

Episode- 36

Agricultural Biodiversity-The basis of sustained existence

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Synopsis

The episode deal with the importance of crops and animal stock diversity and their importance for sustainable development. The episode also throws light on modern agriculture practices and loss of traditional knowledge system along with their impact of green revolution on environment. The serial conclude with a message on adopting eco-friendly practices to ensure sustainable development.

Characters:

Dr. Raman (Scientist)

Dr. Neil: (Head of a scientific institutions)

Dr. Ananya (Scientist)

Dr. Balwinder (Senior Scientists):

(Sounds of people talking in loud voices)

Dr. Raman: Why isn't there a need for technology? We need it for improvement in the farmer's condition as well as for food security...

Dr. Neil: Raman, who said we do not need technology. Just see what is the topic under discussion and look, where you are taking it.

Dr. Raman: OK, so what IS (emphasis) the topic under discussion?

Dr. Ananya: Well, the topic is sustainable agriculture or satat krishi and how to establish this system. And just as Dr Neil has pointed not one out of the four of us here are anti-technology in any way like you are unjustifiably trying to paint us.

Dr. Balwinder: Oh ho! Why are you three fighting? Remember, how nine years ago we four decided to meet every Saturday and debate any given topic...and since we are scientists we would also publish in the institute's magazine and website.

Dr. Ananya: That is exactly what I said Dr Balwinder.

Dr. Balwinder: No, Dr. Ananya. You are not discussing. You are arguing.

Dr. Raman: And Balwinder, what is the difference between the two?

Dr. Balwinder: One argues to make others accept your version of the truth. Discussion is the search for the truth. That's all.

Dr. Neil: Well said, Balwinder and on that note let's all enjoy a cup of coffee...here let me take your mugs.

(Sound of a microwave door being opened and then; beeps)

Dr. Balwinder: The microwave is such a fantastic contraption. It heats up milk so quickly and coffee is ready in a jiffy.

Dr. Raman: Percy Spencer.

Dr. Ananya: Percy Spencer...who?

Dr. Raman: The inventor of the microwave.

All laugh.

Dr. Neil: Coffee is ready!! Raman, your observations about technology are OK tell me, can any technology be an alternative to biodiversity? Take agriculture for example, there used to be such a fantastic biodiversity in play...and now...alright maybe still a little of it is left...yet I feel technology has adversely affected biodiversity.

Dr. Raman: Prove your allegation, Dr Neil.

Dr. Balwinder: Arrey Raman, it used to be said that India used to have one and a half lakh varieties of rice cultivars. The gene bank in Delhi stores about 50 thousand varieties and the International gene bank has over One lakh varieties.

Dr. Raman: What is the point you are making Dr Balwinder? Everyone knows these facts.

Dr. Balwinder: Ah! But after 1960, i.e., post Green Revolution only a handful of cultivars are grown on a commercial scale. So where did biodiversity take refuge? In the fridge?

All laugh.

Dr. Ananya: You are all aware that Nikolai Ivanovich Vavilov included India in the list of 8 places that he considered were the centres of origin for crop plants.

Dr. Neil: Yes, according to Vavilov, about 166 species of crop plants originated in India. And the wild ancestors or genetic relatives of about 320 other crops can be traced to India too.

Dr. Balwinder: Yeah...Rice, pulses such as Arhar, Turmeric, Ginger, Peppercorns, Bananas, Bitter gourd, Aubergine, Okra, Coconut, Cardamom, Jackfruit, Sugarcane, Bamboo, Indigo, Amaranth, Mango....and who knows how many other agriculturally important species have been gifted by India to the world.

Dr. Neil: Rice is indeed India's premier gift to the world. And just imagine the enormous genetic diversity present in the many varieties of the species of fruits, vegetables and spices that you just named.

Dr. Raman: Explain please.

Dr. Neil: Arrey Raman, didn't Dr. Balwinder just say that we have safely preserved about 50 thousand varieties of cultivars for just rice alone and it is possible that there were 2 lakhs or more varieties. And take mangoes for example...there are over a thousand varieties ranging in size from that of an almond to a water melon.

Dr. Balwinder: Don't forget the humble aubergine or brinjal. It can be round and fat, or thin and elongated. It can be small or large. It can be green, white or dark purple. These are manifestations of genetic diversity.

Dr. Ananaya: Yes, in Garhwal it used to be a common practice to sow Baranaja.

Dr. Balwinder: Baranaja? What is that, Dr. Ananaya?

