Farm Machinery
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Lecture – 01
Importance of Farm Machines in the Context of Enhance Production, Multiple Cropping, Labour Scarcity etc.

Dear students welcome to NPTEL course and Farm Machinery. Well my first lecture has been designated at Importance of Farm Machines in the Context of Enhanced Production, Multiple Cropping, Labour Scarcity etcetera. Now, through this course I would like to explain here particularly in this first lecture as to what is the importance of such a course; one must know why he is learning a particular course, which way this course will be helpful to him in future course of time as well as how he can contribute in the growth and development of his nation.

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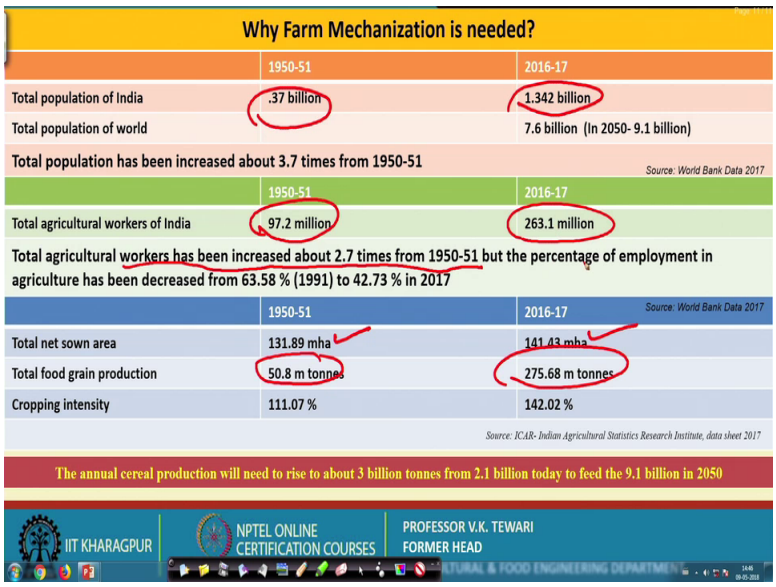

Now, let us have look at what is the in statistics globally and also in India. Now, let us have a look at the population. Now, we have about 0.37 billion people in 1950-51 and today we have about 1.342 billion people and the production in 1950-51 was about 50.8. million tons and today production is 275.68 million tons. Now, if we compare this we find that we are much much below the requirement of the country although we say that we are safe sufficiency in food grain production, but then in order to fulfill and feed this

population we definitely require much higher than what we have and therefore, there are needs of increasing the production.

Now, how do we increase production have also look at what is the requirement what was the area in 1950-51 and what is the area at present. So, if you have look at the area net. So, an area was about 131.89 million hectares and it is at 141.43 million hectares today. So, there is a comparison the increase in the area is hardly 10 million hectares or so, but the production has gained tremendously as well as the population has increased a in a bigger way it is said about 3.7 times than what it was in 1950-51. So, if we compare this we have to look into what is the requirement today, what we have what are the different resources that we have and how with the resource set sources, how we can take care of the production and enhance the production that is the main aim.

Now, how what are the power sources that will be there on the farm? Now, the power source to start with it is the human being. So, you can have a look at this the agricultural workers has been increased by 2.7 times from 1950-51. Now, earlier it was 97.2 million now we have 263.1 million although the figures shows that the values are quite high here to, but if we say the population is more, but people are not there people are not there to work in the field. There could be several reasons for that, may be the agriculture has not given that much of production or that much of revenue because of which people have shifted from there to other regions.

You can have a look at this that the percentage of employment in agriculture has been decreased from 63.58 percent to 43 point 42.73 percent in 2017. So, there has been increased fit get figure from 1991 to 2017 itself. So, there has been increased because the people have gone to different other operations which we will see where they go. Now, globally if you see a situation will come up when today we have about 2.1 billion today and to feed about7.6 billion people in the whole world. And by 2050 we will require about 3 billion tons of this food production when we will have a product population of 9.1 billion.

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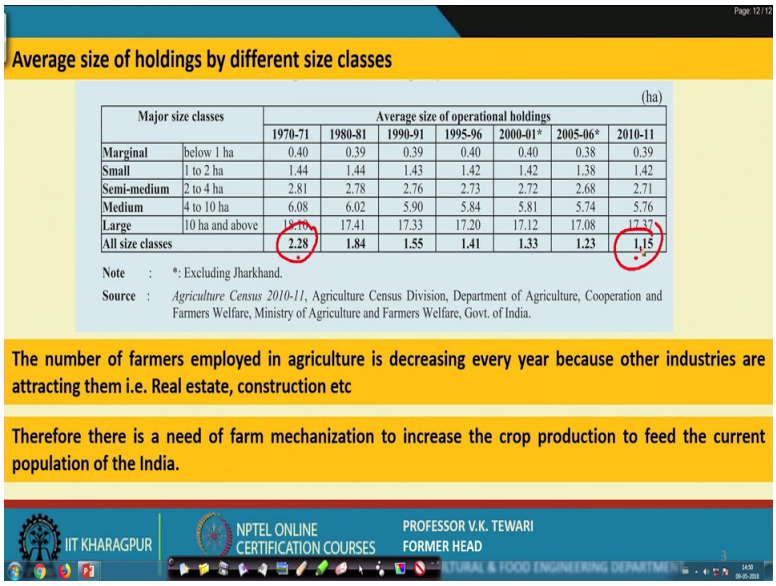

Now, if we go to the next well we can also have a look at the average size of the different holdings particularly in the context of this country. We see that from 1970-71 here the average in different categories say marginal small mediums large and overall size if you see the 1970-71 the average value was 2.28 hectare whereas, in 2010-2011 the figure is 1.15. Now, this itself indicates that the area has decreased. So, what has happened is first problem was that the people have been less a for doing the agricultural operations second is this land is also shrunk and since the population has increased we need more food. So, the problem is very complex.

