Nanotechnology in Agriculture
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Lecture-04
Agriculture_Natural versus Modern

Well resuming where we stopped in the last class, so I have already discussed with you the way the course delivery will be progressing, so in the first week as we discussed that we will be talking little about the historical perspective of agriculture . So if you look pretty early in the civilization human beings were nomads, ways to move from place to place, gather food and once the resources at that particular location get consume, place to move to another location.

But in that whole process someone down line mankind or as a race we learn to grow plants, we as a race where probably rearing animals much earlier than that, but after learning how to race plants that we did the selection over the ages, we kind of concentrated on few crops, few vegetable, few fruits and such variations happen. So in terms of the grains, in terms of the food, in terms of the fruits, in terms of the vegetables happen across the world different places depending on the availability.

You have different kind of grains, different kind of vegetables, different kind of fruits and of course different kind of rearing animals. But end of the day what happen is that from a big pool of plant kingdom, from a big pool of animal kingdom we choose a selected few how and what made us to select those few is an answer question, but we did so like those ones we choose includes rice as one of the major grains wheat, barley, mallets, Sargam, then you have poor mallets some of these.

Similarly we selected potato, cassava, a source of sugar, we selected vegetables like you know brinjal, cauliflower, ladies finger, beans. But if you look at the whole plant kingdom you will see only hand full of it got selected. So now while you are doing agriculture the idea was you wanted to grow only handful of them and these handful plants have to compete with rest of the plant kingdom.

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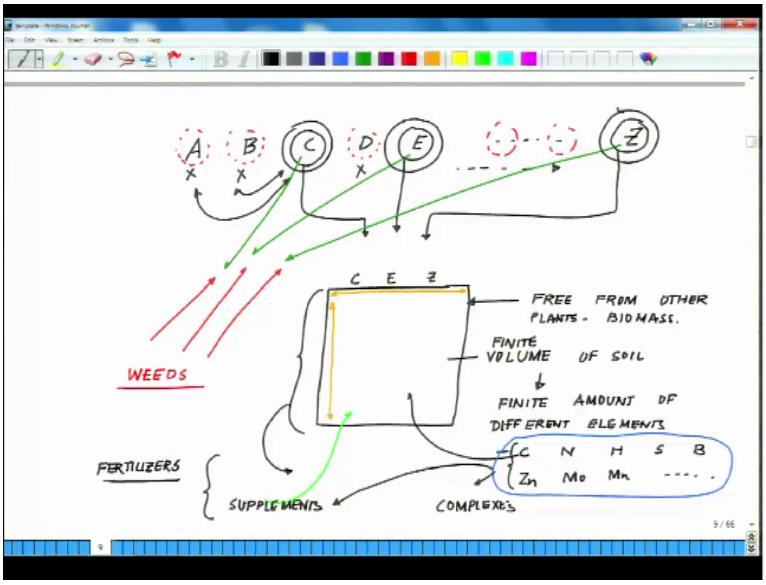

Say in other word if you think of it this something like this, say for example I give idea so say for example I have say these are the different A, B, C, D, E likewise to Z. So if I choose say C, D, E, and say Z. Now I wanted to do, I wanted to grow these for my staple food requirements, in fact to grow them and these are the once which now I am encircling in red, they will be competing with this ones.

So what we can do once these one will be completing, so the first thing possibly what happen in agriculture development is clearing up the land from all other is these, these and likewise. So now you have a piece of land out here I have shown in arrow which is free from other plants. In another word you have the other form of biomass you are now getting rid of. Now exclusively wanted to grow either C, E or Z.

So first of all you have to ensure that competition between intercompetition is being reduced, that you did by physically isolating or removing all the plants. But still there will be some which will be more hardy, more stronger which can compete with your selected one, the chosen once and those chosen once which can compete with your those other once we can compete with your selected once will always pose a threat in the production line of your C, E and Z.

