you must have adjustment in such a way that may be from 80 or 90 kg per

hectare it can go up to 120– 125 kg per hectare. This adjustability must be there and similarly for a fertilizer it should go up to 1000 kg per hectare. These are the adjustment which should there, you need to check these whether they are there in that unit which is given to you for testing or not.

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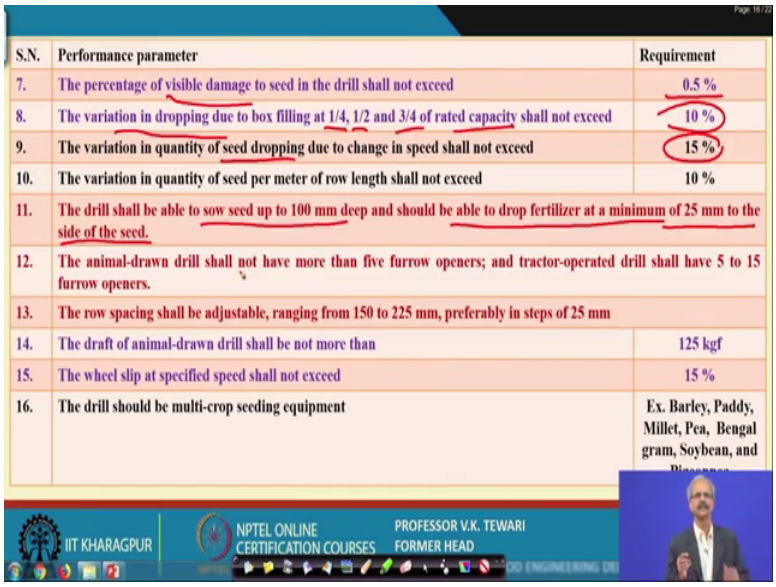


Similarly, for other parameters or performance parameters: like performance of visible damage to the seed should not be more than 0.5. A percent visible damage visible damage should not be 0.5 percent Dropping variation dropping out of the box at one fourth half and three fourth rated capacity shall not be more than 10 percent. The variation in the quantity of seed dropping due to the change in the speed shall not be more than 15 percent and similarly for variation quantity of seed per meter, then the then sown seed per 100 meter depth.

Now, minimum 25 millimeter side of the seed these are differences which we need to put say for the dropping of the fertilizer. Similarly, for animal drawn seed; now, we will not talk of animal drawn here, but then since the bureau tells we have given you this value also you can understand at one location and take care of the differences if you are asked to do for a animal drawn, if you are asked to do for a tractor drawn it you can take care of this.

And, there is also the drill should be multi crop. They insist if it is a multi crop seed drill it is good. For whom it is good? For the consumer or the farmer, then he need not have to

go for different types and the examples are particularly those the barley, paddy, millet, peas, Bengal gram, soya bean and pigeon pea. Now, these are the ones which can be with little bit of adjustment, for example, when you talk of this multi crop may be that if you are talking of fluted roll it can take care of if you are talking of a plate then the plate size could be just change and then the whole thing can be used. So, you have to have these parameters, you must look into these parameters when you are talking of the testing.

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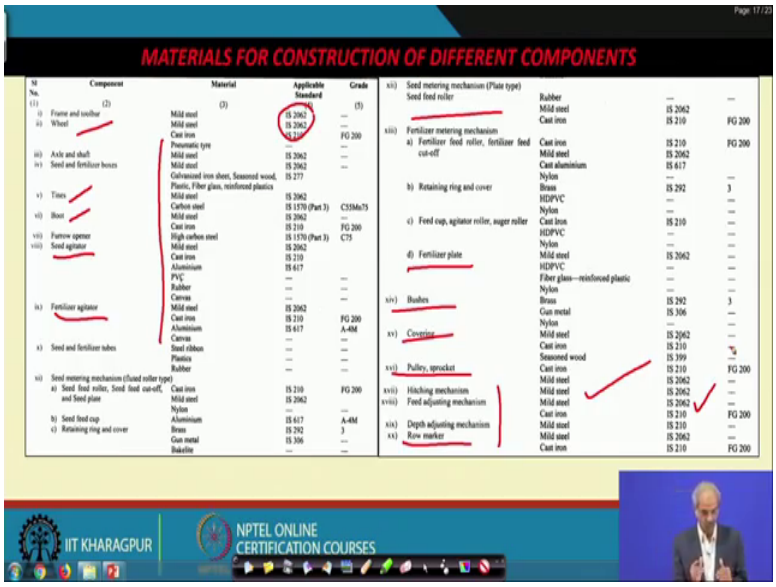


Material for construction of different components, this is very important. See, you must know we have discussed all this in detail and here the bureau wants that these materials they must confirm to these materials of construction. The unit which is given to you for testing must confirm to this. For example, the frame a frame and toolbar mild steel then what are the details are given over here similarly the tines, the boot, then the furrow openers, seed agitator, similarly fertilizer agitator. These are important that what material they are made of see this has been all explained over here.

And, you must confirm whether they are there or not and if they are of different you must note down, you will have to create a report in the end which I will talk slightly later. Then, therefore, is these are important things to be looked into whether the manufacturer has an incorporated these or not. So, for each of these seed metering mechanism here the fertilizer plate, the bushes, the coverings, the pulley and sprocket for the transmission

mechanism, the depth adjustment, row marker etcetera all these materials have been given and their specifications have been given.