Because the resources are diminishing and we need to produce more out of this. So, when the land area is decreasing the requirement of food is more and the people available for this work is also less then we will have to depend on certain aspects and certain other sources by which we can get the production. And then we have to think of a cropping intensity or we have to think of increasing this area because area has been virtually come from 2.28 to 2 point 1.15.

Now we need to increase this area vertically and when we see vertical increase in area we talk of in increasing the cropping intensity. That means, increasing the same amount of areas within the same amount of area we would like to produce 2 crops 3 crops 4 crops depending upon the duration of the crop and depending over the type of crop and

that will give us more and more production. So, the idea is within this we will have to have more production per unit area.

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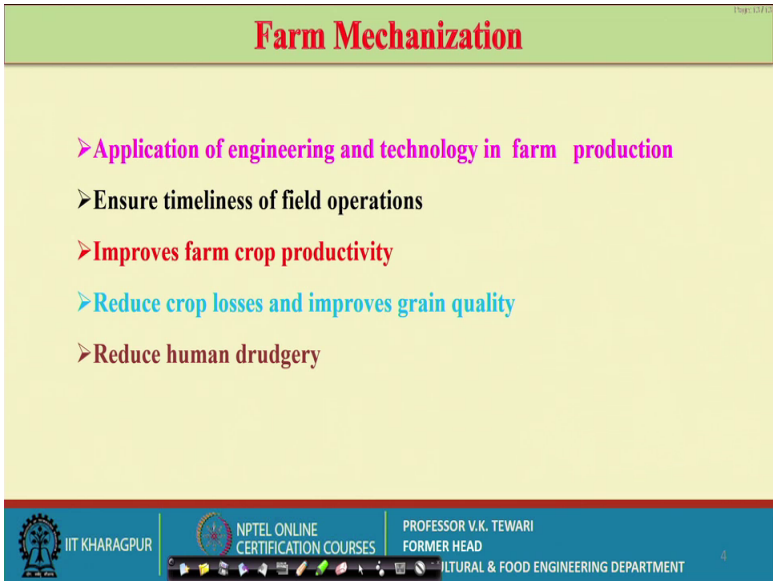

Well so; that means, we will definitely require machines which will definitely learn more power sources which will help us in doing these different operations. What are those? The operations will they start from preparation of the soil for creating good tilth for seeding this was seeds, then second will be for inter culture operations after the crop has grown for certain period of time may be 3 weeks or so, we would require that there should be some (Refer Time: 07:39) of operation. And after the at the operation when the crop has come up if there is requirement of any plant protection in way of some nutrients or fertilizers or for pesticides we will have to take care of the crop and after that harvesting and then threshing

Now, we will have to have these operations to be done now if we see that the human beings are less then what are the other sources the other source is the animal which can be used for doing these operations. But definitely they require certain implements certain equipment by which they can they can do this operations in time. And the third is the power source because more and more power sources will be required for doing this operations. As I said that these operations from field preparation to harvesting and threshing they are totally timed if they are not done within the period of time which is scheduled for it then definitely there will be losses and. So, we would like to maintain a

timeliness of operation of these different operations and for that it is very essential that you should have the machines for doing these operations within the period of time.

Because then your aim is to have 3 to 4 crops in the same area. So, that is only possible if we have machines effective machines which can do these operations within the time. So, that you can after finishing 1 crop you can take up the next crop. So, then farm mechanization is this then that application of engineering and technology in farm production for doing all these operations this is how in a very simple way we can define farm mechanization. Now, the result of that is timeliness for operation timeliness of operation improves farm crop productivity and definitely if the things are done in well in time then it will reduce the crop losses as well as the quality of the grain will also be improved it will again.

Now since the operations you might have seen that the various operations when they are operated when they are completed by human being the human being assumes different occurred postures and that will definitely tell on the health of the operator. So, when we are employing machines we are definitely also reducing human drudgery and enhance the life of the operator. So, the reduced human drudgery is also another operation of this farm mechanization that we will do.