Dr. Ananya: Baranaja or Barah-anaj ...it means 12 types of seeds. The farmer used to sow these 12 species on one small patch of land...he would plant Rajma or kidney beans. Pulses such as Urad, Moong, Kulthi, Ramdana or amaranth, Madua, Jhangora, Bhaat, and Lobia. These would be grown as mixed crops...basically a fistful of assorted seeds would be scattered and these would sprout and flourish.

Dr. Raman: But this way the plants species would sprout here and there...how could one systematize the growth? Management would be difficult.

Dr. Neil: Not really Raman. See different crops ripen at different times. So harvesting times differ too. Besides, when you grow mixed crops, it is unnecessary to add

fertilizers or manure etc., as naturally the fertility of the soil becomes enhanced and there is no need for insecticides etc., as well.

Dr. Balwinder: And the best part is that the entire family is assured to nutrition for the entire year.

Dr. Raman: But management? How would they manage it?

Dr. Ananya: Dr. Raman, in our country the small and marginal farmers constitute about 86 per cent of the agricultural community. These farmers individually own less than 2 hectares land and for them it is not at all difficult to manage mixed farming. It is economically more profitable too.

Dr. Balwinder: And Dr. Raman one factor that tilts the scale in favour of the small and marginal farmers is that they are capable of enormous labour. Management is hardly a problem when every member of the family is ready to toil in the field.

Dr. Neil: Rightly observed, Dr Balwinder! And it is not just in the matter of crops but in case of cattle too, India has enormous genetic diversity. India has about 40 varieties of recognized breeds of indigenous cows...unfortunately quite a few have become extinct perhaps even before being accorded due recognition.

Dr. Raman: India is globally recognized for biodiversity. The question is not that...I am wondering if just biodiversity is enough to fuel sustainable development. Don't you need technology. Would our granaries be overflowing without the Green Revolution? The future is dependent on technology...can anyone negate this statement?

Dr. Neil: The future belongs to technology, right. Even the present. But sustainable development courtesy only technology...I mean without the involvement of Nature...is that at all possible?

Dr. Raman: Nature is under the control of mankind. And mankind will decide the direction that development will take. Not Nature!

Dr. Ananya: Dr. Raman is Nature truly under the control of mankind? Let me explain using a small example. Recently, the well known agriculture-scientists placed some findings pertaining to organic fertilizers before Committee of Estimates under the Ministry of Agriculture. Some truly electrifying facts came to light. One such fact was that because of the unscientific and rampant use of Nitrogen, Phosphorus, and Potassium, the ratio of NPK in Punjab has reached the dangerous level of 39:9:1 whereas the optimal ration is 4:2:1. This is probably because Urea is relatively easy to procure. And relatively cheap as well. So, the farmers used lots of Urea and the Nitrogen content of the soil became extremely high.

Dr. Balwinder: Yes, and our national ratio of NPK is quite high too. It is 7:3:1 instead of the internationally accepted 4:2:1.

Dr. Neil: Rightly said, Balwinder. And not only that, do you know Dr. Raman that the scientists said that in the early days of the Green Revolution one Kg of NPK fertilizer resulted in 50 kg of agricultural produce; now it is only 10 kg. This actually translates to much less produce even though much more fertilizer is being used.

Dr. Ananya: Now, less production yet increased use of fertilizer indicates that the fertility of the soil is decreasing. And this in turn means more expenditure for the farmers.

Dr. Raman: So was the Green Revolution a wrong step?

Dr. Neil: No, Dr. Raman. The Green Revolution was a demand of the times. Today we are food-secure. This makes us responsible for the environment, for health and the generations that will follow ours.

Dr. Balwinder: This is why we must pay attention to Ecology even as we develop technology. This way it will be possible to ensure sustainable development.

Dr. Raman: But how can we decide which technology is right and which is wrong? Because technologies are controlled by companies and each company claims that its technology is the best and markets it as such.

Dr. Neil: The Silent Spring is a book written by Rachel Carson in 1962. This was the first time that the adverse effects of pesticides used in the fields were brought to light.

Dr. Raman: Dr Neil, the companies did counter Rachel Carson's claims quite fiercely.

Dr. Ananya: So what? The ill effects of chemical pesticides are evident now!

Dr. Neil: The debate wasn't just chemical vs organic. Basically we gave up living in harmony with nature. Silent Spring shook the world. And even at that time there was concern about biodiversity...but the companies are huge...colossal.