So, you must see that the seeding equipment which is given to you confirms to these material of construction, then only you should it; otherwise if there is anything different you must check. Sometimes you will have to also test these materials whether the material which is says is really a material or not, you will have to go to a real testing agency to find out whether the tines are having that much of carbon in this one or not or what is the constraints of that sometimes you have to do that as well.

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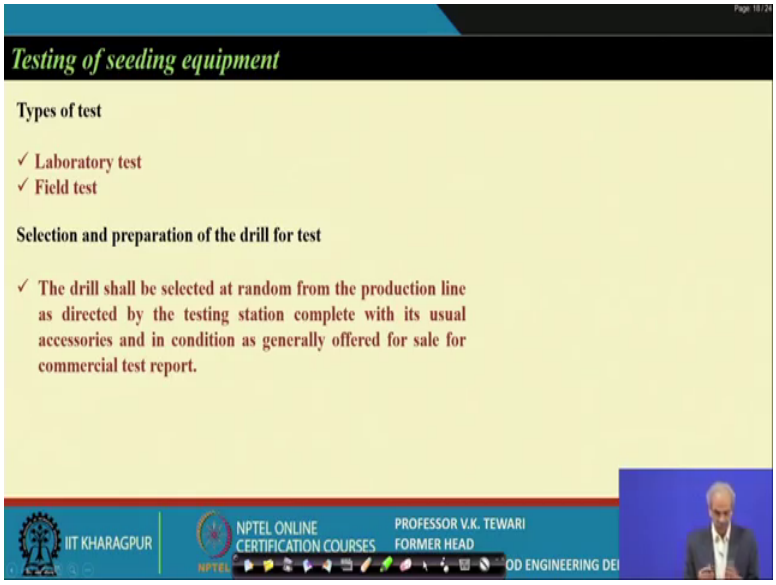


Testing of seeding equipment; now, what are the types of seeding that we do here equipment testing which we do? We do laboratory test and field test, yes, because in the laboratory we would like to do certain test and see what happens in the field we would like to conduct test and see what happens. Because, then we have once we confirm as a designer or as a tester test certification a certification giving agency if you want then you will have to talk about this because, you are on the basis of your certification the government may give some subsidy or the government may allow the person to manufacture this in large number and it is very important you must pick up how do you pick up this.

So, this very important part of it, because, see the selection preparation of the drill for test. How do you do it? In fact, this is very essential because what may happen is that the

manufacturer may give you the unit and say that sir, please take this unit. You have tested this unit from all corners and following all the procedures, but then you find that the one which is showed to you is really made of all the materials of construction and confirms to all the requirements, but the ones subsequently which is making and producing in large number are different and then therefore, there will be unnecessary blame on the manufacturer or the certificating agency.

And, therefore, it is important that selections should be random from the production line, it should be random. Generally what is to be done is when the when you go you must pick up from the line randomly and then tag it and put your seal on that and then that should be transported to you should check the seal before it you open it for testing etcetera. So, this has to be done, this is very important when you are talking of a commercial report which you want to give.

Sometimes you also give a confidential report where which will be only given to the manufacturer to let him know that these are things which you must change. So, for a commercial test this is what you need to do first.

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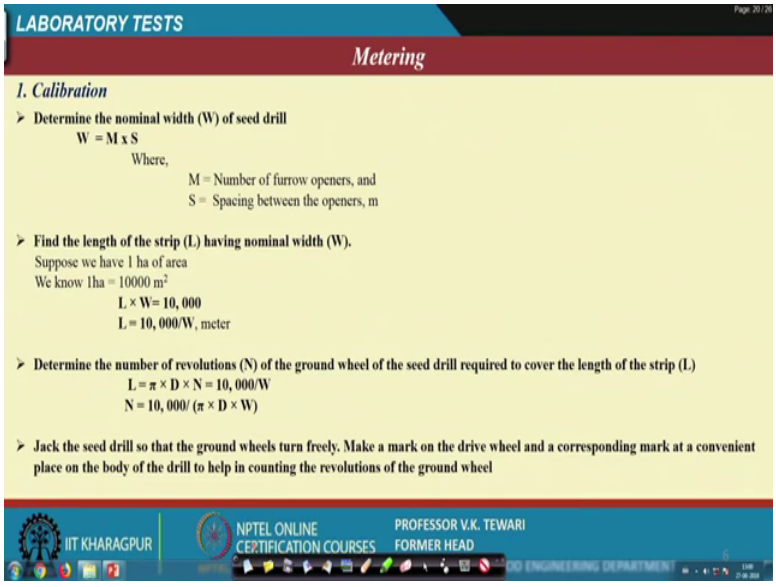


These are the calibrations. Well, we have discussed these calibrations, we want that in the laboratory how do you calibrate, it has been discussed to you long back, that you would like to see that certain number of rotations of the wheel ground we will see how much falls. And, accordingly you should be able to work out that per hectare, what is the

amount and all that you should be in a position to find out the total number and total amount.

And, these are the procedure has already been explained to you in the earlier my lectures, that is why I may not go into details of this, but then definitely I will tell you that you should follow these and in order that these tests are confirmed in the laboratory condition not that well, we have just put, but there should be standard way of following and standard way of data collection. Because then, you will have to report this data until and unless you report the data, nobody will believe you and no certify agency will believe you or nobody will take your report until unless you have these details.