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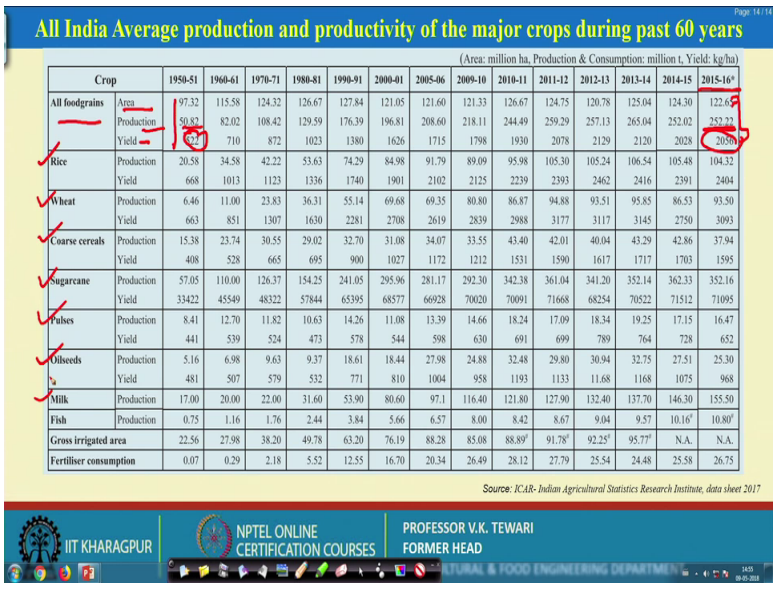

Crop		1950-51	1960-61	1970-71	1980-81	1990-91	2000-01	2005-06	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16*
All foodgrains	Area	97.32	115.58	124.32	126.67	127.84	121.05	121.60	121.33	126.67	124.75	120.78	125.04	124.30	122.6
	Production	50.82	82.02	108.42	129.59	176.39	196.81	208.60	218.11	244.49	259.29	257.13	265.04	252.02	252.22
	Yield	522	710	872	1023	1380	1626	1715	1798	1930	2078	2129	2120	2028	2050
Rice	Production	20.58	34.58	42.22	53.63	74.29	84.98	91.79	89.09	95.98	105.30	105.24	106.54	105.48	104.32
	Yield	668	1013	1123	1336	1740	1901	2102	2125	2239	2393	2462	2416	2391	2404
Wheat	Production	6.46	11.00	23.83	36.31	55.14	69.68	69.35	80.80	86.87	94.88	93.51	95.85	86.53	93.50
	Yield	663	851	1307	1630	2281	2708	2619	2839	2988	3177	3117	3145	2750	3093
Coarse cereals	Production	15.38	23.74	30.55	29.02	32.70	31.08	34.07	33.55	43.40	42.01	40.04	43.29	42.86	37.94
	Yield	408	528	665	695	900	1027	1172	1212	1531	1590	1617	1717	1703	1595
Sugarcane	Production	57.05	110.00	126.37	154.25	241.05	295.96	281.17	292.30	342.38	361.04	341.20	352.14	362.33	352.16
	Yield	33422	45549	48322	57844	65395	68577	66928	70020	70091	71668	68254	70522	71512	71095
Pulses	Production	8.41	12.70	11.82	10.63	14.26	11.08	13.39	14.66	18.24	17.09	18.34	19.25	17.15	16.47
	Yield	441	539	524	473	578	544	598	630	691	699	789	764	728	652
Oilseeds	Production	5.16	6.98	9.63	9.37	18.61	18.44	27.98	24.88	32.48	29.80	30.94	32.75	27.51	25.30
	Yield	481	507	579	532	771	810	1004	958	1193	1133	11.68	1168	1075	968
Milk	Production	17.00	20.00	22.00	31.60	53.90	80.60	97.1	116.40	121.80	127.90	132.40	137.70	146.30	155.50
Fish	Production	0.75	1.16	1.76	2.44	3.84	5.66	6.57	8.00	8.42	8.67	9.04	9.57	10.16[#]	10.80[#]
Gross irrigated area		22.56	27.98	38.20	49.78	63.20	76.19	88.28	85.08	88.89[#]	91.78[#]	92.25[#]	95.77[#]	N.A.	N.A.
Fertiliser consumption		0.07	0.29	2.18	5.52	12.55	16.70	20.34	26.49	28.12	27.79	25.54	24.48	25.58	26.75

Now, you can have a night idea about what is the all India average production and productivity of the major crops during the past 60 years it is very essential to have a look

at these values to an appreciate as to what has been the production over the years and what is the requirement in future of different crops. For example you can look at the see food grains food grains here we will see the area production and the yield. In 1950-51 this is the requirement 97.321 hectares million hectares 50.82 million tons and then yield 522 is kg per hectare

Now, in 2015-16 the same value have you can see that 97.32 a million hectare has become 122 million 0.65 million hectares and the yield which was 50.82 million tons has become 2.52 million tons. In fact, this is a figure which is slightly recent figure, but it takes of the food grains only. So, 252.22 million tons and the yield which was 8 to 82 has become 2056 kg per hectare. So, although we have increased this, but there are various reasons for this and this will be seem for all the crops if you see the rice crop, wheat crop, coarse cereals, sugarcane crops, pulses oil seeds, milk production we can have a look at all these and then we will see that there are definitely has been a change in the values from 1950-51 1 to this.

There are several reasons for that and those reasons are. In fact, the application of various power sources in during this period of time in different categories for the tillage operation for seeding operation for harvesting operation for threshing operations and. So, on well if you see the details of that we may find that the fully the whole may be a country like India has not been fully mechanized on all respects because the rather areas in which the crops are not be mechanized, but particularly because I said earlier and we have shown you that the different categories of farmers.

