Soil Fertility and Fertilizers
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Lecture: 32
Soil Health and Quality, Problem Soil, Land Capability Classification (Contd.)

Welcome friends to this second lecture of week seven of the NPTEL online certification, course, of soil fertility and fertilizers. In this week, we are discussing about soil health, problems soils, soil quality, and land capability classification.

In our first lecture of this week, we have discussed about what is soil health, what are the indicators of soil health and also we have discussed about the soil degradation and soil degradation processes. We have seen the overview of world soil degradation and also we have seen the anthropogenic degradation of soil.

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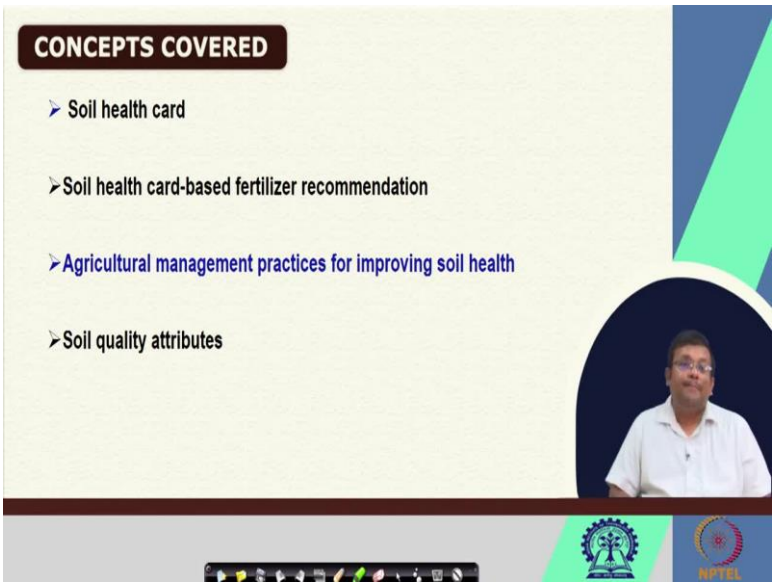

Now, in this lecture we are going to cover this following concept first of all we are going to discuss the soil health card scheme from the perspective of Indian soil management. Apart from that we have also discussed we will also discuss soil health card based fertilizer recommendation and we are going to also discuss agricultural management practices for improving soil health. And also finally, we are going to discuss about soil quality attributes. So, the major focus of this lecture will be soil health card and the related information.

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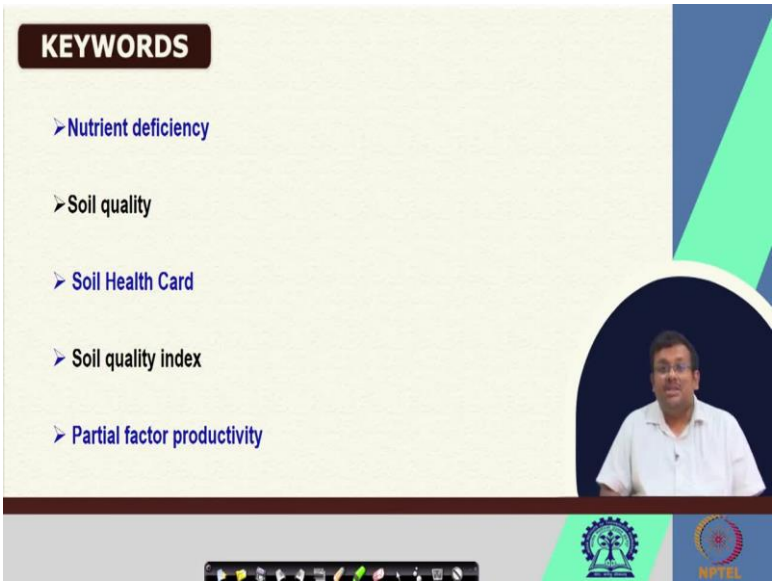

So, these are the keywords for this lecture, nutrient deficiency, soil quality, soil health card, soil quality index, and also partial factor productivity.

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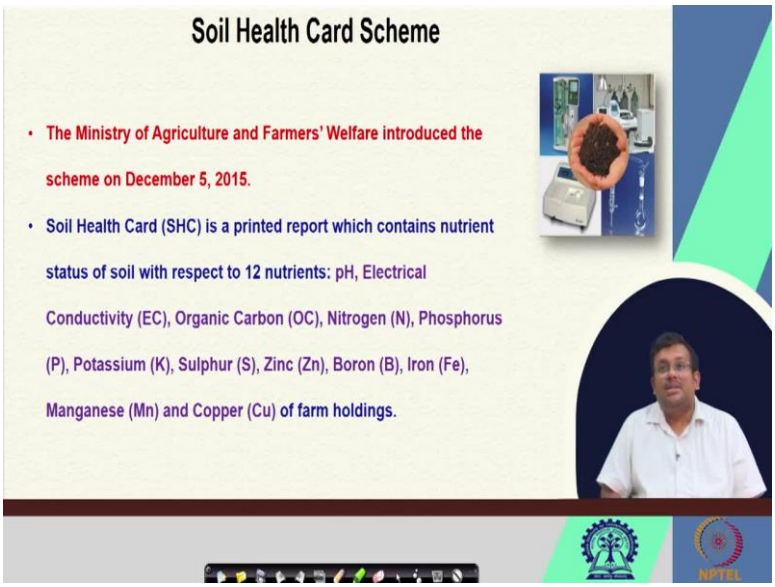

Now, if we start discussing about what is soil health card, it is basically a scheme which was started by the Ministry of Agriculture and Farmers Welfare on December 5, 2015 in India. Now, soil health card or in short form we call it SHC is a printed report which contains nutrient status of soil with respect to 12 different nutrients. So, what are those 12 different nutrients? You can see in the screen they are pH, electrical conductivity, organic carbon, nitrogen, phosphorus, potassium, sulphur, zinc, boron, iron, manganese and copper of farm holdings.

Now, when I talk about these nitrogen, phosphorus, potassium, sulfur, zinc, boron, iron, manganese and copper, remember that these are all available fractions. So, as a whole, when we are measuring these 12 fertility properties we can give and we can also have a overview of the fertility status of the soil and we can accordingly give the recommendation.

