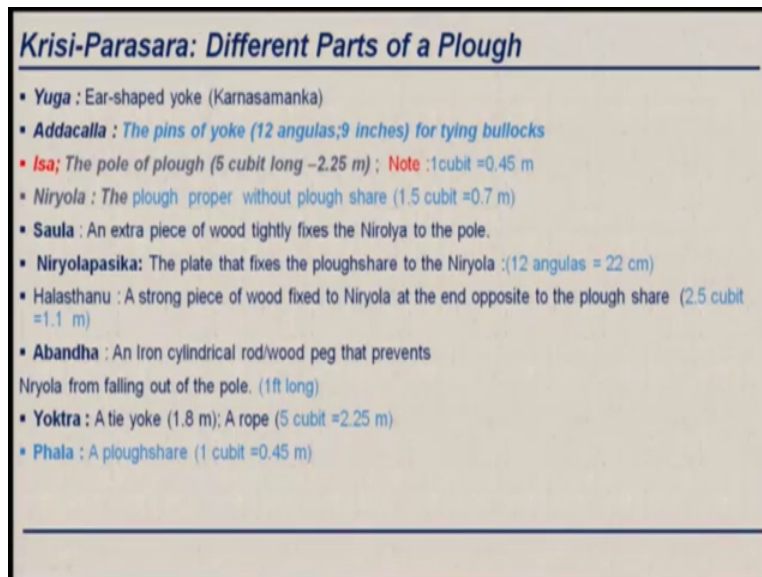


Course on Introduction to Ancient Indian Technology
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Lecture 13
Module 3

Let us start this lecture with a third process that agriculture is the true culture of Indian civilization. You must recall which I had told earlier that Indian civilization is the only living civilization from time immemorial, right. Other most of the other old civilization are dead because we consider agriculture is very important and in the last lecture if you recall that we discuss about how our ancestors who started cultivating I related to the story of the narrative of Lord Krishna and Lord Balram who is also known as Haldar, hal means plough.

And beside this we also looked at various tools like starting from the digging stool, stick to the hoe then various kinds of hoe, axes and lot of other tools we looked at, but if you could recall well that we were discussing about plough. Plough is very important and which was you know invented according to me in this country long time back, of course as per as our narrative goes on.

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And so we will have to look at how precisely it is given the about the design of the plough in Krisi-Parasara and if you look at different parts have given and one is Yuga in English but it is yoke basically ear-shaped yoke, right. Sorry Yuga in Sanskrit but it is ear-shaped yoke that is

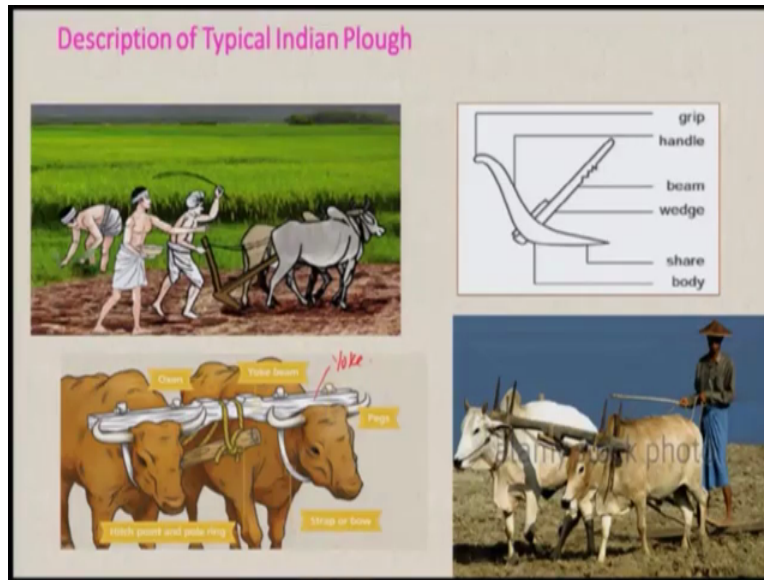
known as Karnasamanka and there is Addacalla and which is basically the pins of yoke and which is around twelve Angulas means nine inches kind of things for tying the bullocks, this terminology let me introduce after that we will see each one of them and corresponding to the figure so that it will be very clear to you.