So, since the category farming about 60 to 65 percent of the farmers are in the area of less than and within about 2 hectares or so, and only few portions of the percentage is in the larger hectare. So, that has been the case it is not been possible to mechanize full. So, certain operations are largely mechanized certain operations are being done on custom hiring basis which I will tell you some other lecture in during the course of my lecture itself which will which will be dealt with slightly in greater details when we will be talking of matching implements; when we talking of other aspects of farm machinery mechanization we will talk of that later.

But then here I want to show you that what is the production and productivity of the different crops over the last 60 years. This is a trend which indicates that the

mechanization is helping and has helped and continue to help and therefore, there is a need for the machines there is needs for effective machines there is effective need for new machines in this area well this is another important information which one must know.

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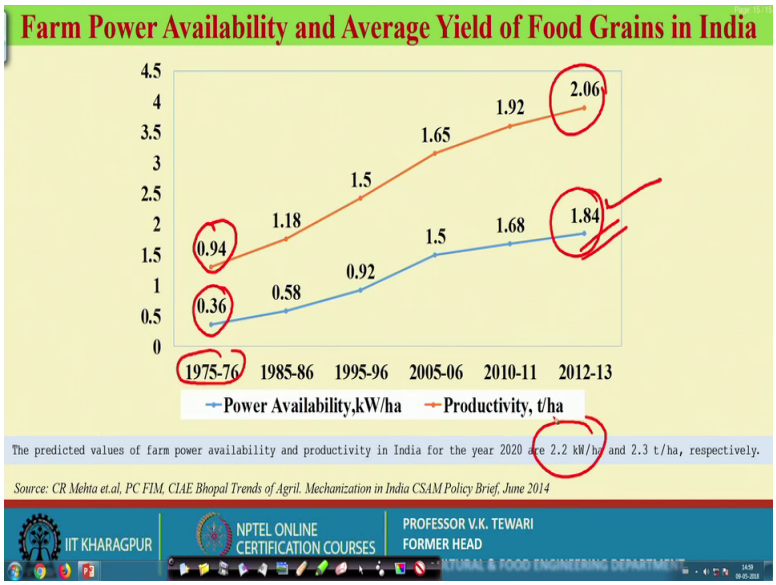

Now, you can have a look that in 75-76 see this is the amount of power available per hectare and this has grown from and in 2012-13 if the figure is to be taken to be like this then 1.84 hectare kilowatt per hectare sorry kilowatt per hectare. So, 0.36 kilowatt per hectare to 1.84 kilowatt per hectare and this shows that there is definitely a direct relationship between the power on the farm and the productivity because the other line this line shows the see productivity is here the 0.94 tons per hectare to 2.06 tons per hectare.

Now, this now there is a production thus by 2020 these this value 2020 this value is going to be over 2.2 kilowatt and well if you come compare with other countries I think of the this figure is much much lower as compared to Japan. And other countries where the values is much beyond 7 and 8 kilowatt per hectare something of that figure; But then it indicates that you need to have more and more farm power in order to have more and more production.

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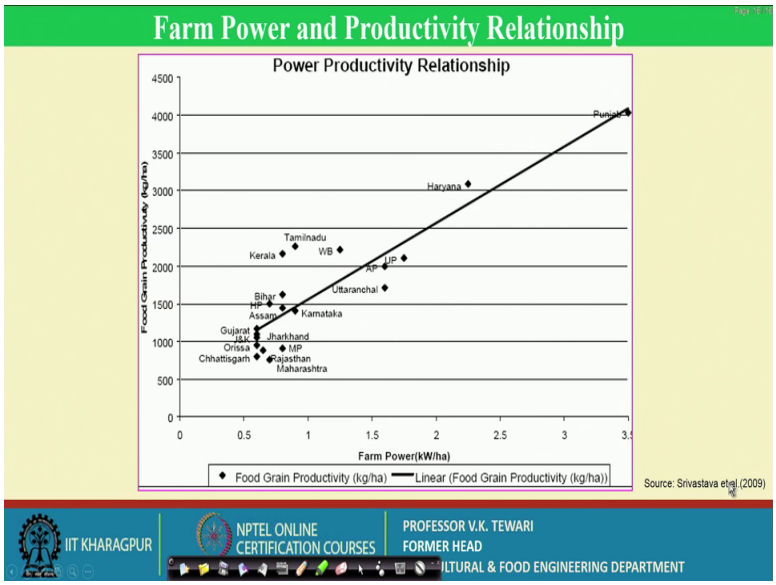

Now, this further emphasizes that farm power and productivity are well related how they are related you can have a look at the different states now, we know that in different states more of length people with are length sizes are there you see in Punjab and Haryana up and Uttaranchal and other eastern I mean the northern part of the country in the eastern part of the country.

We find that the the area is much more smaller and more of small and small line holdings are there because of which mechanization has not reached to those areas, but then this also shows that there is a good direct relationship between farm power. And the productivity of any crop if you think of food grain production here kg per hectare and food grain productivity kg per hectare you can see the values which are given for the different states.