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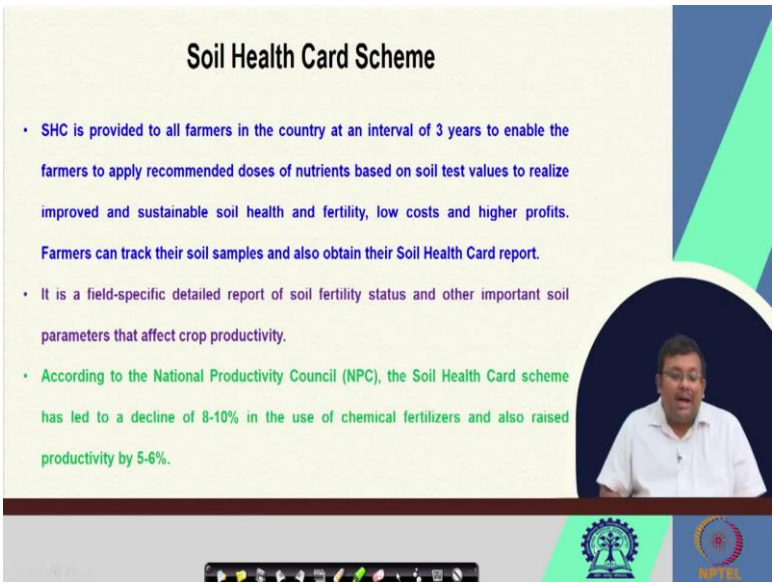

Now, this what is the requirement for the soil health card? So, the soil health card is provided just like a prescription. This soil health card is provided to all the farmers of the country at an interval of 3 years to enable the farmers to supply or apply recommended doses of nutrients in the soil based on soil test values to realize improved and sustainable soil health and fertility also to a low cost and higher profits.

So, remember that the sustainable soil management has become an important agenda for Indian subcontinent, because here we can see a huge amount of soil degradation. Now, government has given emphasis for maintaining the soil health and maintaining and sustaining the soil health. So, the soil health card scheme basically aims to give the soil health card to the farmers of the country at an interval of 3 years.

It is a field specific detailed report of soil fertility status, and other important soil parameters that affect crop productivity. Remember that farmers can track their soil samples and also obtain their soil health card report from online, from the website of Soil Health Card.

According to the National productivity council or NPC, the soil health card scheme has led to a decline of 8 to 10 percent in the use of chemical fertilizers and also raised productivity by 5 to 6 percent. So, with the help of the soil health card scheme, it is possible it was possible to

increase the productivity and decrease the use of chemical fertilizer for sustainable soil management.

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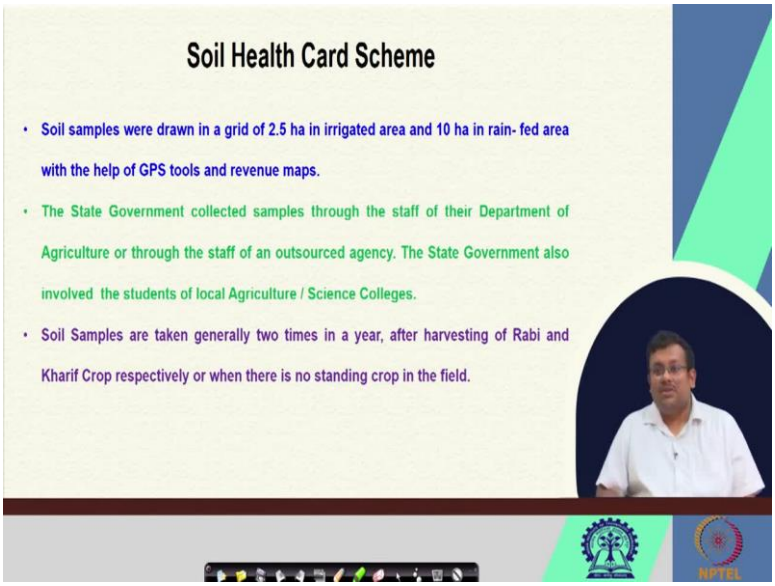

Now, remember, in this scheme, soil samples were drawn in a grid of 2.5 hectare in irrigated area and in 10 hectare in rain fed area with the help of GPS tools and revenue map. So, one sample was collected per 2.5 hectare of irrigated area and one sample was collected for per 10 hectare in the rain fed area. And in this way, the soil health card scheme covered all the states and union territories in India.

Now, the state government generally collected samples to the staff of the Department of Agriculture or through the staff of an outsource agency. So, there are different outsource agencies and the state government also involved the students of local agriculture and science colleges for collecting the samples and analyzing the samples. Now, soil samples are taken generally 2 times in a year after harvesting of rabi crop or winter crop and kharif crop or rainy season crop respectively or when there is no standing crop in the field. So, this is how the soil samples have been collected for the soil health card scheme.

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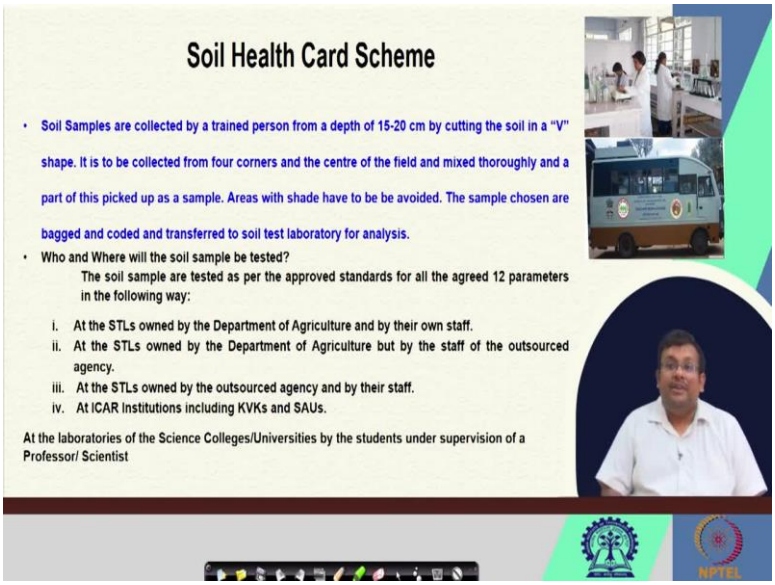

So, soil samples are collected by a trained person from a depth of 15 to 20 centimeter by cutting the soil in a V shape. We have already discussed in our previous week lectures that how to collect these V shaped for a slice. It is to be collected from four corners and the center of the field and mix thoroughly and part of these picked up as a sample I have already told you how we can collect the samples and then how we can make a composite sample from multiple samples and then how we can do the quartering method to reduce the sample size.

Remember that areas with shade have to be avoided. The sample choosing are bagged and coded and transferred to soil test laboratory for the analysis. Now, the question comes where the soils are being analyzed. The soil samples are tested as per the approved standards for all the agreed 12 parameters in the following way. First of all, at the soil testing labs owned by the Department of Agriculture by their own staff and at the soil testing lab owned by the Department of Agriculture but the staff of the outsourced agency and at the soil test laboratories owned by the outsourced agency by their staff.

And at Indian Council of Agricultural Research Institution including Krishi Vigyan Kendra and State Agriculture Universities. So at the laboratories of the science also at the laboratories of the science colleges or universities by the students under supervision of a professor or a scientist. So, these are the places where we can get these soil samples tested after collecting.

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Now, the next question comes to our mind how the quality of the soil test is ensured? So the state government refer 1 percent of the sample in a year to a referral laboratory to analyze and certify on the results of primary laboratory. The state government helps to establish also referral laboratories as required.

So, next question comes to our mind what is the payment per sample? What is the cost for analyzing one sample? So, an Indian rupees of 190 per sample was generally provided to state government by the federal government or central government. And these covers the cost of collection of soil sample its test, generation and distribution of soil health card to the farmer.