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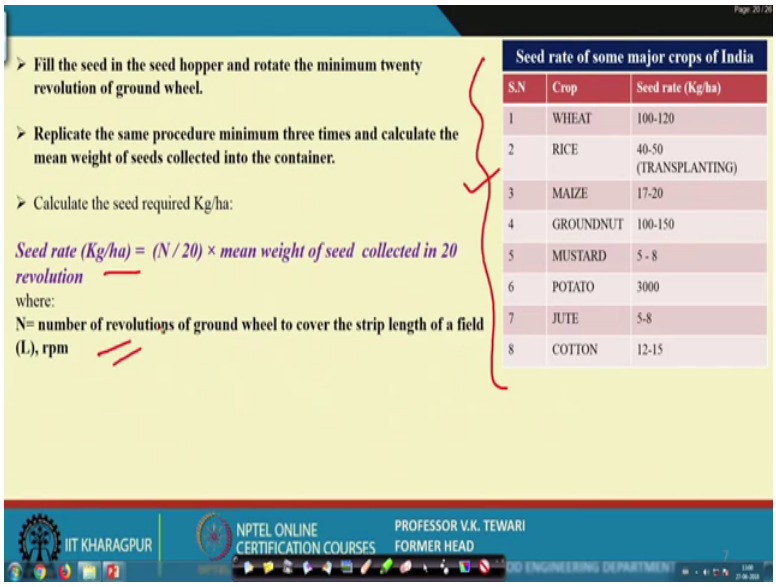


So, seeding rate, you should be in a position to get the seeding rate. Some major crops the seeding rates are given here because then, these are the ones which generally followed. So, you should be in a position to take care of the seed rate which you get here and the seed rate a standard seed rate which are said whether you get this or not you should confirm to the this requirement.

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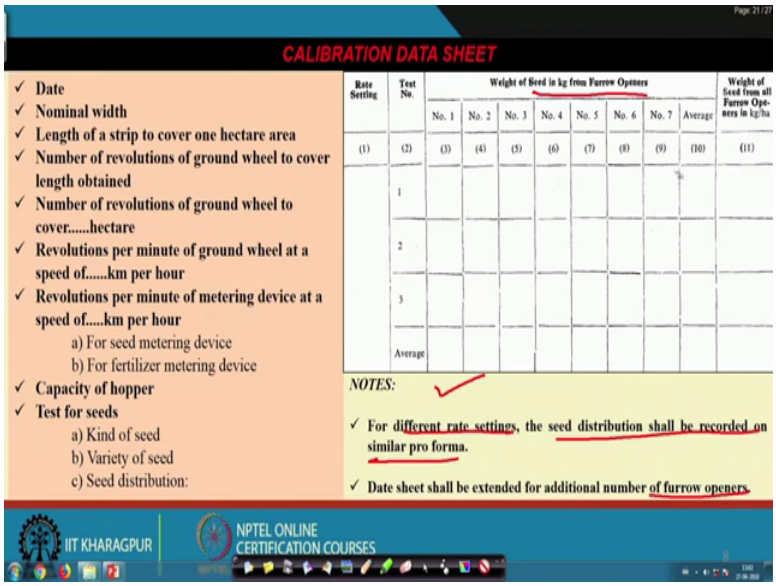


Calibration data sheet; Yes, this is what I was telling that you need to see weight of see weight of seed in kg for furrow per furrow openers number 1 2 3 4 5 6 7. These are the number of times you should conduct this test and then you should take the average. And, they according they said you should find out the seed from all the furrow openers from here like, these the test number and these are the actually number 1 number 2 like all these details are here from where you can get the values and those values should be recorded here whether you have done it 5 times 6 times or not, test number 1 here, then 1 2 3 this is the average.

And, the details are given here; the capacity of hop, test of seed, kind of seed, variety of seed details. These are details which are as per the standards, mind you and this sheet you will require because whatever you have done you must enter into this sheet and then only you will be able to put the record while you are writing report different seeding rates, then seed distribution shall be recorded on similar pro forma. A similar pro forma will be there for seed distribution, what is the distribution of the seeds. Data sheets shall be extended or additional number of furrow openers. For additional number if you have more furrow openers then maybe for each one of them this data sheet should be extended. This is only a format which is given to you. So, you should be careful about this. But, then you need to record your data for the calibration.

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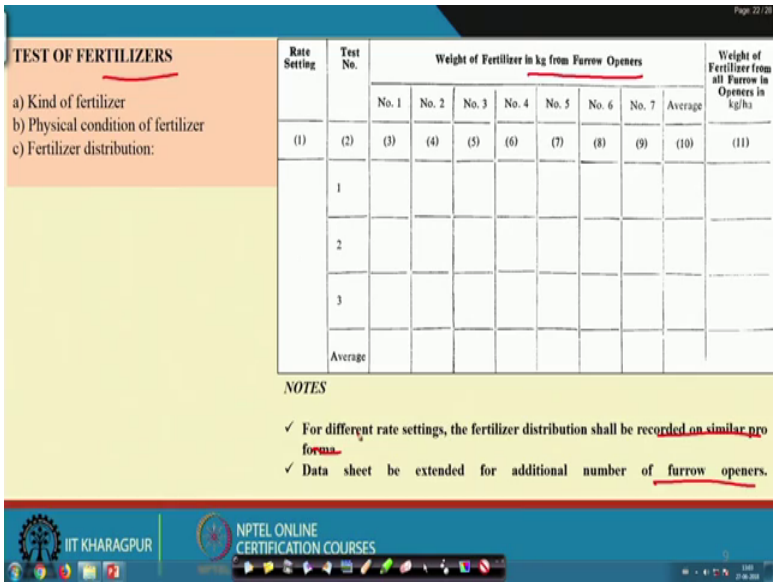


Testing the fertilizers; similarly, for the fertilizers you should also do for a fertilizer also you should do weight of the fertilizer in kg from furrow openers. Different furrow openers are there, then you can get what is the average value this is the test number how many test you want to do. If the furrow openers are more, you can do the same thing which I had discussed earlier and similar pro forma should be followed.