And those are what in term in technical term is weeds, they are also part of the plant kingdom, but they will compete with your chosen crops and maybe they are much more stronger in terms of genetics, in terms of the physiology that they can outsmart your chosen

crop. This is one example I am giving where slowly we will realise how we move or march towards modern agriculture.

Now let us take the second situation, so here you have a finite land of a finite dimension. Now in this land you have a top soil where things grows ok and which has a simple dimension which you can cross check in any soil science book. Now the thing is that, that finite volume of soil has finite amount of different elements. In other words that finite soil will have a fixed amount of carbon, nitrogen, hydrogen, sulphur, boron, zinc, molybdenum, manganese and this list can go on.

And they will not be freely available, they will be in some form of complexes and the plant what you are growing as the ability to derive those components from the soil. So you grow a crop for a season, you grow a crop for second season, you grow a crop for a third season, you grow a cropper for a fourth season, eventually what will happen this particular piece of land unless otherwise with supplement these different elements will be depleted of those element to the level where plant cannot extract more.

They may be there but plant would not be able to extract more, so what you have to do is you have to supplement this, this thing with those elements and the very moment we talk about supplementing this we are talking about the word of chemicals, word of fertilizers ok, so now after weeds let me introduce something called fertilizers. Now the third aspect now I am going to introduce is you have chosen or you have chosen few.

Say for example you have C, E, Z and now that C, E, Z those are your chosen crops, you are growing them over acres, acres and hectares after hectares you are growing them. Now think of it for a minute in a natural setting how that looks like, in a natural you have things going like this.

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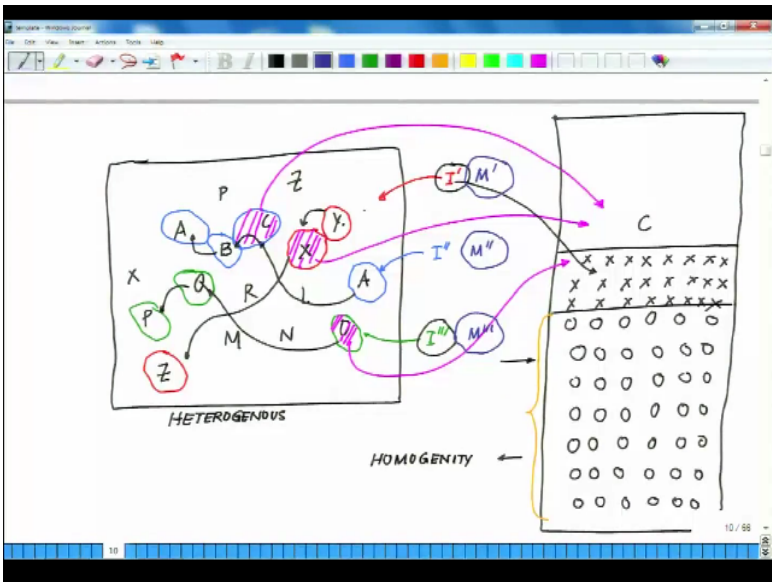

A, B, C, X, Y Z, E, Q, R, L, M, N, O, P, X, Z likewise. So this is a natural setting where things are growing, so there are insects, there are different form of insects which feeds on these vegetative kingdom or into the plant world. Now for insect say for example I denote insect out here, insect say x or say I prime. For this insect most likely it has multiple possibilities, it may refer why and maybe a closer relative of Y maybe X or maybe closer relative of its Z.

Similarly another insect I say you know I double dash, it may prefer say A and a closer relative of A say B and may be a closer relative of C fine. Now I take up another example say you know I have insect I triple prime, so this may prefer O and a closer relative of it say P may be closer relative of K. Now if I from here choose only handful of plants say for example, say example let us take I chose C.

I want to grow C in as a crop, I wanted to grow X as a crop and I wanted to grow say O as a crop ok. So these are my crops, and now I increase the area of these crops many fold, many many fold increase ok, acres after acres, hectors after hectors I am going only now your either C, X and O and the way I grow probably a lot of Cs like this, lot of X like this, lot of Os like this. Now in the system insects are the same.