And what is the total outlay of the scheme we will see in a minute the number of total soil health card which were distributed, but the total outlay of the scheme is rupees 568.54 crore for a period of 3 years and the scheme has been rolled out in the field during 2015 to 16. And there are 2 phases first phase and second phase then we will see the details in a minute.

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Apart from that, there is another program called Model Village Problem. So, it is a pilot project that is development of model villages is also being implemented by the Ministry of Agriculture and Farmers Welfare in the financial year 2019 and 20. So, please note that this project is different from the Saansad Adarsh Gram Yojana or SAGY which was launched in October 2014 with the goal of developing the socio economic and physical infrastructure of the villagers.

Now, what do you mean by a development of model villages. So, under this project, a model village is selected for aggregation of soil samples and analysis of each agricultural holding and the program promotes farm holding based soil sample collection and testing with farmer's participation. So, this is in a nutshell this model village program.

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So, if you go to the website of the soil health card, you will see that the advisories are given and the major objectives of soil health card program is to provide the information to farmers on nutrient status of their soil. And it also provides recommendation on appropriate dosage of fertilizers to be applied for improving the soil health.

And remember that the soil health card based nutrient application promotes balanced and judicious use of nutrients and that is why there has been a decline of chemical fertilizers you use. So, it also the soil health card program also promotes integrated nutrient management which results in reduced consumption of chemical fertilizer we have already covered that and application of fertilizer based on soil health card recommendation avoids under or excessive use of fertilizer and thereby it increases the profit.

Now you can go and farmers can register or farmers can get more information regarding the soil health card scheme in the following websites I am going to show you and also there is a website, there is a website where you can calculate the fertilizer dose based on the soil health card recommendations.

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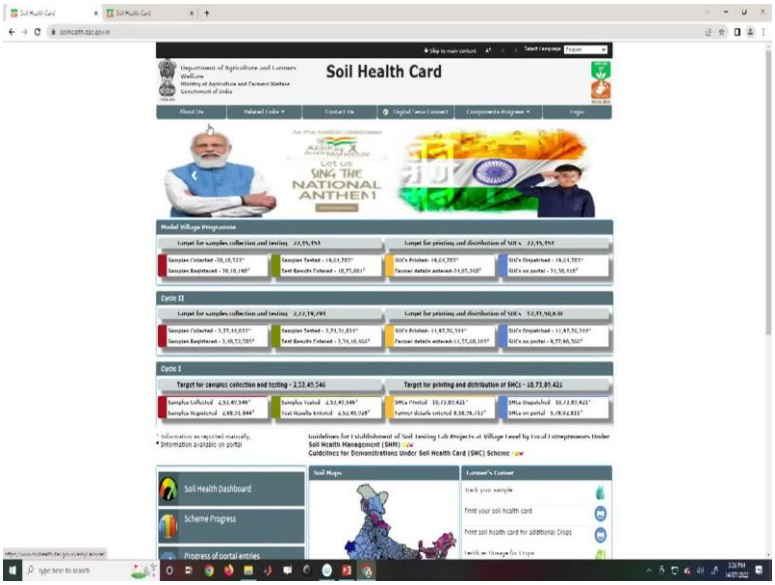

So, if we go and see the websites, so, this is the website of that soil health card, and you can see that all the details are being mentioned here and the current status are being mentioned. We can see there are 2 cycles of the scheme cycle 1 and cycle 2 and in the cycle one the target for samples collection and testing was 2,53,49,554 and target for printing and distribution of soil health card was around 10 crore and but these are the actual scenarios.

So actually 2,53,49,546 samples were collected and 2,88,00,000 samples were registered. So, 2,53,00,000 samples were tested and test results enter for 2,52,00,000 total soil health cards printed were 10 crore around 10 crore and farmers entered were 8 crore and so and dispatch, soil health card dispatched 10 crore and soil health cards on portal is around 5 crore. So, you can see that this is the first phase and the second phase target for sample collection and testing is around 2,72,19,794 and these are the current status. Apart from that this model village program status is also given here.

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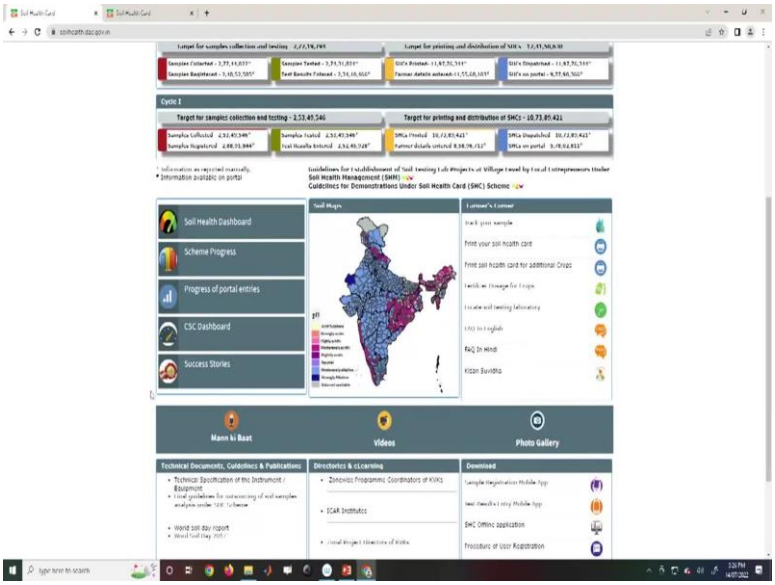

So, anybody can go and see the current status and farmers can track their samples. So, they can track their sample the status of their sample testing, they can print their soil health card and they can also print soil card for additional crops and they can calculate the fertilizer dosage for crops and they can also look at soil testing laboratory nearby to their place. And also in the soil head dashboard and scheme progress if you click on the scheme progress.

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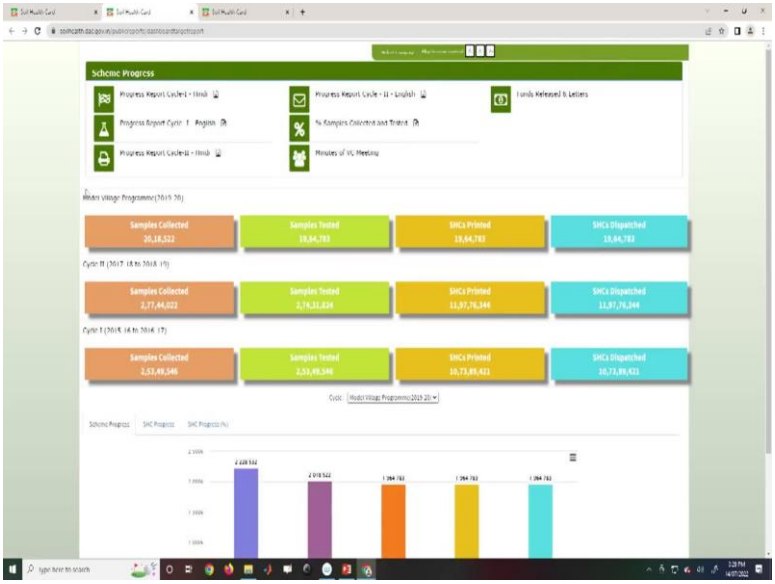