So, that the data is available here and one can see that for all the test which you have done under laboratory condition or in the field condition what where are those data put, this is what we are talking with respect to laboratory conditions. So, far physical condition of the fertilizer and fertilizer distribution how the distribution takes place, everything this has to be there for these three items.

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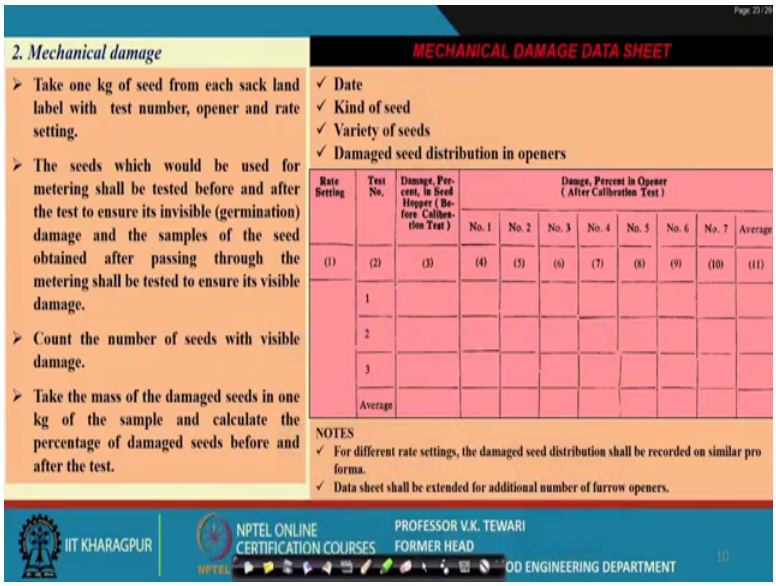


Well, mechanical damage, this is very important because many a times you should also see that the type of metering mechanism which they have given with that the metering mechanism is damaging the seed or not. Because, you may find that he has designed a mechanism in such a way that whenever the seed is metered you there is a physical damage to that. And, it could be a damage which is yield critical, it could be a superficial damage, but we need to know that. How will you know? We have to take this a the seed initially and then grow in into the laboratory and see what is the percentage germination and then once you have metered it several number of times and then see what is there and try to germinate them again and find out the difference.

So, if the germination takes place similarly then you should know that even if there is damage or there is some superficial damage that is not going to yield a critical damage and that is why you can take that, but then it is very essential. And, for that you need to again record again record the data into data sheet here because this will give you proof that you have gone for the mechanical damage test also. You have gone following the various procedures this is the procedure which has been for which is actually properly written into the code and we have taken from the code.

So, there is no tampering of the information here I am only trying to put them together and let you know that how do you do and you are encountered for such a task.

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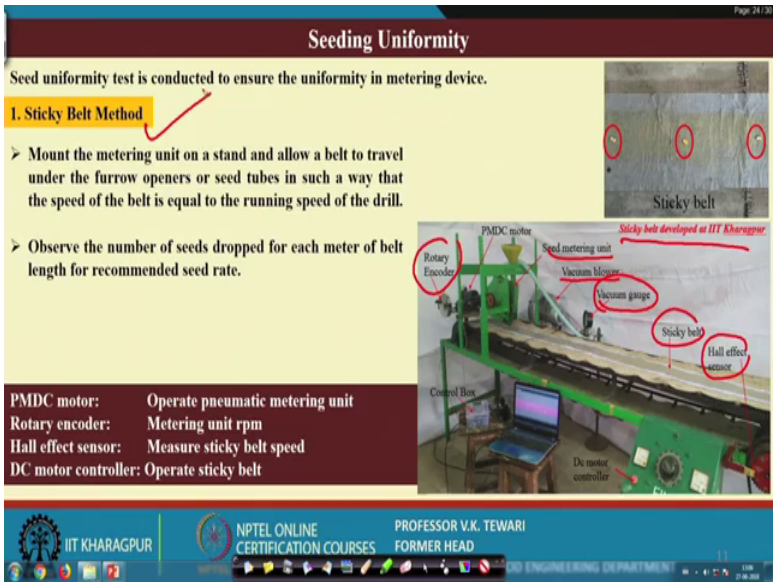


Now, the seeding uniformity is very important because how uniformity the seeds are falling or the fertilizer. Now, the methods which are followed are sticky belt method. The method which is done at IIT, Kharagpur we has a sticky belt method which is developed IIT, Kharagpur. They there is a sticky belt here, you can see that this is a sticky belt here and there is a hall effect sensor in order to find out the speed in vacuum gauge is there, vacuum blower is here, seeding metering unit and then rotor and then a rotary encoder etcetera. Because, these are essential for you to see that how do you find what is the seed which has fallen what is the spacing of the seed how much is the dispersion and the uniformity etcetera.

So, you will be in a position to use this. This is the setup which has been developed at IIT, Kharagpur for sticky belt method. There could be another methods by which you can test these, will go to the other method.

