Nanotechnology in Agriculture
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Lecture-25
Nanotechnology in Animal Production

Welcome back to the lecture series in nanotechnology in agriculture, so today we will be starting another aspect of application of nanotechnology that is an annual production. So whenever we talk about agriculture there are 2 broad areas which comes a front one is the plant side, the other one is the animal side. And if in the animal side if you look at it, so start off with what will be dealing today will be basically nanotechnology in animal production okay.

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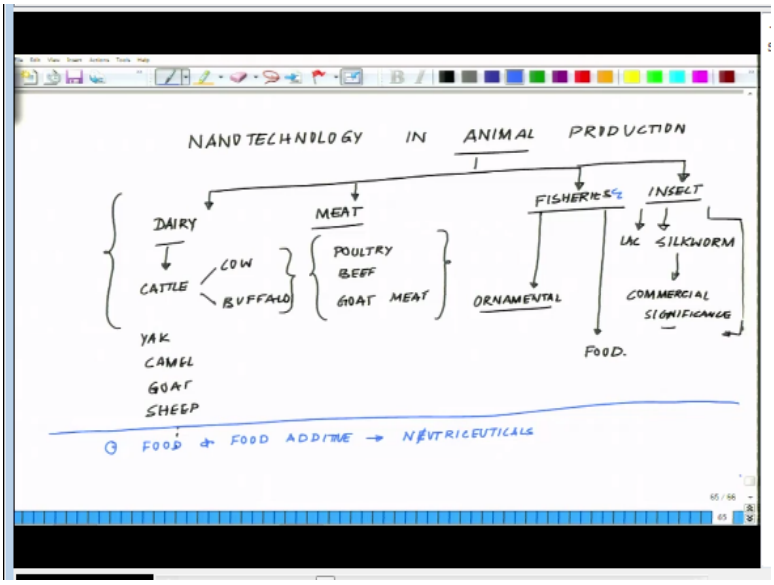

So when we talk about animal production we are essentially dealing with multiple sections of animal and for their multiple utility. So one of the major industry what we talk about will be the dairying, so all the milk producers, then we will be talking about the meat producing animal. Then we will be talking about fisheries and occasionally we can also talk about some of the insect related stuff especially when you talk about something like silkworm.

So this is one way you can classify them or you can classify them based on the animal. But I purposefully focused in this particular classification that way you can see the utility and value of it. So when you talk about the dairy we are talking about a series of cattle which and goat in

Indian context will be cow, buffalo and in a slightly lesser sight. You can have yolk, you can have camel, you can have goat, sheep and likewise series of them.

But the major chunk without here terms of the meat you have poultry, you have beef, you have goat meat. And few others but these are the one which are prominent, in terms of the fisheries you have 2 classes of fisheries one is for the food purpose, the other is for the ornamental fishes which is also very big market. And in terms of insect silkworm Lac and few other insects which has commercial significance.

Now when you talk about animal production what are the areas what is being dealt**,** now when nanotechnology make come handy. So let us make a rough classification of the areas when nanotechnology may be very helpful. So one of the areas where nanotechnology will very helpful will be food and food additives especially as we will be discuss further with this informal discussion.

When you talk about the food additives, so if you look at human nutrition just for that what we are much more familiar with we talk about source of carbohydrate, source of protein, source of lipids, or facts. Then you have vitamins, minerals now in animal nutrition it is pretty much the same, you need carbohydrate, you need protein, you need fat, you need lipids, you need minerals. Now one of the challenging part is delivery of minerals, nutraceuticals.

It is a big area and it is a huge market are there wide open and not only that this has significance in animal world, it has significant in human world too where you have to deliver a small amount portend amount and without causing any side effect, that is why it comes pretty handy. So food and food additives okay, so that falls under the family of your nutraceuticals, that is one of the big big area.

So, essentially in a nutraceuticals when we talk about we are talking about feeds supplement at the nano scale okay.

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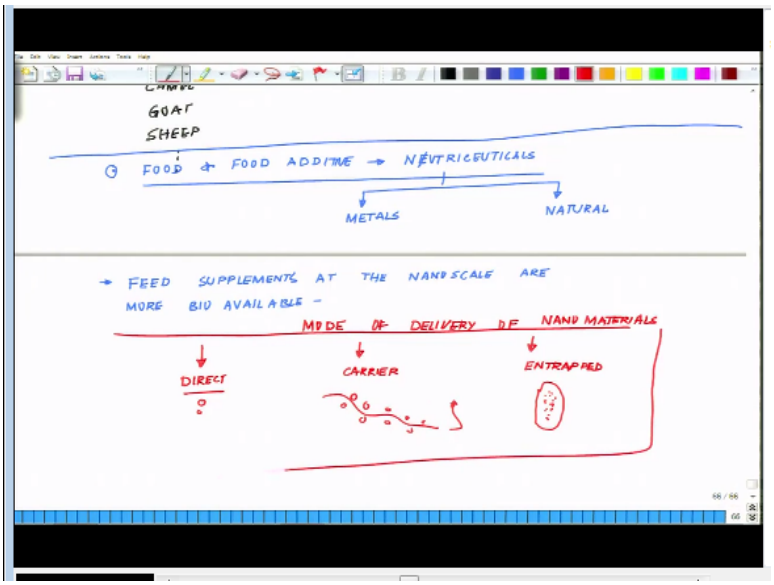

So, feed supplement like minerals and vitamins feed supplements at the nano scale are more bioavailable or in other word they are absorbed much more easily. And we will talk about later how these are being absorbed to animals as compared to the micro scale and occur in the gut and better absorbance okay. So this is one aspect, now these food and food additives are nutraceuticals could be sources of minerals and metals mostly which is falls another, mineral category metals or this could be natural okay.