Isa, Isa is basically pole of a plough which is around 5 cubit long in meter if you convert it is 2.25 meter as one cubit is around 0.45 meter. We had also looked at this unit conversion in the last lecture. And Niryoala or you can call it Nir Yola the plough proper without ploughshare and which is around something 0.7 meter and Saula that is also La you can say and extra piece of wood tightly fixed which is used to fix the Niryoala to the pole and Niryoalapasika is another component of the plough that is basically a plate that fixes the ploughshare to the Niryoala which is around 22 centimeter kind of things.

And Halasthanu it is basically hal means plough and sthanu means you will have to hold it and this strong piece of wood fixed to Niryoala at the end of opposite to the ploughshare it is (3:43) which is around 1.1 meter. And there is Abandha a iron cylindrical rod sometime wood peg also being used that prevents the Niryoala from falling out of the pole and Yoktra is basically a rope which is being used for tying the yoke right kind of things.

And Phala is the main thing which will be tearing the soil whenever the plough ploughing is being done and if you look at early days people were using this Phala or the ploughshare made of wood in the last lecture we had seen you know around 800 to 1000 BC people started using iron for this ploughshare in India and of course this is the some of the things figures if you look at this is your this ploughshare is not being shown here but the share body is given and this is your beam which we call it as a basically the Isa the pole and this is the hand grip or the Halasthanu.

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So this is a picture so what I am showing you know that you know this is being done together that means there is a ploughing going on and also the broadcasting of seeds both are going on together in this figure and so what I was talking about how to this is the basically the yoke right and this is your yoke beam and this is peg which is connected so that this ox can be tied properly you know this way and there is of course this yoke is connected to the Isa that is the pole with the wire here and sometimes you can have it joint with a rod also, iron being used now days particularly and if you look at this figure here it is a design is little more kind of constant for the ox.

But here there is design which is in between these two wooden rod you can say the ox can will be moving, right it is there a flexibility and there is being used also rope and you can observe from here there is a wooden plank which there on which the man is sitting, standing sorry man is standing. So why it is so, what is the purpose of this that might be coming into your mind we will discuss as we go along.

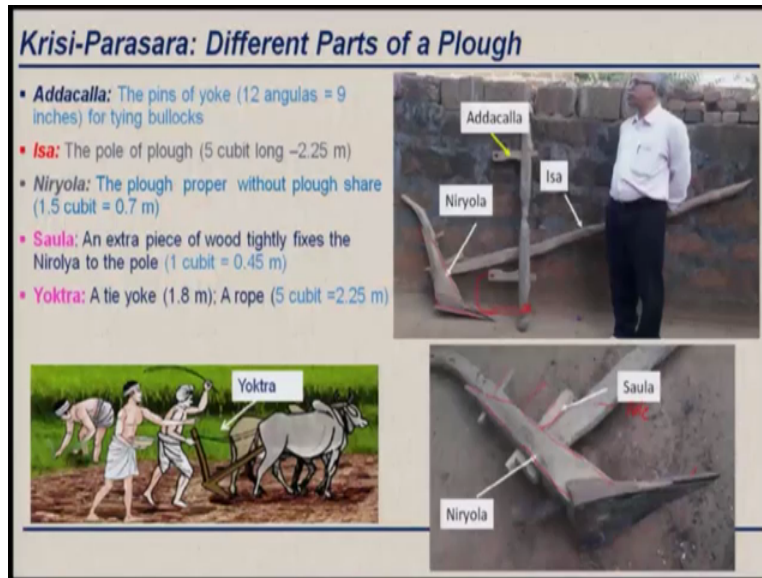
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So this is the as I told the yoke is basically a wooden crosspiece that is fastened over the neck of oxen, two oxen and attached to the plough or a cart because we can use for ploughing and also we can use this yoke with the help of oxen. We can also you know drive the cart for the transportation purposes.

So Yuga if you look at, this is basically this shaped is ear-shaped yoke like this is the you can say Karnasamanka and Addacalla which is a basically this one but I will show you in the next slide may be that this is can be used to wooden rods can be used that is also known as Addacalla which is around 12 Angulas and 9 inches right. And this is used for tying the bullet right or you can say Ox being used right.

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So if you look at this is the Addacalla which was being basically used, this is the one and there will be another one if you look at there is a hole here right and there will be another person which you can put into this rod and then you can in between this portion that Ox can be placed and you can use some where the rope can be from here to there so that you can use that way.

So they are same you know things but it is designed differently this is more flexible than that of the things that we have used and there are several varieties of these you can get in India that is the beauty of that that for the same purpose various design will be available which will be varying from one region to another and Isa if you look at is the pole of the plough and which is around 2.25 meter you know this is the Isa, what is having it can be made of wood, it can be made of bamboo as well right, people have used depending on what is available.