Dr. Raman: But Dr. Neil, is it possible to guarantee food security without the use of pesticides? In this era of intensive agriculture, when enormous areas are under mono culture which necessarily attracts more pests...can we do without pesticides and yet hope for good crops?

Dr. Balwinder: This is correct observation on your part that monoculture on intensive scale has given rise to some problems. That is the reason why mixed cropping, i.e., sowing two or three crops together on the same land is now being discussed. As far as the use of insecticides goes; biological agents such as

other insects can be used to kill insect pests. And bio-control agents are being used too!

Dr. Ananya: Ah! You are referring to the biological control of pests. And this is possible only because of the genetic diversity present among the insects. Yet, farmers have not exactly embraced the process; it is easier for them to spray chemicals.

Dr. Balwinder: No, No Dr. Ananya. Our traditional Knowledge says Keet *niyantranaya Keet he Asto-amogha*. This means for the control of insects; insects are invincible weapons.

Dr. Raman: What are you saying Dr. Balwinder? I admit that biodiversity is essential but to believe what you are saying...that is difficult in this day and age.

Dr. Balwinder: On the contrary Dr. Balwinder...let me give you the example of Needhana village in Jind District, Haryana. Dr. Surendra Dalal worked with the villagers since 2010 educating them about insects. He set up the Keet Saksharta Pathshala or a school dedicated to learning about insects. It was an insect-literacy campaign. Soon, the farmers realized that insects are part of nature, just like we are. They became aware that each species has a part of play as natural cycles unfold. There are no friend insects or enemy insects, per se.

Dr. Neil: Yes, today thousands of farmers have joined the Keet Pathshala. There are farmers who have not used a drop of insecticide in their fields for the last six years. Interestingly, their returns outstrip the returns of those farmers who rely on chemical insecticides.

Dr. Raman: How is that possible?

Dr. Balwinder: In Needhana village, the womenfolk celebrate Khet Diwas and thousands of farmers participate in the event. They learn about insects from the women of villages such as Needhana and Lalitkhera.

Dr. Raman: Interesting; how come the womenfolk are so active?

Dr. Neil : Dr. Raman, even today it is women who shoulder 80-90 per cent of the work in agricultural fields. And these women of Jind District in Haryana have decided that they will not serve up a daily dose of poison on the plate. So not only have they mastered the techniques of how to carry out farming without using pesticides but are teaching others too.

Dr. Balwinder: Yes indeed, Dr. Neil. Let me tell you an interesting fact. The womenfolk and also, the farmers here have identified 204 species of insects. Out of these 43 eat flesh and can be said to be non-vegetarians. 161 eat parts of plants and can be considered to be vegetarians. Now, generally speaking it is believed that vegetarian insects are pests and flesh-eating insects are friends.

Dr. Neil: Unfortunately when we use pesticides indiscriminately, the population of vegetarian insects shows growth. That is the pest population flourishes!

Dr. Ananya: Oh!

Dr. Balwinder: These farmers and the women folk inspect the fields like scientists using magnifying lenses and study the life cycle and behaviour patterns of these insects. They found that pests feed voraciously on the different parts of the plants and make tiny holes. In October this happens naturally to allow sunlight to penetrate to reach the bottom-most leaves so that photosynthesis is carried out easily providing food for the plants.

Dr. Ananya: Wow. Agricultural scientists must have been amazed to see farmers melding Traditional knowledge with science.

Dr. Balwinder: Yes indeed and that is why there is an initiative to harvest the entire knowledge base and techniques on a scientific footing.

Dr. Neil: There is the need to take forward the Keet Pathshala campaign. The most important factors here are the identification of the insects, collection of scientific facts about them and taking the information to as many farmers as possible.

Dr. Balwinder: This is happening too. Farmers are becoming aware about the adverse effects of pesticides. In states like Punjab which is facing the backlash of indiscriminate use of pesticides farmers have realized the importance of insect-literacy campaign. They are coming forward to gather information during such campaigns.

Dr. Ananya: The womenfolk recognize 204 different species of insect and know their food habits too...how wonderful! And they do not use a drop of chemical insecticide. See, Dr. Raman, this is the incredible contribution of biodiversity to agriculture.

Dr. Raman: No one is denying the importance of biodiversity in the field of agriculture. The question is can we rely solely on organic practices or traditionally farmed species to guarantee food security for all? Today, India is globally ranked first in milk production and second in cereal and horticultural produce. Additionally, it ranks first in production of certain vegetables. However, would this have been possible without technology and hybrid seeds? The question still remains. Biodiversity is necessary. However, without input of technology sustainable development is not possible.