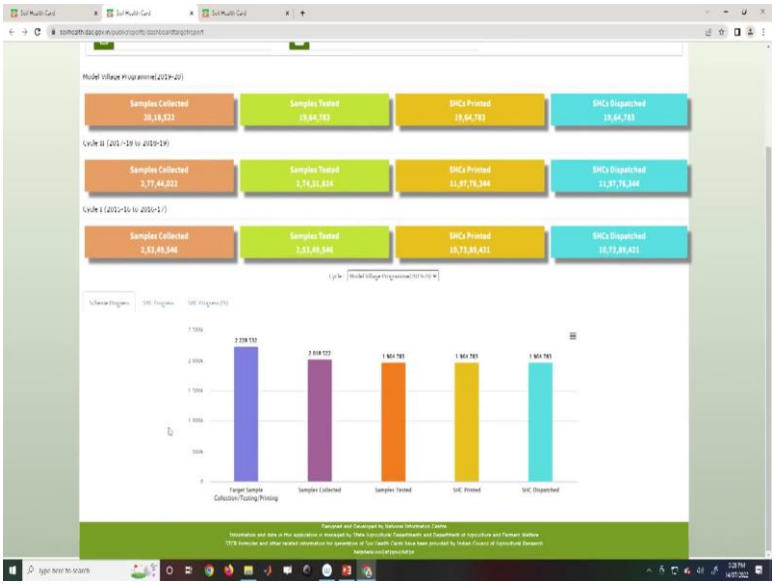

You can get and current scenario of what is the progress of the scheme and what are the target what is actually the sample collected and samples tested and state wise you can also get the information.

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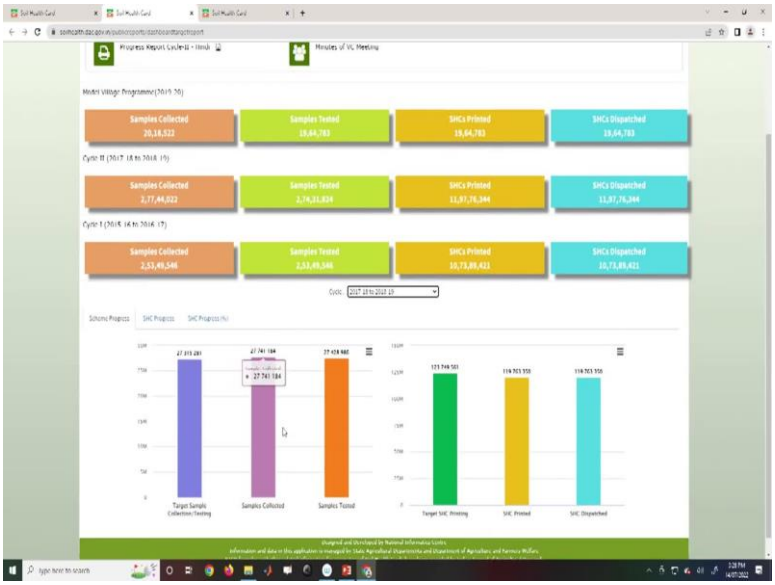

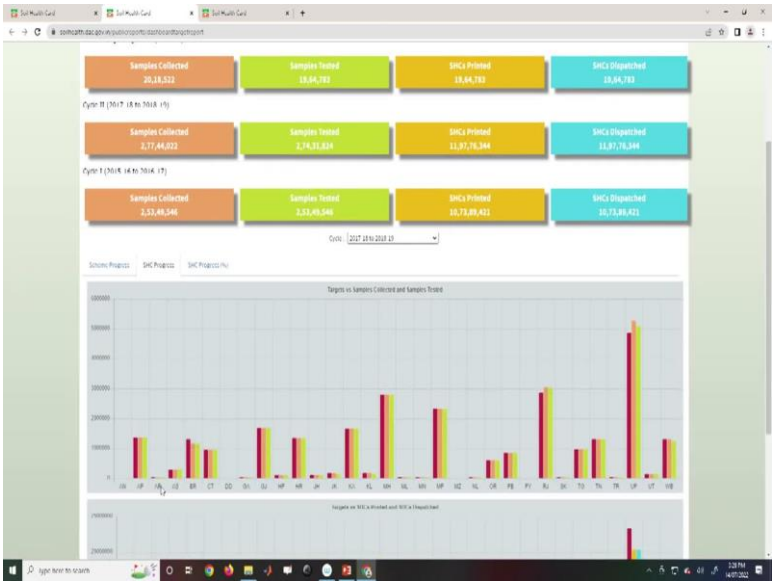

So, for model village program for soil health card program, you will get all the information for also you can get the state wise progress. So, you here you can see the state wise progress of the of the second cycle of soil health card program.

So, these websites are pretty much useful for generating the soil health card and these are very user friendly and farmers can download their soil health card from this website. So, this is the soil health card.

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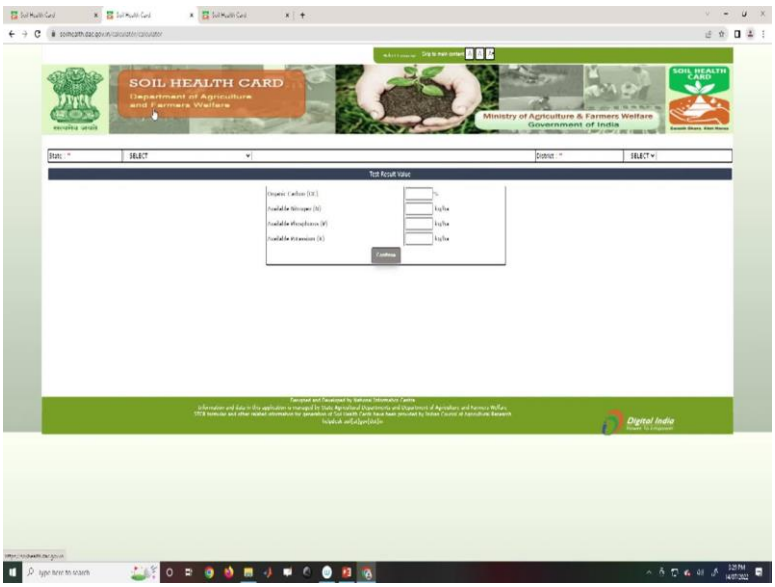

Now, also there is a link for fertilizer dosage calculation. So, if we just go to that website and see what is there? So, this is the website where you can calculate your fertilizer based on the report of the soil health card.