And according to me bamboo may be better off because it is lighter and the load will be less and it is also the (())(8:59) little flexible also that is the one part and it is having a better life, it can take more load as such and it will be cheaper as compared to wood even at this moment of time. So therefore that can be that is being used by the various people but not in all places in this country because bamboo is being grown in some place and those places it is being used.

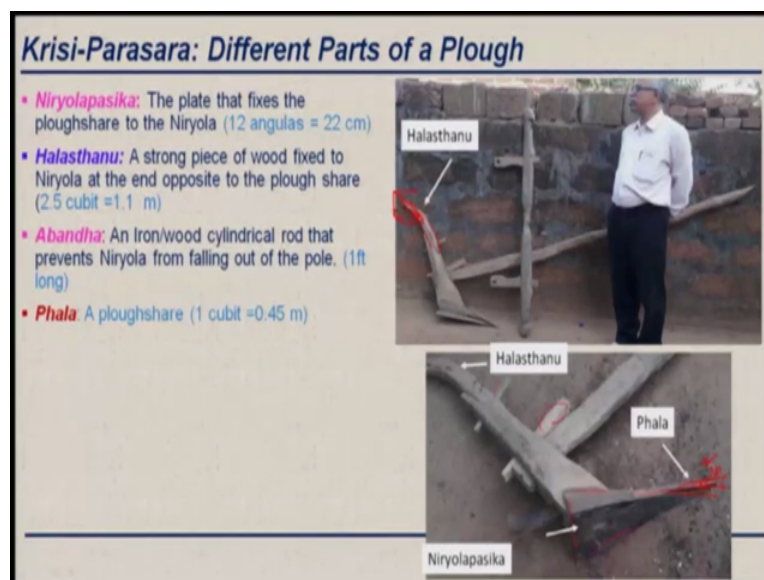
Niryola is the plough proper without ploughshare so if you look at ahh this is the Niryola right, which is around this portion if you look at 0.7 meter this portion you known if you look at this is the portion which will be Niryola kind of thing there is another portion which is there in this

place and without ploughshare, ploughshare is this one I will show you this is Niryola. I think this figure is better, this is one piece right, one piece here like that it goes and of course this is your ploughshare and which is the extra piece of wood you know is being tightly fixed to Niryola with a pole, this is the one pole but there is another term being used.

There are two wooden pieces being used here for joining this Niryola with the pole, this is your pole or Isa what you call it is joint so you have a peg will have to put you can say it is basically peg which will tighten it and when it will move it will not really come out because it is moving in the same direction, if you look at this is a width is higher and this is lower so it is as it is moving in this way so it will be remaining fixed and will not come out and it will be tight, tight enough also

So and there is another one here which is also joining this with that one that is known as Saula and Yoktra that is basically a rope which is being used and this is the portion is known as Yoktra like which by which they can also control the movement of the oxen, it can be go to the left it can go to right you know that way they can do by tying this one. So if you look at the farmer who is ploughing will have a control over the Ox movement or Oxen movement, that is the thing what is being used.

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And Niryolapasika that is the plate fixed the ploughshare, this is the portion Niryolapasika, right and of course this whatever I am showing is made of Iron right. But earlier days and even today

also in some parts of the country this is made of wood right this Niryalapasika and which is around twenty two centimeters in length and of course if you go to some other book there also what is the width and everything is given not in this case Krisi-Parasara.

And if you look at for this thing this plough say I went around something 60 kilometres from the CT inside and it was very frustrating to search and get now days because most of the people are using tractor, I am afraid may after 10, 20 years this plough which was being used in this country profusely will not be there and there is no person I was also asking the farmer that the person who is making is not there because those people are jobless so they are also not doing.

So the indigenous technology is going out of our life at a rapid rate and this should be kept with us because people can do not the company there is a difference because here the people can also design and change so that their creativity will be retained and also their need can be fulfilled. So the knowledge will be with the people not with a company or some specific people, set of people who will be really misusing and then scooping out money out of this and then whole people will be active and creative in nature which is the basic nature of human being.

Therefore, indigenous technology should be kept and it is a very simple one and from the nature you can make, you need not depend on the lot of things so that is the important point I would like to emphasize I will be doing it again and again because that is the point for which you know I want to communicate to you and that is my main motive that why will you go for indigenous technology and how we can make our life more creative and more purposeful and more peaceful and more what do you call satisfied in you know satisfied life how we can maintain it.