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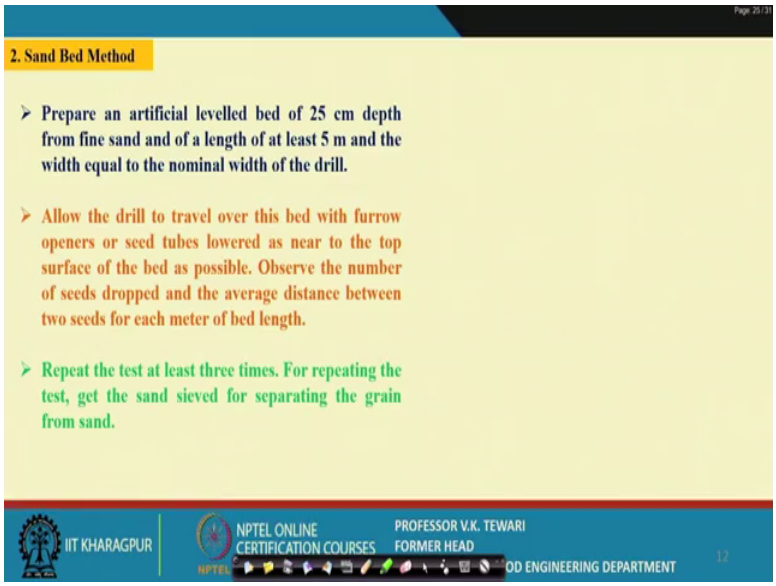


Sand bed method with, this is another many a times with sticky belt only on the surface of that the seed is fallen., But, sand bed we would like to put the whole seed drill, but this generally this is one row. The sticky belt may be generally one row because we are doing in the laboratory, but then sand bed method one is that you can have a large sand bed and where you can operate the whole unit and then measure what is the number of seeds which are fallen, where they have fallen, what is the spacing, what is sometimes the depth etcetera we can see about the whole thing and then find out. So, the test must be done at least three times.

Now, remember that whatever data you take, these must have some must be subjected to statistical testing. Some statistics must be there, you cannot say that one only one data you have taken and say that this is fine. No, you should say take sufficient number of test and replications to confirm your data and confirm your inferences what you want to give.

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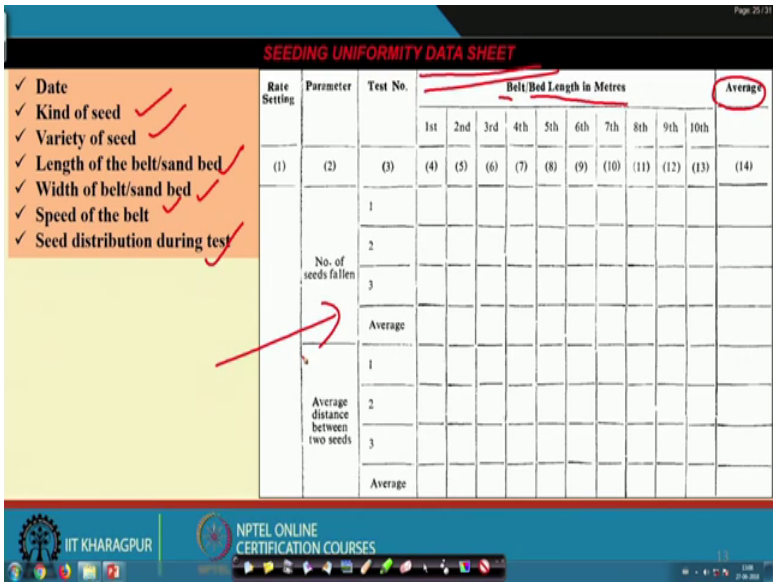


So, for the seeding unit uniformity here, there is a procedure. Now, there is you can see this seeding uniformity data sheet. This data sheet is very important. You will find the belt or bed length meters, these are the details here. This is the average value you get and what you get date kind of seed variety of seed length of the belt or the sand bed width of belt or sand bed speed of belt seed distribution during some of the test.

Now, these are important and with respect to this is the total data sheet. So, you must follow this data sheet when while you do this under laboratory condition this will help you in creating the report.

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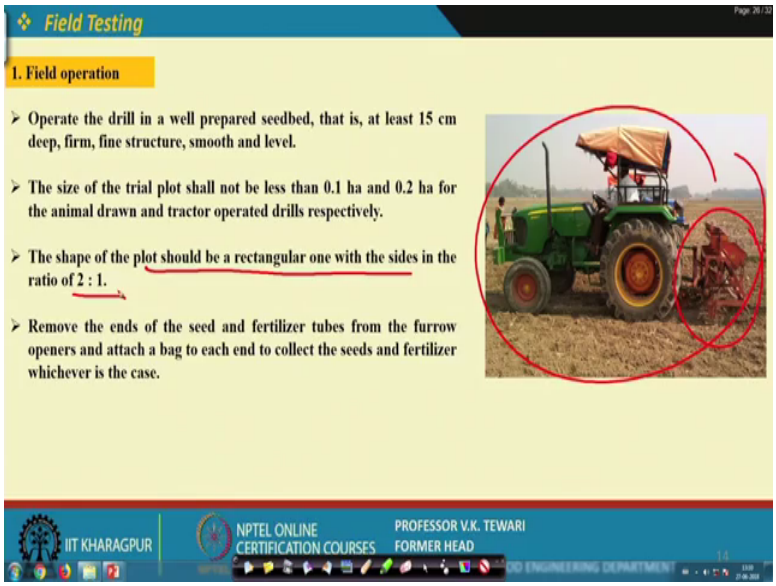


Well, field operation. It is very important than once you have tested in the laboratory you need to test in the field as well, because we see in the laboratory we have test a certain portion of it. Once it goes into the field what is performance it is performance of all the tines etcetera and then whole metering mechanism, whether choking takes place or not you will operate actual field condition, you will create as proper seed bed or seed you can say soil tilt in which this has to be operated. You have to create that proper condition and then only we can do this field operation. This is the one work done this is the one which we have done at IIT, Kharagpur.