Dr. Neil: Dr. Raman, What is sustainable development?

Dr. Balwinder's mobile rings

Dr. Balwinder: Yes, yes. I'll be leaving in half an hour...yes, yes...OK. Bye.

Line is disconnected.

Dr. Ananya: Looks like it was a call from home...did you receive a scolding?

All laugh.

Dr. Balwinder: No...no...that was my daughter. For her college assignment on Monday she has to make a presentation on Milk allergy. She needs my help for the project. No scolding involved.

All laugh.

Dr. Raman: Today is the day devoted to our weekly debate and discussion. Phone calls from home are not allowed because everyone knows that we are engaged in debate and discussion. Dr. Balwinder you should explain this to your family members.

Dr. Raman's phone rings.

Dr. Raman: Yes...Hello. But...but....Ok...Ok...Alright. Ok... Bye.

Dr. Balwinder: What's the matter? It was a call from home, wasn't it? Was it urgent? Did you finish the conversation properly?

Dr. Raman: I received a reprimand.

All laugh loudly.

Dr. Balwinder: Good joke Dr. Raman.

Dr. Raman: Yes indeed when you receive a severe scolding it is best disguised as a joke.

Laughter.

Dr. Raman: Jokes apart, Dr. Neil you had asked what sustainable development is. It is something that can continue forever. It is something that will keep the environment secure. It is something that will not oppress or exploit anyone or anything; not human beings nor the environment.

Dr. Neil: Ok, let me accept your words. So, did the Green Revolution not destroy biodiversity? Hasn't the intensive monoculture prevalent today, not had deleterious effects; both on human health and the environment? Is it possible to carry out agriculture without biodiversity? Is there and creature that is non-essential in the scheme of nature? If the answer is NO, then how are insects our enemies?

Dr. Ananya: We can survive not by clashing with nature but by living with nature. And that is the message we have forgotten. Sustainable development is possible only when we consider ourselves as part of nature and accord the same respect to all creatures.

Dr. Balwinder: So, it is sorted then.... we ought not adopt any technology that is not beneficial to nature and biodiversity. For sustainable development we must draw on our traditional knowledge...so, let's go now. I have to do some research on milk allergy.

Dr. Raman: Why in such a hurry Dr. Balwinder? I am the one who got the scolding, remember? And anyway the reason behind milk allergy will be found to be rooted in Biodiversity too.

Dr. Ananya (in astonished tones): So, Dr. Raman, you admit that agriculture or farming is not possible without biodiversity...and that practices in current use need to be changed.

Dr. Raman: I have been in complete agreement right from the start. However, it is necessary to inject a little fire into debates, and Yes, to explain to Dr. Balwinder about milk allergies I will need to talk about A1 and A2 types of milk. And yes, it is the genetic diversity of our cows that can help fight milk-allergies and a few other illnesses. Our indigenous cattle breeds that is!

Dr. Balwinder: What are you saying, Dr. Raman? Our indigenous breeds? But what is A1 milk? And A2 what is that?

Dr. Neil: Actually the question should be, Can milk be harmful? Is it possible that health problems such as heart diseases, Type 1 diabetes, issues of the nerve cells of the brain ...you know, problems such as autism and all...can all these be triggered by drinking milk? Is it a risk factor?

Dr. Raman: Yes that is the question. Can milk be harmful? Can drinking milk trigger auto-immune disorders-cases where the body's immune system turns against itself. And the answer is ...in many of the cases plaguing India...and the world...the culprit is cow's milk.

Dr. Neil: Quite rightly pointed out. Looks like you have researched this topic very well. But Dr. Balwinder and Dr. Ananya, you need to know... milk from what variety or breed of cow. Since this is a scientific discussion we have to take into account Indigenous or native breeds, exotic or foreign breeds and hybrid breeds.

Dr. Ananya: By hybrid varieties we mean those breeds developed by crossing native breeds such as Sahiwal, Gir, Red Sindhi, or Tharparkar with foreign breeds such as Holstein Friesian, Jersey or Red Dane. But what are A1 and A2?

Dr. Raman: I'll tell you. Look there are many types of proteins that are found in cow's milk. We will limit our discussion today to A-1 beta casein and A2 beta casein. To understand the connection between milk and a host of diseases you will have to understand the differences between A-1 and A-2 beta proteins. We will simply call these A1 and A2 ...OK?