So the Halasthanu what I was telling a strong piece of wood, this is the piece of wood you know what is being joint this is known as Halasthanu right fixed to the Niryola, this is Niryola and to the end of opposite side of ploughshare is something around 1.1 meter. And I have shown the Halasthanu here and here also, both the cases you can see and why it is given and in because you will have to give little pressure so that this ploughshare will be entering into the soil and this angle of the ploughshare is very important okay.

So one question might be coming to you why will use the plough, why not the tractor right that might be question to you because tractor is more powerful and it can also till the land for a at a faster rate, there are several problems with a tractor, one is there will be pollution and you will

have to pay the money you know not only maintenance of the tractor, tractor is very costly and it is a the pollution will be there and you will have to depend here you can use rear the Ox and their cow and cow dung, cow dung and then urine and other things you can utilize as a fertilizer, manures and also the insecticide and pesticide, lot of things can be made indigenously.

So that you need not to pay money right and when you rear these things you will get lot of psychological benefits also and was telling that there is a angle, this Halasthan this angle is very important. See this is having some angle here alpha, right and this angle should be designed properly so that force you know will be getting vertically when I make this thing this would be having vertical force and this would be horizontal force, so that force has to be giving some little pressure on that okay.

So this has if you look at one can also look at whether it is optimized or not or optimally designed or not, right but lot of work can be done on this to improve further, it is not that it is the final one.

So Abandhar that is the ironwood cylindrical rod that prevents Niryoala from falling out of the pole. There are two terms which is similar but I think one of them will be for the this and another will be that, there is a thing which I think one has to look at it okay.

So Phala, Phala is the main thing ploughshare which will do the job of tearing, this is the phala. This angle is very important because that angle will decide this angle you know whatever it is going with that, rather this angle, this angle. If I say Alpha or may be Alpha of I can say Phala, Phala or the ploughshare, right is very important because that will decide the depth of the soil which can be you know taken out from the the land or the ground or the field so that it will not get into deep and why it is so, any idea? Why not we make it more angle so that it will you know take out the or the tear the land further with the depth wise and so that it will be better.

And there is also provision how much it will be we will see that and as compared to the tractor this depth which can be achieved by the plough is much smaller and that is is important point because if you look at the top soil is very important, right it should not go to the bottom soil and that will be affecting the what do you call fertility of the soil.

So we will be discussing about later on, but you think about and also explore yourself why plough is superior as compared to the tractors what is being you know trench is being used. So far the tearing the land is concerned depth wise right. So that is the important point one has to understand, right.

So if you look at the preparation of the soil is very important and that is why the plough is being used and you will have to also use manures right and you need also the irrigation irrigation means you will have to supply necessary water what is required for a particular crop. And ploughing of field is also important so also sowing seeds and methodology what is being used and as per our text is concerned other scripture, whatever you call earlier text right. There are three main activities of you know plantation or you can say farming, what is that one is of course the preparation of the soil that is anyway you will have to do, apart from irrigation, manuring is one, ploughing is one and sowing of seeds is these three are you know important.

And cultivator must or a farmer must be well acquainted with soil, seed and season. There are three S if you look at right, three S and the soil is very important we should know what kind of soil it is, what kind of crop we can have so also the seed. Today we you may be surprised to know farmer today do not have the knowledge of seed because they are buying from the market, right.

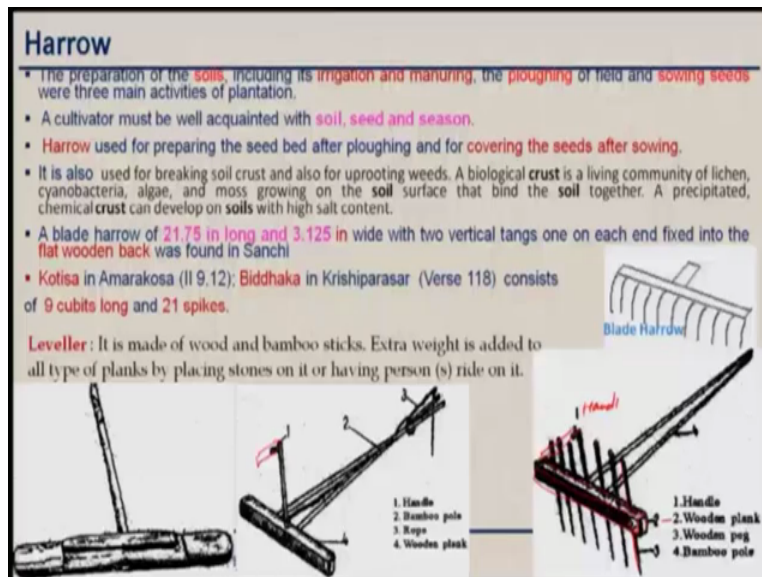
And they do not know, earlier days they were not only knowing the seed and they know also how to improve the quality of seed and how to preserve it and how to get, if you look at with the genetically modified crop which is our people have now started using then time may come if they will terminate their propagation with the market forces. Then you will sow those seeds but you won't get the seeds which can be germinated you know, then what will happen. You know the people will control these market forces other business people and we do not have a control over that, nature and they will do in a lab and we do not know what they will be doing, changing.