Now for I insects think about yourself in this situation, for you here I come I say I am the insect I prime, so I have to hunt down where is so my choices are X, Y, Z fine. Now I have to hunt up and come here, then I have to hope down here for you so, that hope down here and

likewise () (13:09) which is the lot of work for me similarly for I double prime I come here, I hope to here I from there hope here, my family and everything.

And similarly for I three primes so come here then move here, now I see that I, I prime the insect, whose target is X, so which one I will prefer shall I go here or shall I come here. Because if I come here I know all the plants are X X X X X X likewise. So for me to acquire resources will be much, much more easy out here, similarly for the O I triple prime so we have lot of Os.

So in other words what we are saying is the modern form of agriculture, what the word through the ages since mankind learn how to grow crops has believed in a word called homogenous or homogeneity. Yet nature is a heterogeneous mixture, yet we know in a heterogeneous system you cannot really feed at a McMillian. So your options are very clear, you will have this strategy out here.

And you have to work around it, now in order to counter your pest in the form of insects and by the way this could even microbes instead of say I, I can put it as M, M prime, M double prime, M triple prime. So these are the microbial infestation ok and they may have their own targets. Now in order to counter this we started developing this set of chemicals which after I introduce weeds, fertilizers.

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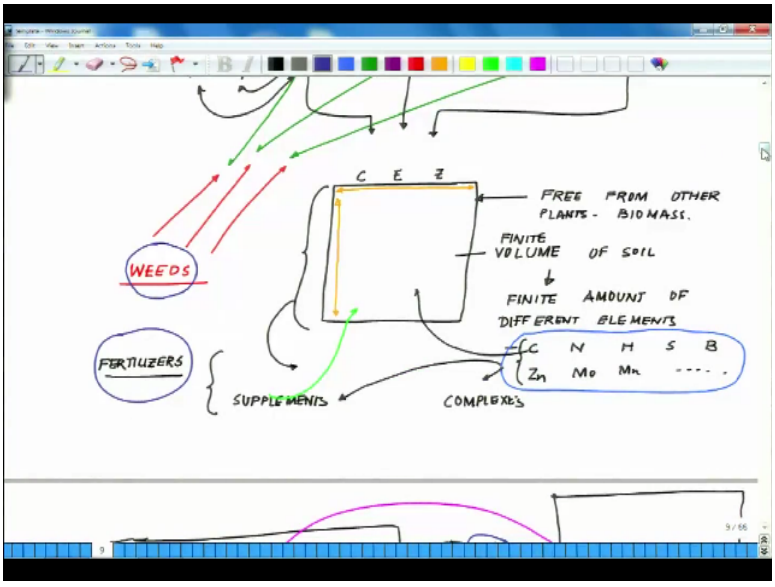

Now I introduce a third thing which is called insecticide and pesticides which will be countering our unfriendly never good which is ok, whereas I did not mention here regarding the weeds.

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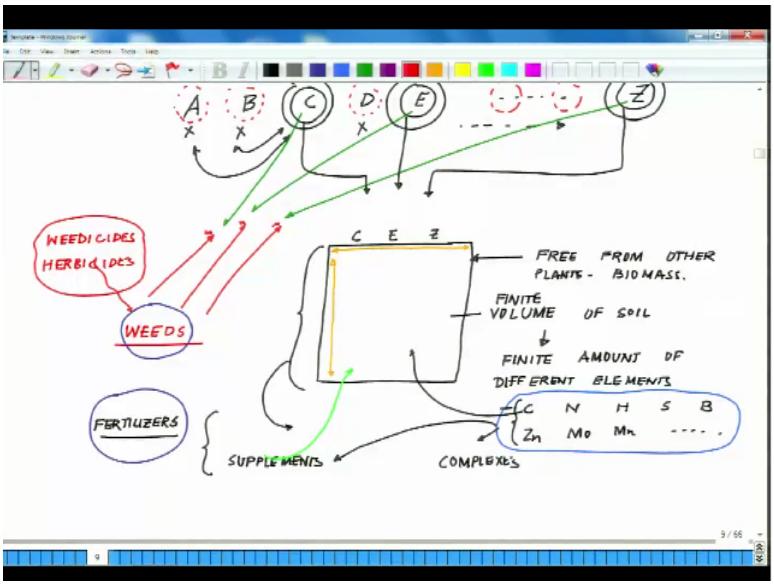