Dr. Neil: Some breeds of cows produce A1 type of milk. Other breeds give A2 type. During digestion of A1 milk, there is generation of bioactive peptide, beta casomorphin 7 (BCM7). It is an opoid, so it is a narcotic. It is an oxidant and leads to generation of free radicals. It is to protect against free radicals that we consume anti-oxidants such as lemons, lime and Indian gooseberry...amla you know.

Dr. Raman: Rightly said Dr. Neil. And BCM7 has been implicated in many illnesses, including heart disease, diabetes and autism to name a few. It has even been called 'the devil in the milk.' It wasn't till a research paper was published in New Zealand in 2007 that we came to know about this devil in the milk...that is, A-1 beta casein. Subsequently, quite a few other research papers have been published on A-1 beta casein.

Dr. Balwinder: Oh! And we have been in the dark about this.

Dr Neil: Actually, a few thousand years ago, a natural single-gene mutation occurred in Western breeds of cows such as Holstein Friesian, Jersey or Red Dane resulting in production of the A1 beta casein protein. Actually mutations are heritable changes in the genes which are units of heredity. Mutations can be triggered by many factors including exposure to UV radiation and to chemicals, collectively called mutagens. So, some 8000 years ago, there was a mutation in the genetic makeup of European cows. Now, because of this mutation, A1 milk differs from A2milk. The difference is in one amino acid in a chain of 209 amino acids; at position 67 A-2 milk has amino acid Proline, while A- 1 milk has the amino acid Histidine.

Dr. Raman: So, those cows that have Histidine in position 67 on the amino acid chain produce milk with A-1 beta casein...the devil in the milk. Those cows untouched by the mutation, produce milk that has enormous health benefits. That is A-2 beta casein enriched milk.

Dr. Neil: It is clear now, isn't it Dr. Ananya and Dr. Balwinder, that the Devil in the milk is A-1 protein and the Angel in the milk is A-2 protein?

Dr. Raman: The interesting fact is that indigenous Indian and African breeds of cows and goats carry the gene for A-2 milk protein. The western countries are aware of the benefits and so, while they may sell A-1 protein containing milk to other countries; they sell A-2 protein containing milk at a premium in their own countries.

Dr. Neil: And they are breeding our native breeds such as Sahiwal, Gir, and Kankrej to increase production of A-2 protein containing milk. This milk can not only prevent the onset of many diseases but also help the ill to regain their health.

Dr. Raman: It is important to realize that India is the world's leading producer of milk and much of the milk is consumed in the country. However, by hybridizing our indigenous cows with western breeds we have introduced the genes for A-1 protein milk into our bovine genetic stock. Maybe because of this India is the Diabetes capital of the world and incidence of heart diseases is on the rise.

Dr. Balwinder: Oh! So this is one of the reasons...well, I am going to start having only milk from A-2 certified Indian breeds. Isn't it amazing that the native Indian breeds that we did not value are being cherished and adopted by the world for sustainable development?

Dr. Ananya: What is truly amazing is that our cattle breeds have evolved to be in sync with our geo-climatic conditions. And that is why it is said that genetic diversity of plants and animals or biodiversity is the cornerstone of agricultural practices. It is our responsibility to save it. Dr. Raman, your words remind me of my late Grandfather.

Dr. Raman: What is it, Dr. Annaya?

Dr. Ananya: My grandfather used to say that buffalo and other mammals may provide milk but the cow gives nectar.

Dr. Balwinder: He was so correct. In our blind race for development...or should I say destruction? ...we forgot our indigenous biodiversity, our own traditionally harvested crops even our native breeds of cows.

Dr. Raman: We have actually forgotten that we need to go back home...get up, everybody. And yes, Dr Ananya, Dr. Neil we had a great discussion today. And Dr. Balwinder, please update the website. Write that without conservation of the environment, without conservation of biodiversity, we cannot hope for development of the human race. Actually that way lies destruction. Irrespective of the technology to be used, it is necessary to study its far-ranging effects. Such studies are especially important in the field of agriculture since it is the basis of our sustenance.

Dr. Neil: That is exceedingly well summed up. But you forgot to add something on our website.

All other three together: What?

Dr. Neil: That Dr. Raman's wife played a key role in catalysing the swiftness with which Dr. Raman reached the conclusion today.

All laugh loudly.