So therefore, nature is important nature should do, so lot of things are there that are being what you call we need to preserve it and we need to keep and I am not saying that we should not understand the process of keeping the seeds and also the improving its quality. There is a various ways of enhancing Indian or may be other countries also, it is not only India we are having the

technologies but other people are having also but our technology will be more akin to the our place because of various reasons also the season.

Now days the season is changing because of what do you call global warming and climate change. Now how to go about it because if I use the ancient thing now it is difficult to really do you will have to do you know research and find out whether those old things whether they will be applicable today or not, right for that research has to be done taking the clue from the ancient scriptures and other things, we cannot apply just copy and from the old thing and put today. It is not possible, so we will have to do that.

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So Harrow used for preparing the seed bed after ploughing and for covering the seeds after sowing, right. So this is the very important thing so which need to be done and it is also used for breaking of soil crust, crust you know some lump of soil will be there and also for uprooting weeds. There will be some lot of weeds will be there, so you need to remove them because that will be taking the manure from the land. Of course people say that weeds will be better, we will be talking about inter-cropping and that kind of things which we can do intelligently it will be enriching each other, right instead of creating a problem you know.

So that we will be talking little bit, I will be giving some flavour if not because that is a big topic. So if you look at soil crust, it can be physically, it can be biologically. Biological crust is basically a leaving community of leaching and cyanobacteria, algae, moss growing on the soil

surface. See there is lot of microorganisms are there and which will be helping to grow the plants and the because it will acting as fertilizers and we are by giving pesticide, insecticide we are spoiling them u know. Then we give fertilizer artificially what we are doing is not the right thing.

And as I told on the surface and that bind the soil together because these are there therefore it is binding it bring (())(24:11) that is to be broken. If precipitated chemical crust can develop the soil with the with high soil connect because there will be some soil which will be having salt content. So therefore that may be crust and that has to be also broken but without spoiling this you know what is the humus which is created by this microorganism and other things, right which will be decomposing the plants which will there.

And the blade of harrow, this is the harrow which I have shown here is a blade harrow right 21.75 inch long and 3.125 inch width, with the two vertical tanks one on each and fixed onto the flat wooden plank. This is the wooden plank, was found in Sanchi you might be knowing in Bihar, right. And there are several other things also people have found out and if you look at this is the typical which I have shown harrow which is being used and this is a handle, one is handle like this if you look at is a handle and this of course will be having a hand which will be you know you will have to press little bit.

So that it is similar to that plough Hastatanu right this is the handle and this is what you call the wooden plank this is this portion right, this portion is basically wooden plank, right this number two and this wooden peg these are the pegs three is the wooden peg this is the wooden peg, right and this peg, this will be made of basically even iron it is not only wood, iron can be used and this fourth one is a Bamboo pole.

So you will find several of them like Kotisa in Amarakosa, Amarkosa means it is a lot of words together put it together in earlier text and Biddhaka in Krisiparasar verse number 118 consist of 9 cubic long and 21 spikes, there are several of them of course the other one what we got as an evidence of ancient time this is 2 but this is having 21, that is what people are saying.

And Leveller it is made of wood and bamboo sticks. Extra weight is added to all types of planks by placing stones on it or having person ride on it like you might have seen that people are riding. For example, this is a plank it won't level the soil there is a broken now you will have to level. So these are the planks and this is the again handle like kind of things, handle will be here

and these are bamboo poles which will there can be tied and which will be of course the wooden plank this one and it will be dragged by the bull.

So that, I will show you and I have shown you earlier also the figure, right and there is another one which is a simpler one. If you remember I had shown you a picture where this having a wooden plank and that is nothing but a leveller, so we with this I would stop over here and in the next lecture we will be discussing about various other aspects of agriculture. Thank you very much.