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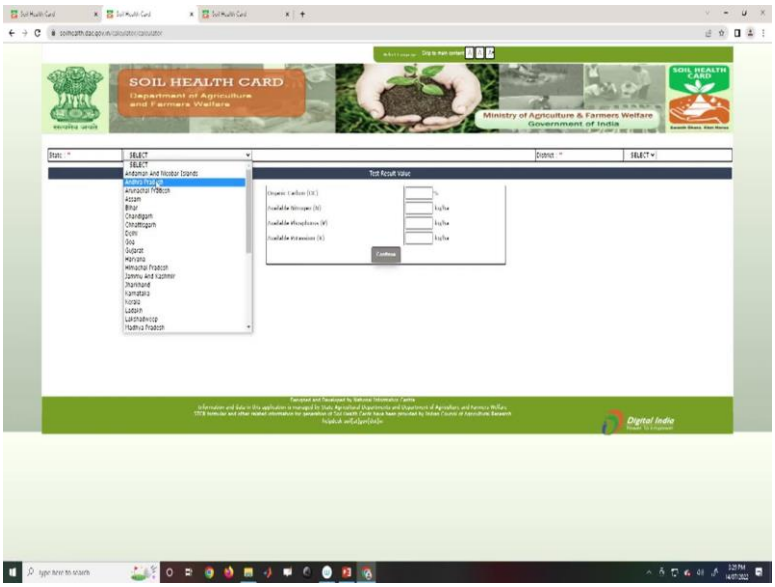

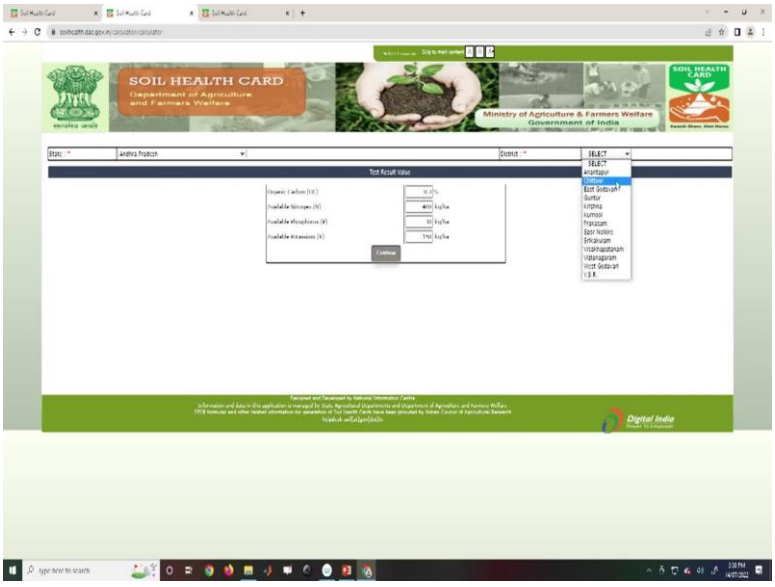

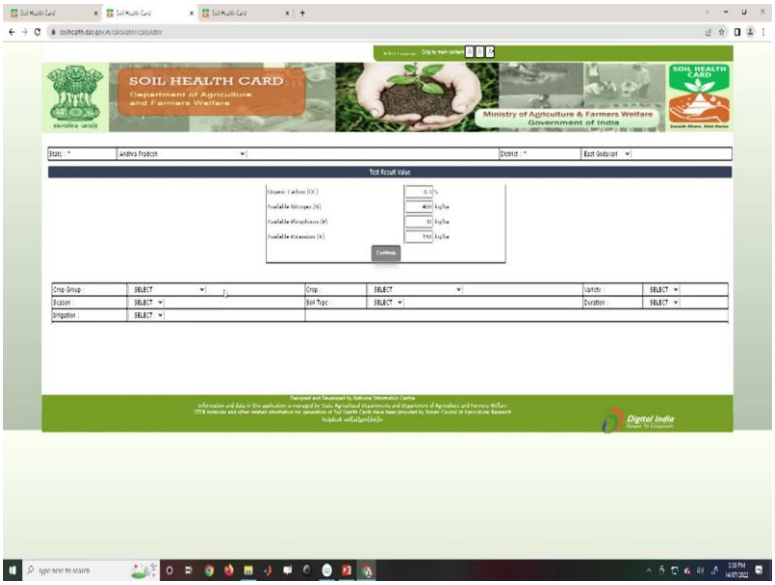

So, you can you can select the state. So, suppose we are selecting the state of Andhra Pradesh and then you can put all the values of for example, let us put the value of 0.3 percent organic carbon and then available nitrogen suppose 400 kg and available phosphorus suppose, we have 40 kg and no suppose 30 kg and then available potassium let us assume it is 150 kg.

So, if you click continue, okay, we have to select the district also. So if we select the East Godavari district and continue then it will open up other options.

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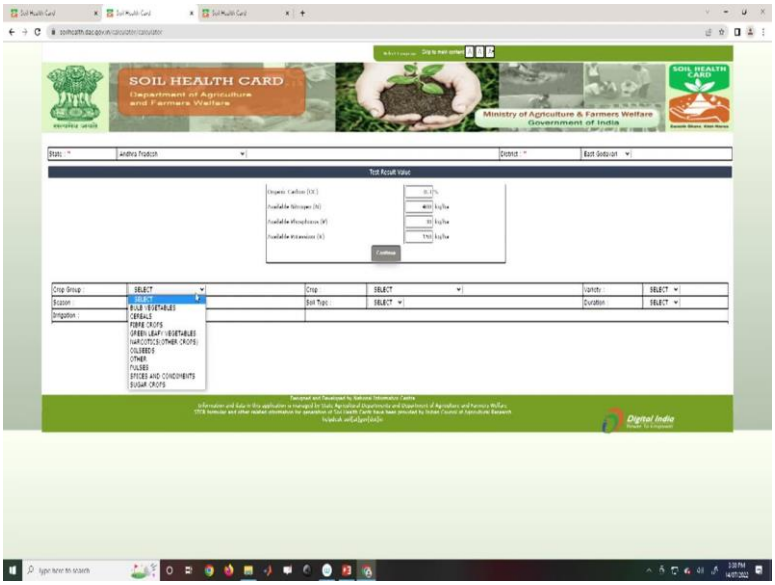