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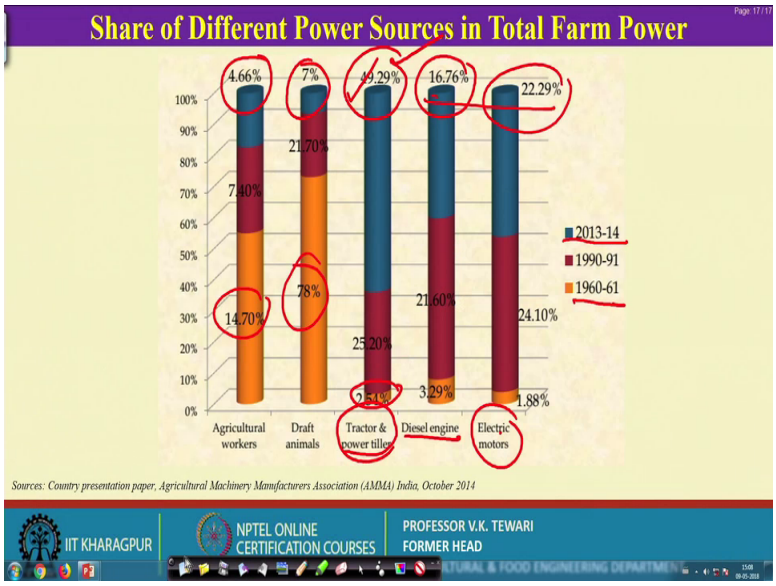

Different power sources in total farm power share how the different power sources which are adding to the total power on the farm well the as we I said earlier that there could be a power from the human beings. The human beings are involved in different working working you can say the tasks in the field.

For example, if a small farmer has a small plot of land he will be only doing with this spade and kurpi and a small tools that he has he will be a able to do most of the operations including planking and sowing of the seeds as well including even harvesting with his own small sickling and all that. So, the agricultural workers or that, but today the situation has been changed to a greater extent people are not available for this as I said earlier, but then we can have a look at it

Now, you see here that the agricultural workers in 1960-61 this is the color so, about 14.7 percent. Now in 2013-14 now this is the figure here. So, you can see that this 2013-14 may, but the figure is if you if one considers is not much changed. So, there has been decrease in the people who are involved in agriculture, this is very important to look at this similarly go to the draft animal power as I said that on the farm. Although the woman I mean the way agricultural workers have reduced similarly is the case with the animal there could be various regions for that, but then if I take the animals we need to have the equipment which are face efficient equipments and those equipment should be available to be drawn by the animals on the on the field.

There could be if the crop has grown up then it is very difficult to drive those people there say for example, other operations, but theory the operations major the utilization of animal power. So, they have been used, but even then it situation today is that they are now only 7 percent of what they were about seventy eight percent sometime in sixties or. So, this has also decreased now when this has decreased this means that the people are shifting towards more and more of machines more and more of effective machines because these animal are not of that much use except for some of the operations may be threshing operations may be theology operations and sometimes we need to culture operation when the crop is small.

They could be also utilized for other nonagricultural operations it is not that they are totally absolute or their power cannot be used definitely they can utilized for that, but then in agriculture if you are talking of the production agriculture here I think their percentage is decreasing. And we need to look into this aspect then we come to the other fuel packed sources here tractor and power tillers involve now you can see this situation in sixties is was only 2.54 whereas, it has increased over the years and now it is 49.29 percent and it is going to increase.

So, more and more of farm power more in more of machines if we if we utilize then definitely this power source will increase and as soon earlier definitely this will result into more of production less of losses etcetera of the crop. So, this is a sign which is emphasizing that there is need for farm mechanization and there is need for using more and more machines for production. Now, have a look at other stationary engines which were required for other operations for threshing or for pumping operations and other you can see the diesel engines now it will go on 16.7 percent and even electrical motors which we are 1.88.

Now they are 22.29 percent here. So, we can see that these 2 sources particularly electrical motors and diesel engines which are used for electrical sorry irrigation these are also for irrigation and sometimes for threshing etcetera the percentage is very close.

Now, particularly here we I can only add that may be because these are these supplemented for such a operations particularly by nonrenewable sources like I mean may be the renewable energy sorry renewable energy where we can think of solar we are getting think of wind power etcetera. So, these are some of the things which may be

compensating for this here, but they trained here is that we have to have more and more power sources; that means, it is empty clear now that we have to have the machines effective machines for different operations for different crops cereal crops plantation crops vegetable crops cash crops for all sorts of this we will required to have machines effective machines, but different operations each operation.

Now, sometimes there is a question asked that why not have small machines to the small operators or the small land holdings the person can purchase the machine. Now, here this is a big debate and that debate is essentially in the sense that the for each of the operations you will have to give him a machine. And if you want to give him a machine if you want to give him a machine which will have which will require some small power the moment you give him that machine there will be a cost attached to that, but smaller the machine smaller will be the output of that now the moment to give him a small machine and output of that he compares that how much time I will do with this machine why not I do for manually.

So, there is a comparison and many a times he is right. So, we need to look into this and the answer comes out that no we have to have certain medium size machines for these people or a slightly bigger size machines for a group of people. And then we will require people who can do say cooperative farming or you can think of having a custom hiring basis use of this machines and possibly those machines will be earlier for a a smaller farmer or farmer who does not have that much of revenue that much of money to purchase these machines.