In order to counter the weeds we have different form of weedicides, herbicides, so this herbicides, weedicides are fairly specific to the weed plants as compare to a crop plants. So they are also very very specific chemicals which ensure that weeds die out not the crop plants. So you see in this little this course we are realizing as we as a race mature to become extraordinarily advance agrarian society.

We almost unconsciously become dependent on things which may be nature has seen but nature has never seen them in such a huge quantity because now from nomads we became settled societies, evolution from nomad to human society. A journey which whose origin is learning how to grow plants and which let to extraordinary dry divers with kind of development in the field of agriculture.

But that came because we kept on discovering, kept on developing different form of compounds which either help us to replenish or depleting soil because see we are no more nomads, so that whole strategy we do a cropping at a particular locations. So this kind of things also use to happen at one point like you know.

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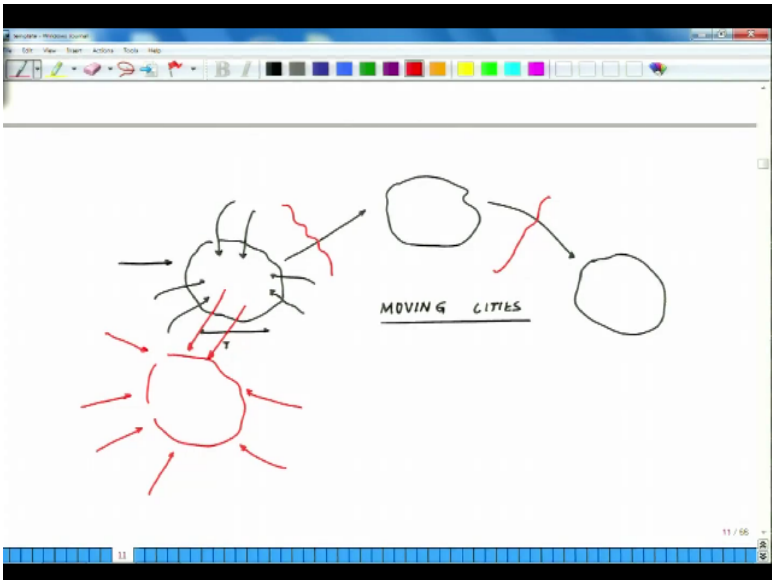

The tribes are moving out here, they grow, they stay there for a while, then grow crops and then they change fast, they move to next place, there they consume the resources and then they move for third place that is the burning, whereas the place what they have left behind over a period of time again by natures action regain its fertility and all other nature resources ok.

But that means if this kind of theory goes then we are talking about something which is unheard of is called moving cities, or moving civilization, yet we know when we talk about cities across the world new york, san Francisco, Delhi, Madras, Bombay, they are cities, they cannot move on from place to place. They have to supply with there has to food chain, they have to be continuously feed in around.

So you cannot add a particular distance, say for example you talk about Delhi or you talk about Bombay, or talk about Madras, see the surrounding this cities you have the agrarian societies which are continues, they are the pipe lines which are continuously feeding the cities. So it cannot happen that city will move along the part and how we do agriculture. So what are your options.

So your this options is gone, you cannot move and this is what has happen, so in an around the cities have developed and this land has that land is finite ok, so this land has to feed not only itself but the surrounding cities, surrounding organ civilization, what are your options, your options are in the previous page, you have to depend on these parameters, reduce the

competition from your selected crops, weedicides, herbicide, fertilizers, insecticides, pesticides.