So, we are showing you we are testing this particular seed comfort as a drill and that is why we have shown you here. So, the seed plot should be rectangular. Yes, you should a have a proper plot. Generally, we see that the plot size is always a rectangle most of the times because we have to think of the turning losses. We must think of a turning losses then only we generally find the 2 is to 1 ratio is the one which is acceptable to us.

So, you have the field and properly create this field with tillage or enough tilt of that; that means tillage operations, so that you create a enough tilt and then on that you can operate your seed for the field operation.

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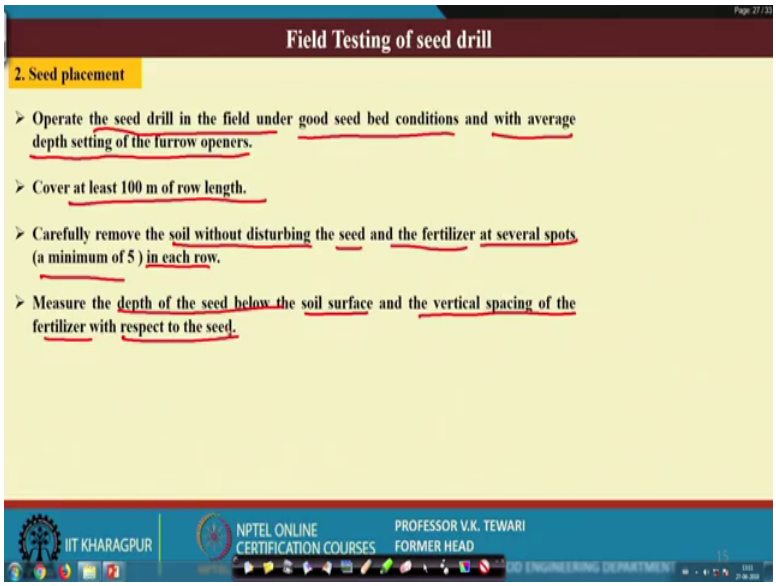


Field testing of the seed drill, seed placement: well, this is important how field testing the seed placement where the seed has been placed properly or not with respect to the fertilizer if you want.

So, just let us have some of these things. See; operate the seed drill in field under good seed bed condition, as I said about the tilt with average depth setting of the furrow openers. There should be average depth setting which you want we have taken the ideal case about 6 centimeters or 60 mm in the design case. If you recall cover at least 100 meter of row length, just cover this well you need not do 1 hectare and then do it. Generally, we require that about at least half a hectare or so should be for any tractored on unit testing.

But, then for the test which you are talking of a field testing of this seed drill for seed placement at least 100 meter roll and should be there. Then careful remove the soil without disturbing the seed and fertilizer at several spots a minimum 5 spots in each row and then see what is the location. This is very important carefully remove and then check, because this is important to you once the seed this has passed you will know that, yes, this is the location at which the seed and fertilizer falls in this particular seed comfort as a drill.

Measure the depth of seed below the soil surface and the vertical spacing of the fertilizer with respect to the seed, very important. These are very important things which need to

be considered while seed placement because then seed placement is not proper in the seed drill then you must reject it.

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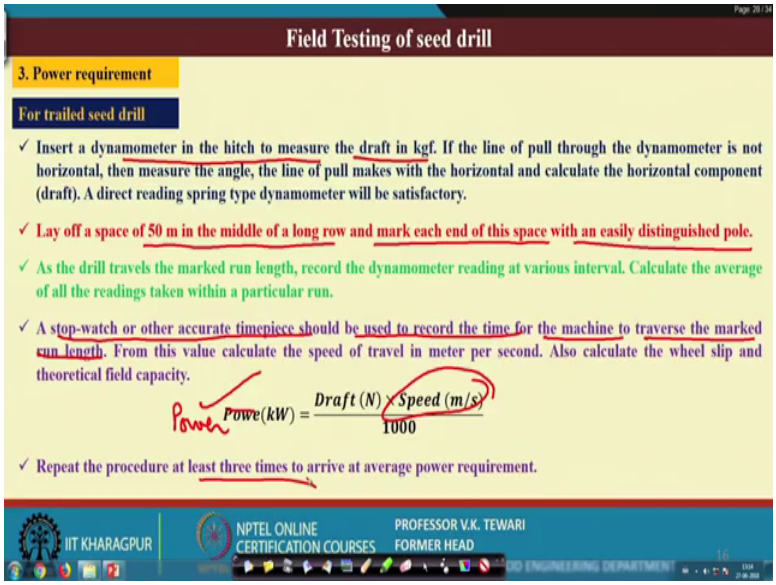


Power requirement: well, field testing of seed drill when we are talking of the power requirement, if you could talking of a trailed seed drill well a although it is connected to the unit, but then we are calling the trailed seed drill because we are taking power of it is operation we are taking from the ground wheel.