So, what he can do he can on rent he can take these things and then get the operations done he does not have botheration of owning the machine for storing the machine for repair maintenance etcetera not there. So, the next I mean the requirement is which is required is that he should have custom hiring basis and a may be on the basis of cooperative farming is going to be the next answer well. So, when we have we have amply proved here that there is need for machines for different operations now let us see what are the different.

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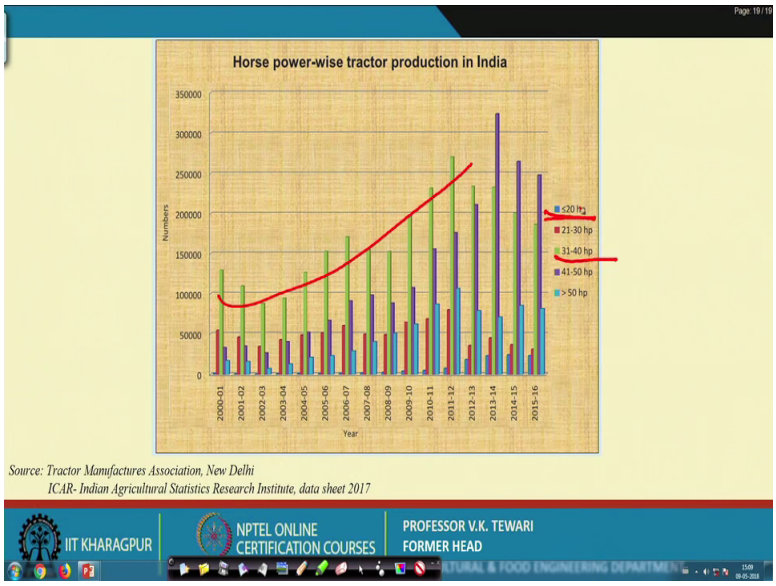

Yes, horse power tractor production in India; horse power wise. Here we can see that in the tractors which are being produced particularly in this country we have taken here. In fact, we are the second largest producer of tractor in the world and we do have larger players of tractors manufactures like John Deere also in this country. So, we will if you see right from last 18 years or so, say from 2000 to 2016 today we see that the type of and the size of horse power tractors that we have been using.

We see that mostly we are using we are using this 31 to 40 horse power, wherein you can see that these are the requirements here this is this is the trend here that about 31 to 40 horse power has been over the year for a longer time. There had been a small there has been need for small tractors also for small farms and they are also, but they are not being a drastic increase in their this less than twenty horse power there has not been increase except for in some of the areas where it can be use for multiple operations as where in the gardens in other locations right.

So, we find here that the horse power mostly in the range of 31 to 40 horse power is the requirement and what we see today is about 41 to 50 horse power. So, 41 to 50 horse power is the range being used because of larger equipment and machines which are being used by the people.

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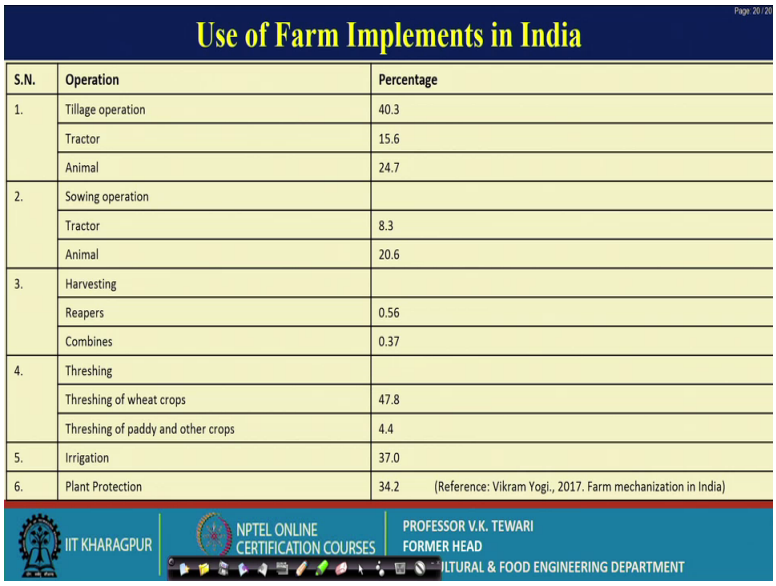

S.N.	Operation	Percentage
1.	Tillage operation	40.3
	Tractor	15.6
	Animal	24.7
2.	Sowing operation	
	Tractor	8.3
	Animal	20.6
3.	Harvesting	
	Reapers	0.56
	Combines	0.37
4.	Threshing	
	Threshing of wheat crops	47.8
	Threshing of paddy and other crops	4.4
5.	Irrigation	37.0
6.	Plant Protection	34.2 (Reference: Vikram Yogi., 2017. Farm mechanization in India)

Where use farm implements in India there are for each operations of course, definitely each operations we have the use of tractor the animal power for various operations right from the beginning as I said earlier. So, you can have a look at this and see that for every operation from tillage sowing harvesting threshing and irrigation plant protection we require a larger area of larger amount of implements are being used.