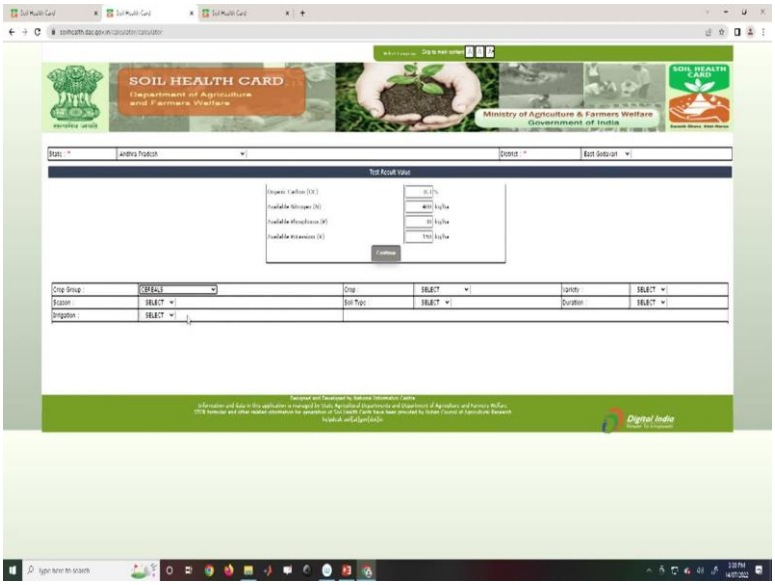
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Department of Agriculture and Farmers Welfare
Ministry of Agriculture & Farmers Welfare
Government of India
Test Result Value
Crop Group
CEREALS
Crop
SELECT
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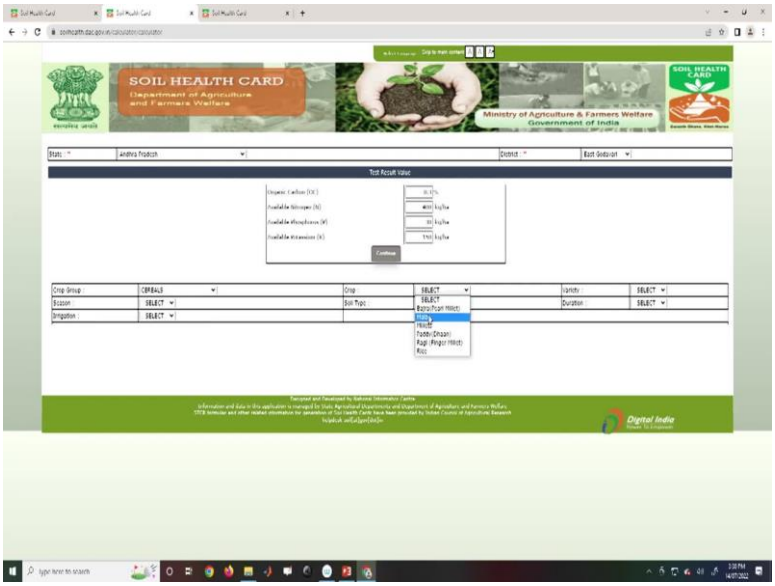
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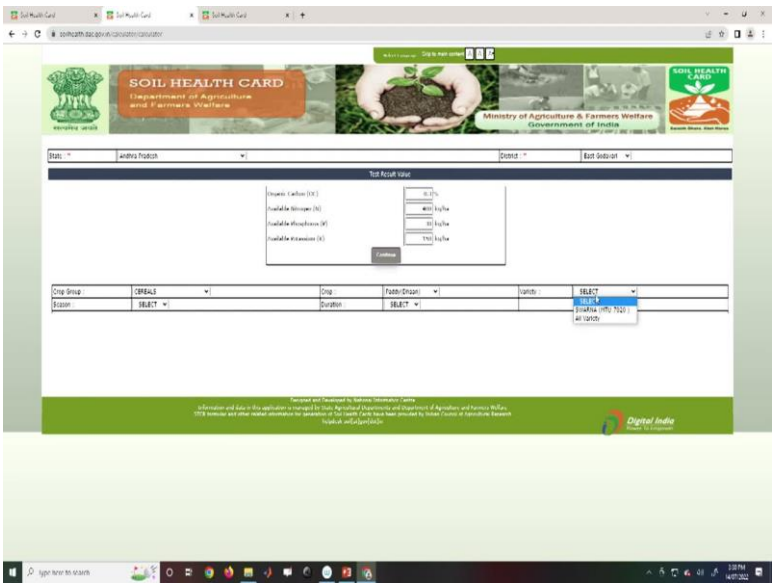
SOIL HEALTH CARD
Department of Agriculture and Farmers Welfare
Ministry of Agriculture & Farmers Welfare
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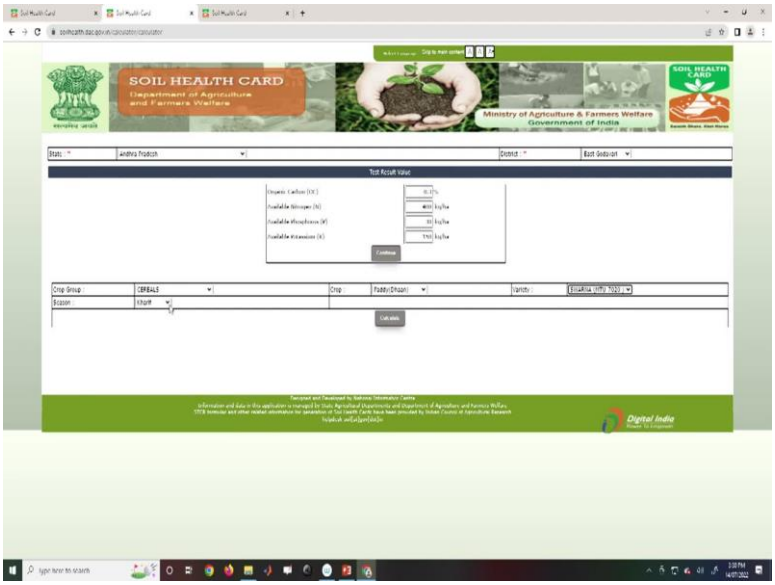

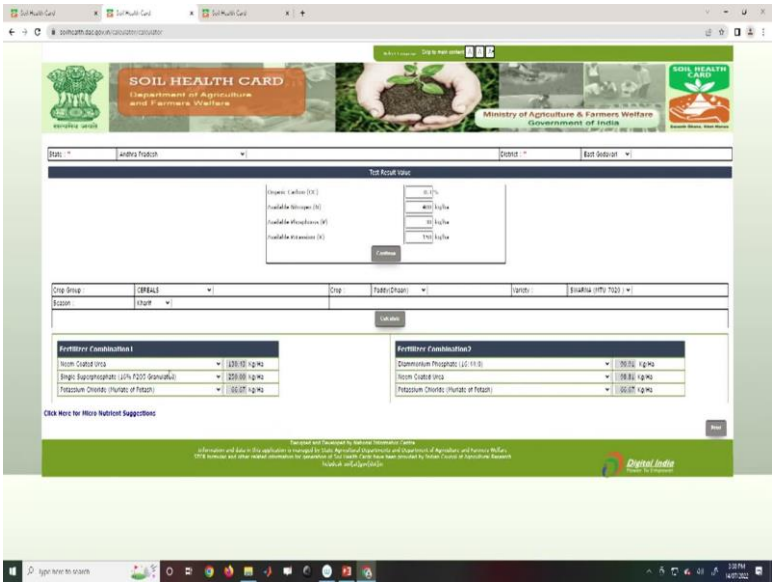

Like which crops we want to go with. So if we click on the cereal, and then we can click on the paddy, rice, and then any variety and then season and if you hit calculate, you will get all the fertilizer recommendation. So here they are recommending that you should use the neem coated urea of 130 kg per hectare, then single super phosphate of 250 kg per hectare based on these hypothetical values and potassium chloride and also there are 2 types of fertilizer recommendation one with neem coated urea and other also with another combination where DAP neem coated urea and muriate of potash is given in here neem coated urea single super phosphate and potassium chloride or muriate potash is given. So, these are based on the major micronutrient.