So, for what is the insert dynamometer? Now, here certain things need to be looked into. See, a dynamometer is to hitch measure to draft. So, a dynamometer is used for measuring the draft because in between the seed drill and the tractor you can have a dynamometer, you can have a hydraulic dynamometer, you can have any load cell etcetera and then you can measure the draft while it is being pulled. So, it is easier for a trail time, but if it is mounted type then you will have a different requirement whether you can have a 3 point linkage dynamometer to find out the actual draft and all that, but then for this trailed seed we are explaining you here.

Then lay off a 50 meter in middle of long row and mark each end of the space with an easily distinguished pole. Now, these are essential things which we are talking with respect to the power requirement stop watch or other accurate timepiece should be used to record time for the machine to traverse the marked run length. Because we are interested to know how much is the wheel slip, which takes place and what should be the

actual speed at which it works and therefore, is speed is found out here and then the power requirement will be known, this is power.

So, repeat the procedure at least three times. Yes, this procedure should be repeated three times to get sufficient value of this the power requirement of that unit when you have attached this particular seed cum fertilizer with the tractor or to the unit power source and power source most of the time here we are discussing with respect to tractor only. It is a question of whether it is a 40 horsepower tractor which I discussed there or a 20 horsepower tractor you want. So, depending on that it can vary.

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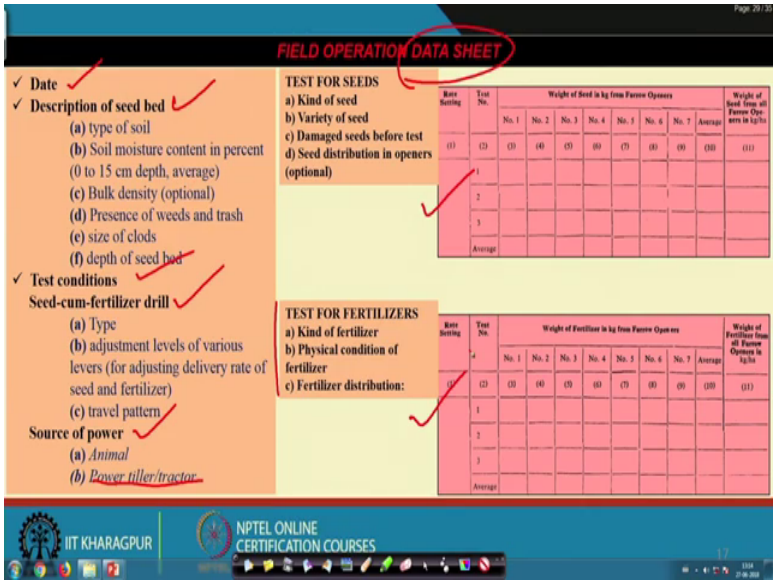


This is the field performance data sheet. This is important; you need to maintain this again. See, the data sheet has to be dotted the date at which we have done, then the description of the seed bed, then the type of the soil, soil moisture, bulk density test condition, the seed cum fertilizer drill, source of power whether this is tractor whatever and then test for seeds kind of seed variety of seeds etcetera and then test a fertilizer all these details.

So, for each one of this is for the seed, this is for fertilizer. These data sheets need to be prepared as per the interest which you have done in the field.

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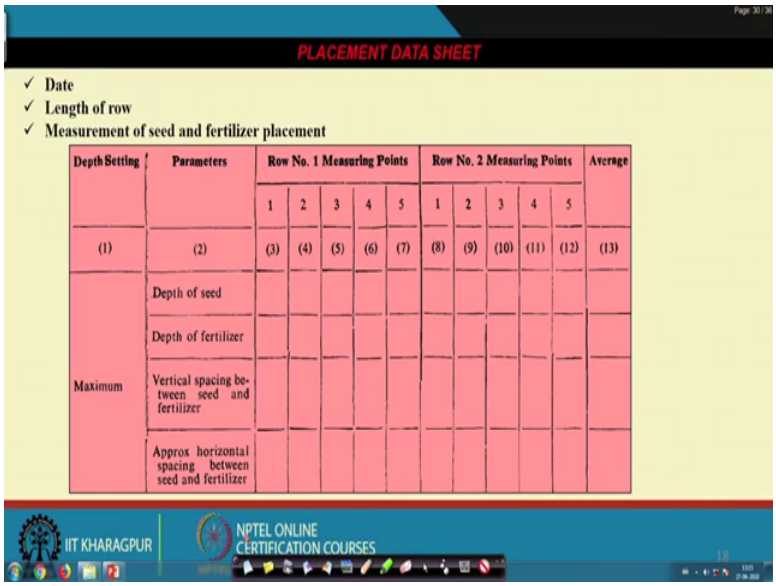


Placement of data sheet: this is how you place the data sheet with respect to the measurement of seed and fertilizer placement how they are placed.