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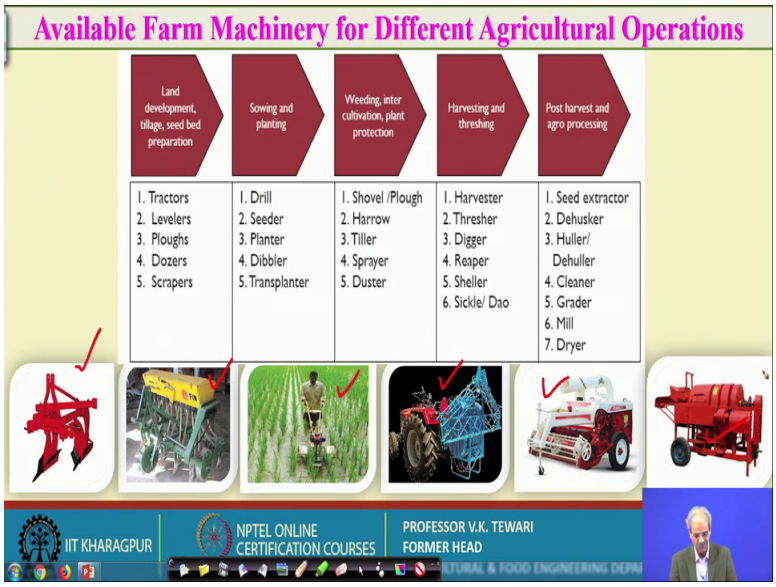

Now, some of the machines which are used for different agricultural operations we are just given you these right from this land development sowing weeding inter cultivation

harvesting post harvest operations and some of these machines have been shown to you here which we which are the which are for say plough here this was seed drill this is for inter culture operation this for spraying operation this is for harvesting and then threshing. So, these are some of the equipments which will be required.

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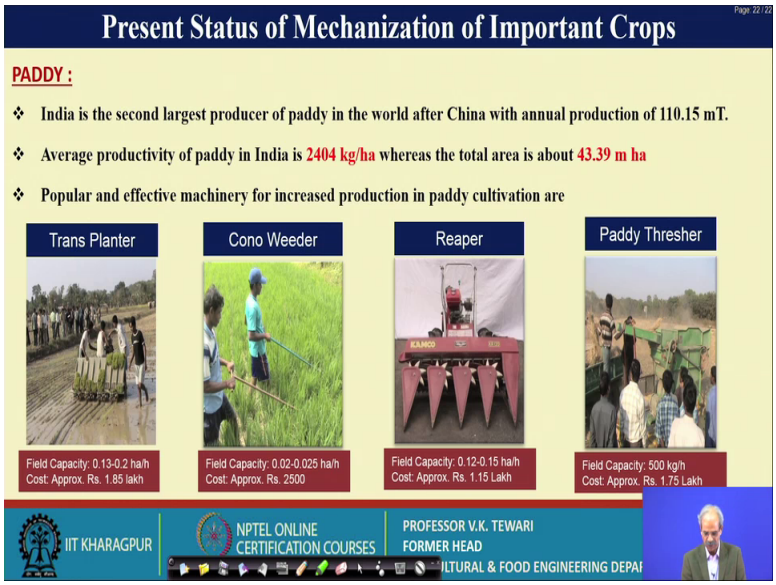

Now, the present status of mechanization of important crops paddy you can see that all the operations are mechanized from transplanting cono weed weeder for inter culture operations for harvesting operation and for threshing operations.

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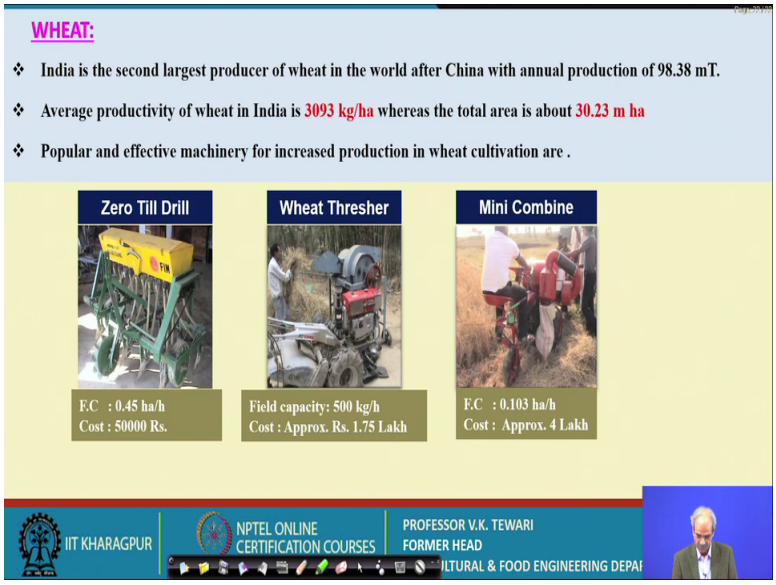

For wheat we have the 0 till drill wheat thresher mini combine, this for this crop also many of the operations are mechanized.