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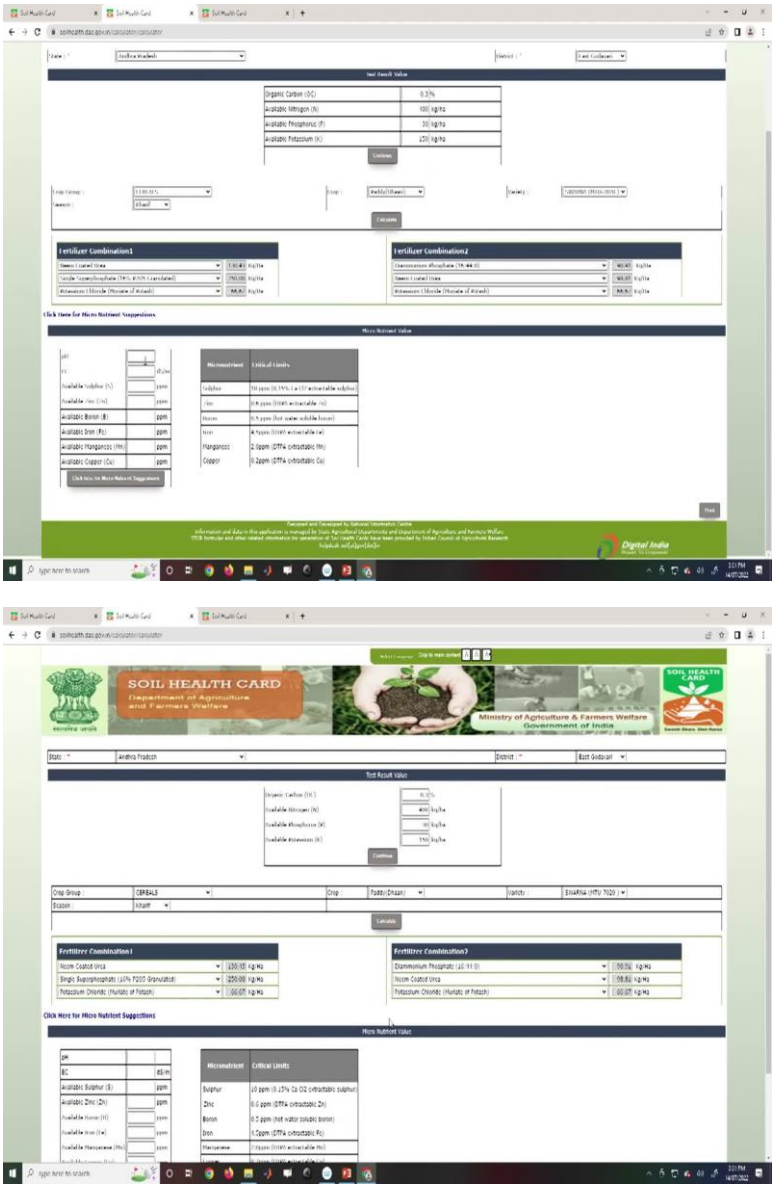

So, if you want to go with the micronutrients suggestion also so, here you can put all the information regarding the pH, EC, and the available micronutrients and you will get the micronutrient based advisory also. So, these are very useful website which you can use for calculating or farmers can use to calculate their fertilizer recommendation for their area for their particular crop and their variety and they can get judicious fertilizer application prescription and they can thereby increase their yield. So this is how this soil health card scheme basically works.

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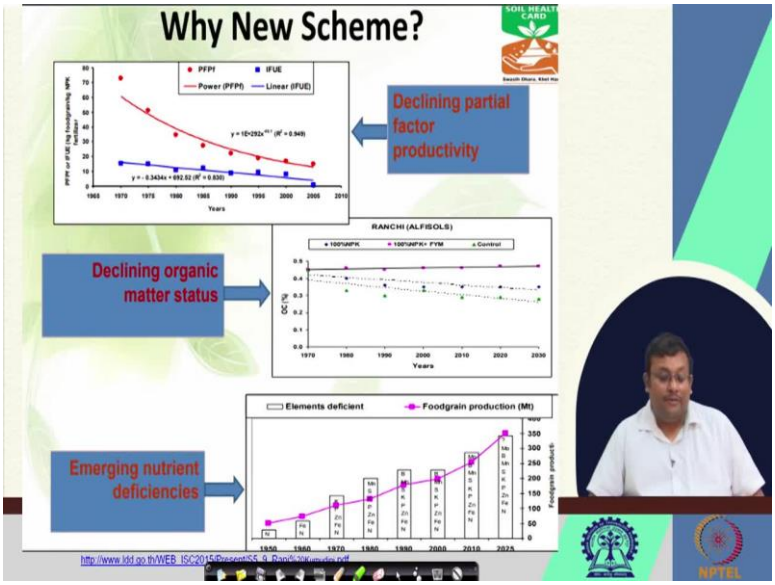

Now the question is why we go for the new scheme. So here you can see that the partial factor productivity is declining with each passing year. So, as we are going through these intensive cultivations we will see that the partial factor productivity or yield versus application of nutrient is quite going down and also we can see there is a continuous decline in organic matter status and in Indian soil and also we can see that there are emerging nutrient deficiencies with the passage of time.

So, in 1950 there was only nitrogen deficiency however, in 2020 to 2025 you can see that there are multiple elements which are becoming deficient in Indian soils. So, as a result, this scheme is indispensable for maintaining or sustaining the soil fertility status specifically in Indian soil.

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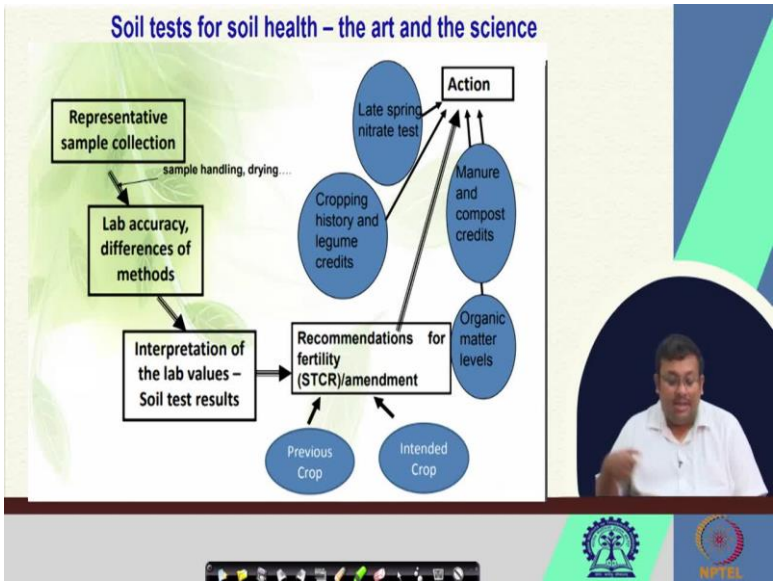

Now, what are the soil tests are required for assessing the soil health. So, of course, we can collect the representative soil sample collection and then we can sample the you can dry the samples and handle the samples and process the samples and then we can check the lab accuracy by again also we can measure using different types of methods and we can compare their accuracy and based on that we can interpret the lab values and soil test values.

And based on these recommendation, based on the soil test values we can give this recommendation or soil test crop response recommendation or STC recommendation. And not only these STCR takes the help from the soil test results, but also it considers the previous crop and intended crop and then it generates a particular action.