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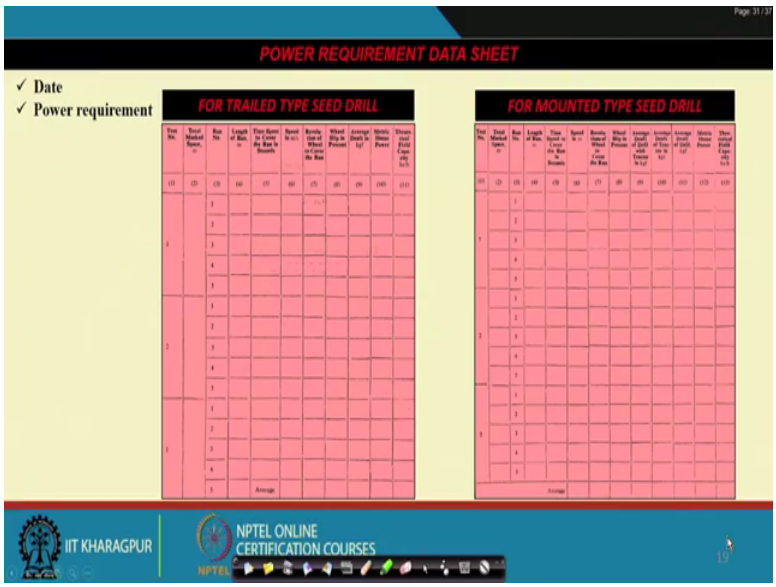


Power requirement data sheet- well, we discussed power requirement if it is a trailed type seed drill. This is the details which are given here. The power requirement we must put what was the date of this and this is a trailed type seed drill. So, these are the way we can put the data here you can see the total marked space run, length of run, time spend for to

cover run, in second speed revolutions then wheel slip in percent, average draft measured a meter metric horsepower their theoretical field capacity.

Accordingly, for mounted type of seed drill accordingly these values should also be a found out for the mounted type seed drill and for mounted type seed drill as I said you should have a different dynamometer do this thing. We at IIT, Kharagpur we have developed a 3 point linkage dynamometer which in course of another lecture, I will let you know, what is this and how accurate is this for finding out this. It is very important we have done at IIT, Kharagpur and hence I will let you know this which is not available anywhere else. So, this is the way you can put the power requirement data sheet here.

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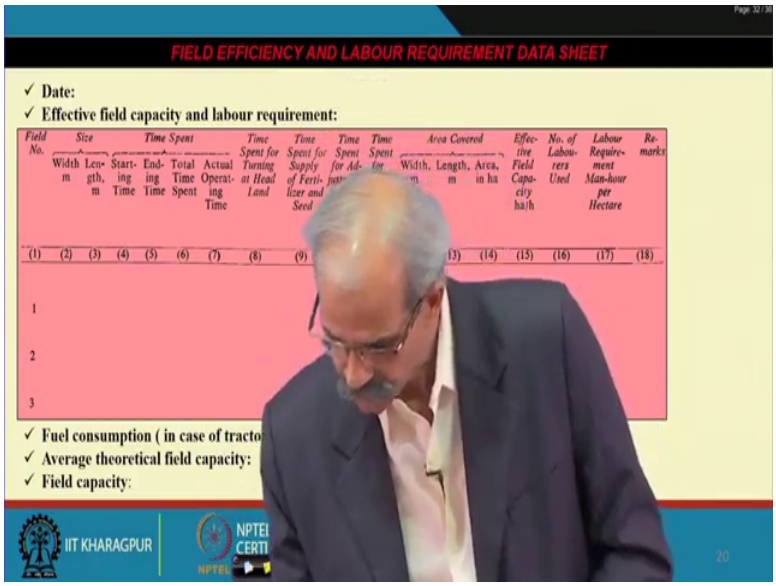


Field efficiency and labour requirement data sheet. Yes, this is the data sheet which talks of when they at what time it was done, what is the field capacity, how much is the labour required and then what is the fuel consumption of the tractor, how much field capacity you got, what is the field capacity you got and all that, all details you must record over here as per the format which is given by the BIS.

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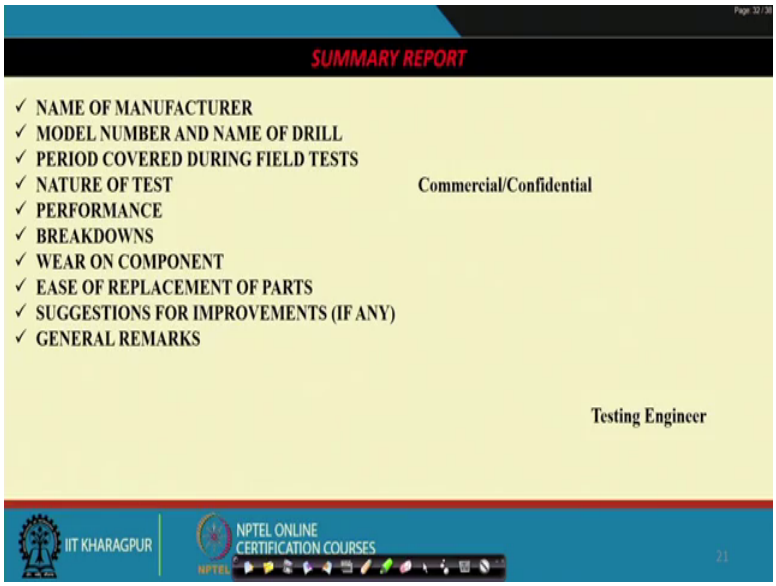


Then summary sheet- now, summary report these details which you have talked off. Remember that, until unless you give a proper report to the to the agency who has come to you for testing your report will not be there and for this you should be qualified engineer who can certify this, who has tested as per these and taking the reports and data as per the data sheet which is given, followed all the detailed requirement, then only you can check whether it is a commercial or a confidential test. For a commercial test these are the all requirements, for if it is confidential certain data which will not be there in that and it is given in the in the bureau standards whole procedure itself. So, the ultimately, then the summary report at the test engineer has to sign and then forward it to you.

Thank you very much.