There are several natural food additives which are available, this aspect of nutraceuticals is exceptionally important from the animal production point of view, say for example there are several poultry animal who produces x which are very pretty fragile like you know. The shell is kind of weak it cracks it cracks because there is a possibility that the poultry which is producing it is not getting proper calcium support okay.

Similarly in other quality of the yolk kind of goes down, so all these things falls under that trace nutraceuticals supply. So from most of the farmers this area of nutraceuticals, animal farmers is exceptional important and again one of the challenging part of nutraceuticals is the absorbance in the gut. How fast it can absorb because when we talk about nanoparticle you are realizing nanomaterial, so there are 3 modes by which you can really delivered.

You can just I am addressing from the aspects, so the mode of delivery if you look at it very carefully, mode of delivery of nanomaterial. So one it could be direct or second it could act as an career to deliver something or it could be interact in something some kind of like a capsule okay. So, it is something like you know a capsule you have and you have the nutraceuticals in trapped in it all you have they act as a career like this for the delivery of it or directly they enter okay.

Now nutraceuticals could be delivered in all these 3 formats depending on how the gut is absorbing the nutraceuticals. So, this is one of the very critical aspects and we will talk little bit more once you enumerate where all in animal production nanoparticle may come pretty handy okay.

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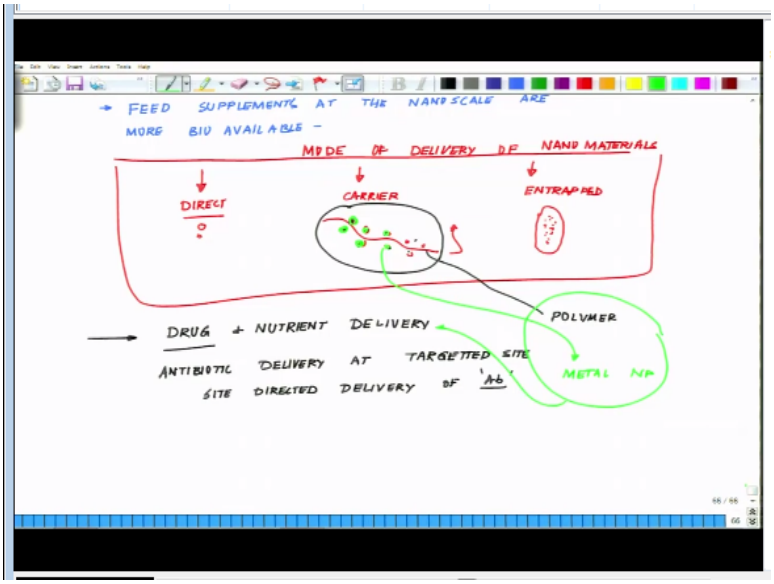

So, the next area of interest is where lot of investment is happening is the drug and nutrient delivery. When you talk about drug and nutrient delivery it can be loaded with traditional antibiotics and may act as a shuttle to release them. When enclose proximity to a pathogen, so basically when you talk about drugs we are talking about antibiotic delivery at targeted site. So site directed delivery of short term I am writing antibiotic is Ab okay antibiotic.

Similarly metal nanoparticle may be conjugated to a polymer for a combined nutrient biocide delivery approach okay. So exactly something like that metal nanoparticles will be these are the metal nano particle there we conjugated with polymers and suppose this one is the polymer okay

and these are the nanoparticle here. So, conjugating the metal nanoparticles, these are the NP nanoparticle and this could be a very portend way for nutrient delivery as well as nutraceuticals delivery.

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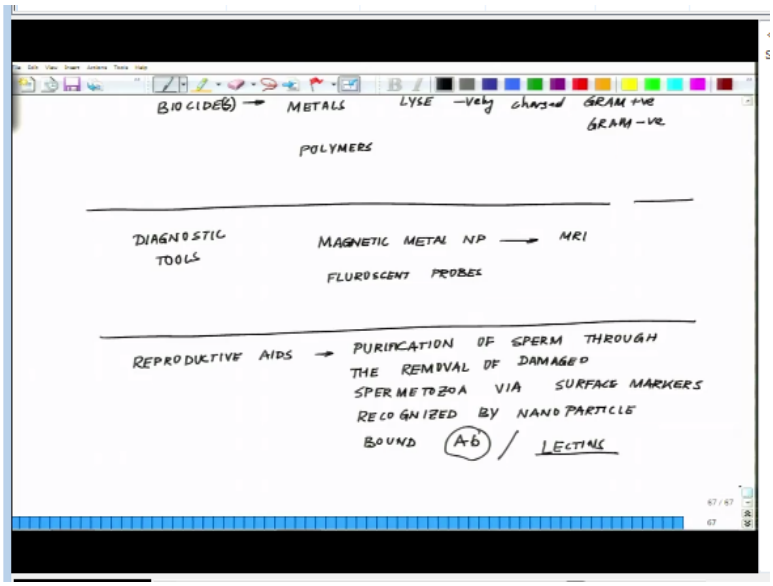