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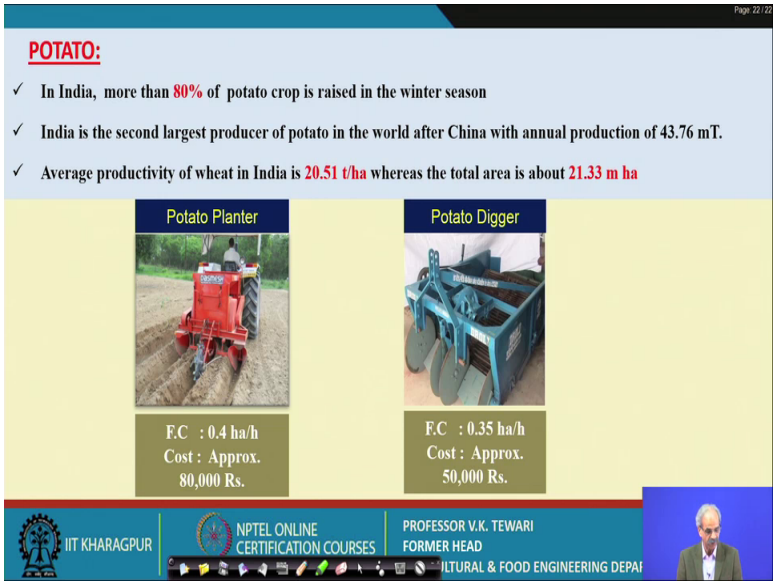

For potato crop this is another crop which is of more important in this area we have machines which are used and to a greater extent and these machines are effective machines which are available in the country today.

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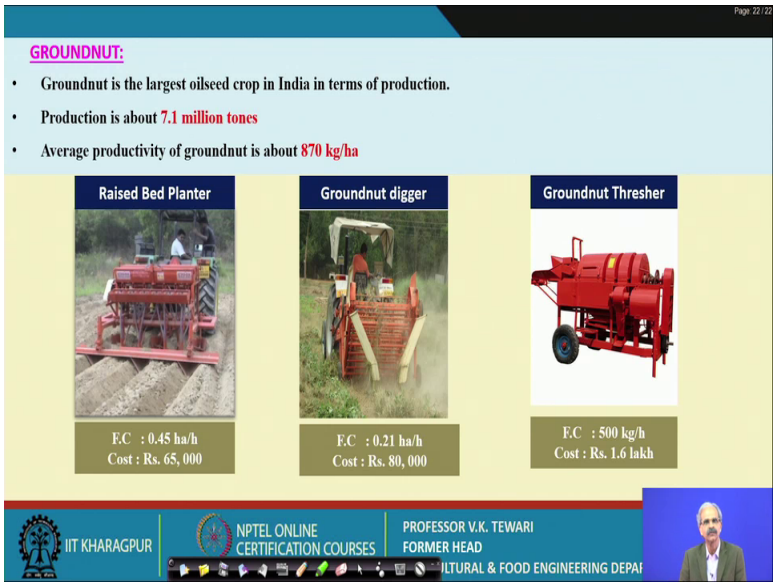

Then for groundnut this is another crop which is available in the country and be used by farmers in different areas and we have given you the capacity etcetera of this. We can

look at these machines and it emphasizes that for more or less to a greater extent we have machines which are available and there is need for more more adoption of this. Now, one has to think of what should be the more of adoption of these machines which is important thing.

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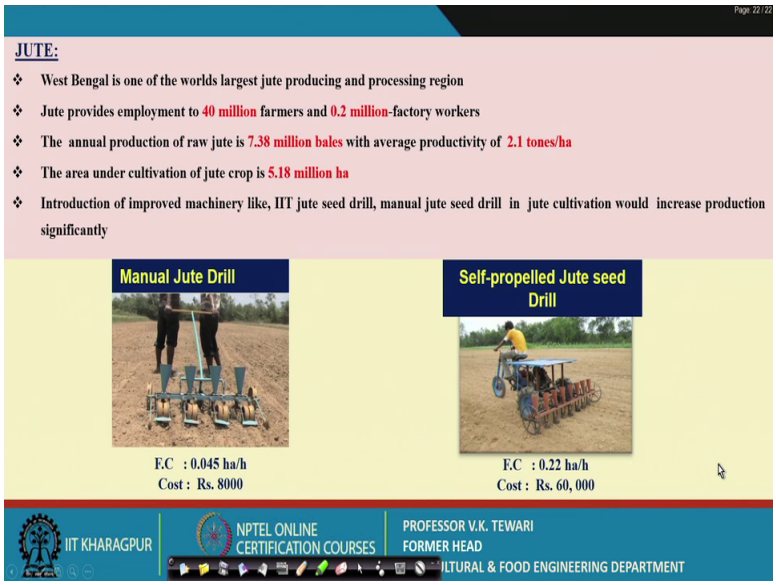

For jute particular in this part of the country we have manual jute seed drill which is here we have designed a seed drill at IIT Kharagpur, which is self propelled machine for eight row and this is effectively working.

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Therefore, what we exactly we want to say throughout this first lecture; I wanted to only emphasize that for global food security and sustainability there has to be have more and more of food production and that is only possible through farm mechanization.

Therefore, we need to know about the different machines, different designs of these machines, effective designs of these machines, effective utilization of power, different power sources on the machine is the talk of the day here and better farm machines better farm machinery is required on the machines. I think I have convinced and I have tried to convince you why this particular course is important from the of view of contribution particularly to the agriculture production.

Thank you.