Similarly they are application as biocides, what are biocides, so basically they are either the metals of the polymer lies negatively charge gram positive or gram negative bacterial cell wall oaky. It could be used as biocides like you know pesticide or something which is antimicrobial okay, so this could be either metals or polymers and they could lies negatively charge gram positive bacteria or gram negative bacteria.

Similarly this polymers could destabilize bacterial cell walls such as such that the homeostress is distracted and to the lethal extent okay. In the same line there is another area which is extremely important animal production is the diagnostic tool. So the diagnostic tools could be again could be of 2 kinds they could be the magnetic nanoparticles as diagnostic tools magnetic metal nanoparticle for the MRI magnetic metal nanoparticle for MRI application magnetic resonance imaging application or FMRI.

Similarly fluorescent probes are also available for diagnostics applications okay like 2 photon applications and all. The next important area but there is tremendousness scope is reproductive aids, the reproductive aids we are talking about the purification of sperm through removal of

damaged sperm matters are why surface marker recognized by nanoparticle bound antibodies or electrons okay.

So, this is especially for this sperm bank where good quality sperm from high producers are being conserved or preserved. But in order to do that you have to ensure that your sperm quality is being maintained, so in that process you have to remove the damaged sperms. So that it the material which is coming out from the lysed sperm, does not damage the surrounding sperms okay for that.

So what could be done is purification of sperm through the removal of damage spermatozoa, through the removal of damaged spermatozoa via surface markers recognize by nanoparticle bound antibodies Ab stands for antibodies or Lectins. Lectins are carbohydrate binding proteins okay.

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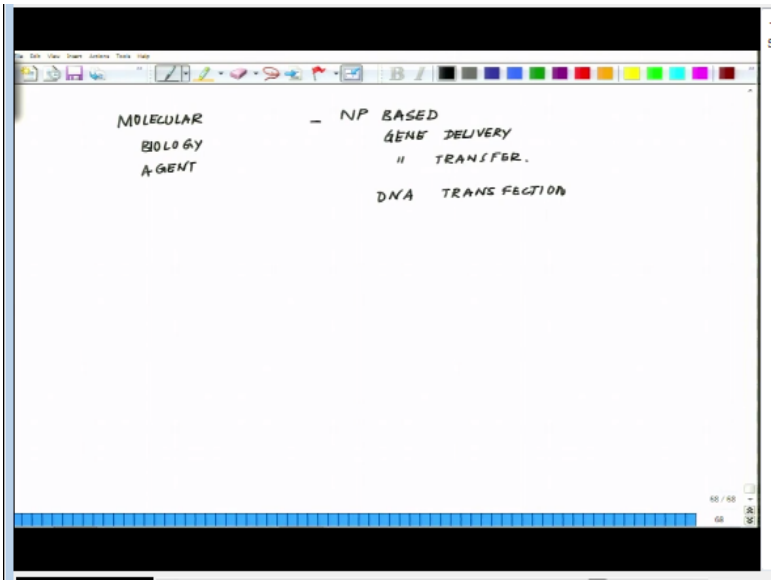

Next important aspect is the molecular biology agents which is essentially the biotechnology agent molecular biology agents in the veterinary medicine. So, which includes nano particle NP stand for nanoparticle, nanoparticle based gene delivery, gene transfer similarly DNA transfection. So if you look at it now if I have to summarize the areas where it all, so starting from drug to nutrient delivery to nutraceuticals, biocides, diagnostic tool reproductive aids and molecular biology agent.

So, if you look at this spectrum of application of nanotechnology in annual production the spectrum is pretty wide. There are multiple level where nanoparticle or nanomaterial find a applications in annual production starting from production diagnostics to reproductive aids so and, and so for. Now they are several criteria by which one has to go through before these products or these kind of stuff could be commercialize like you know what is a toxicity level. How much we are injecting into the system.

There are several rules or several regulations by different federal governments which takes care of it. So as well proceed through will be talking about some of these technologies where nanoparticle different kind of nanoparticles have find application in increasing the muscle mass will be talking about especially with respect to cerium oxide increasing the muscle mass, will talk about some of the nanomaterials which have been used of gene delivery.

We talking about some of the nutraceuticals which have increased the milk production or egg production exactly the same as we talked in the agriculture the different nanomaterials. Here also we will follow a sequence where will kind of enumerate them and this list is going to go up. Because more and more we are understanding nano biotechnology and its applications biotechnology will have line share from nanoscience in the years to come.

I will closing here, in the next class we will take a specific examples of nanomaterials which are helping in or which are assisting in animal production okay thank you.