And where it recommends a particular action then, we have to take care of cropping history and legume credits, also the late spring nitrate test, then manure and compost credits and organic matter levels all these will be considered for giving the proper recommendation of management practices. So, soil test is very much necessary for maintaining the soil health.

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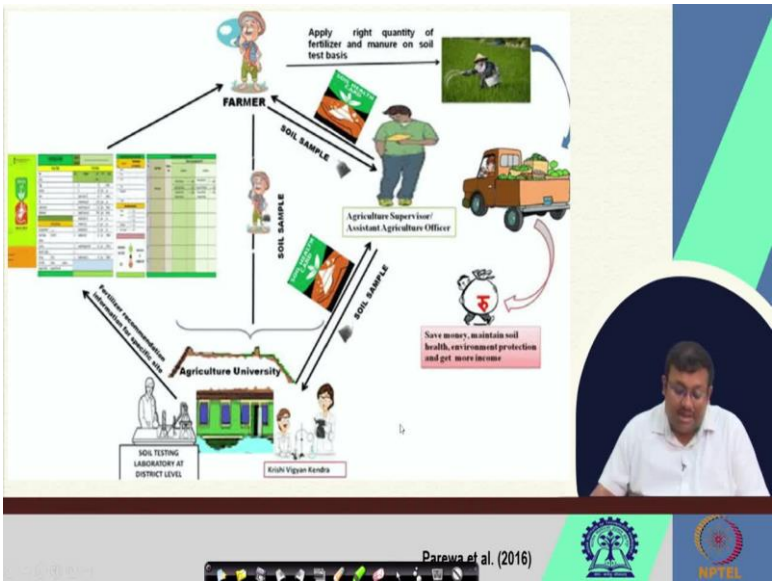

So, these flowchart also gives the step by step, how these farmer can assess their soil health by the soil health card scheme. So, the farmers can send the samples to the agriculture supervisor assistant agriculture officer and they can give the sample to the Krishi Vigyan Kendra or agriculture university and there we do the people do the soil testing laboratory at district level and then they send then they generate this fertilizer recommendation and information for specific site and this thing can be accessed by the farmer and he can get these results from there.

And also based on these soil test values or soil tests soil health card recommendation, they can apply the right quantity of fertilizer and menu to the soil test basis and thereby they can increase their profit by saving money and maintaining the soil health and environmental and ensuring the environmental protection. So, this chart or this flowchart gives the overview of the benefit of soil health card scheme. So, the farmers can either give the soil health soil sample to the agriculture supervisor or assistant agriculture officer or they can directly give the sample to the testing place and they can get the recommendation for their particular crop and for their location.

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So, basically if we see that soil health card is a printed report that a farmer will be handed over for each of his holdings. It will contain the status of all these 12 parameters and also it will contain the fertilizer recommendation and soil we will get the proper judicious fertilizer doses. So here you can see here, this is how the soil health card looks like.

So here you can see the test values are given for all the 12 parameters and their interpretation are also given. So here you can see test value is 6.39 so the rating is acidic. And also here EC is 0.37 decisiemens per meter so it is normal. So, based on these ratings are basically given here and you can see the all the details of the farmers and then their address, mobile, gender, category and all these details and soil sample depth and soil sample details are also being mentioned.

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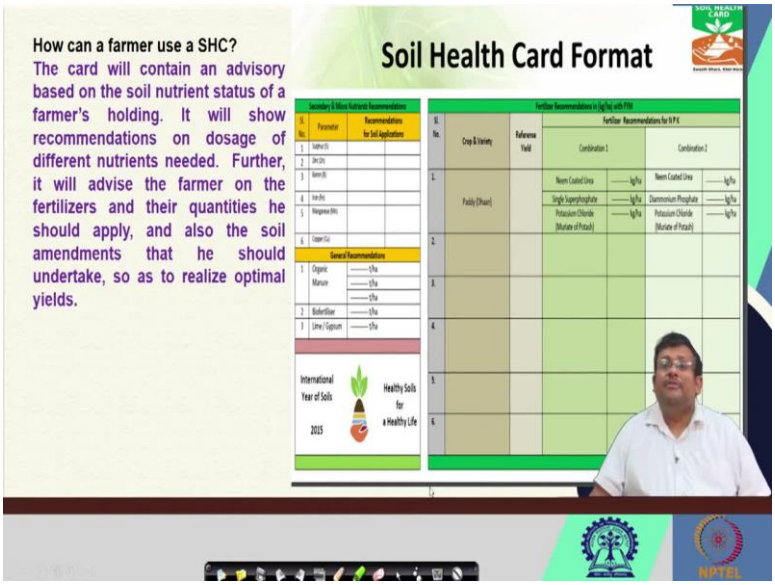

And how the farmer can use the soil health card now, this card will contain an advisory based on the soil nutrient status of a farmer's holding. So, it will show the recommendation on dosage of different nutrients needed. So, further it will also advise the farmers on the fertilizers and their quantities he should apply and also the soil amendments that he should undertake or so as to realize the optimal needs.

So here you can see in the soil health card, not only we get the soil test values and their interpretation, but also will get the fertilizer recommendation just like I have showed you in the website, we can calculate the fertilizer recommendation in different combinations. So, similarly in the soil health card also, we are going to get the different combination of soil of the fertilizer recommendation using the soil test values.

So, the soil health card will contain not only the soil health test values and their interpretation, but also it will contain the fertilizer recommendation also.

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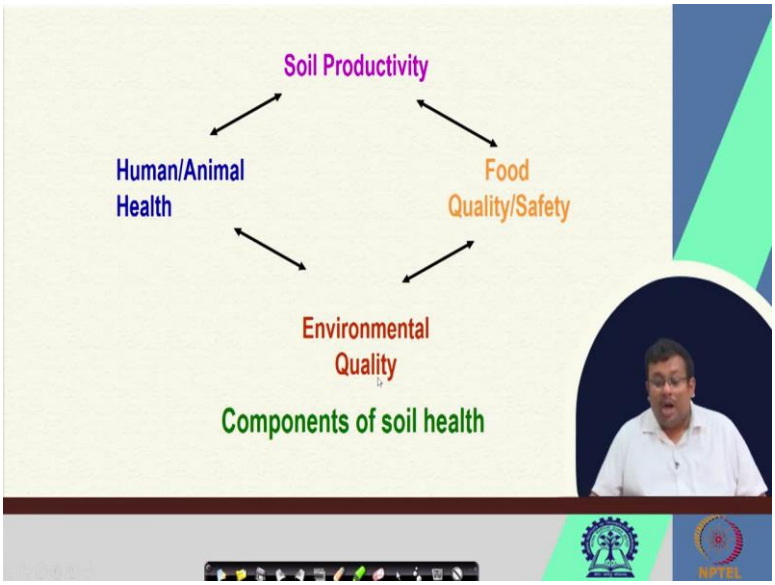

So, what are the different components of the soil health of course, if we consider soil health is an interaction between environmental quality, animal health or human health, soil productivity and food quality or safety.

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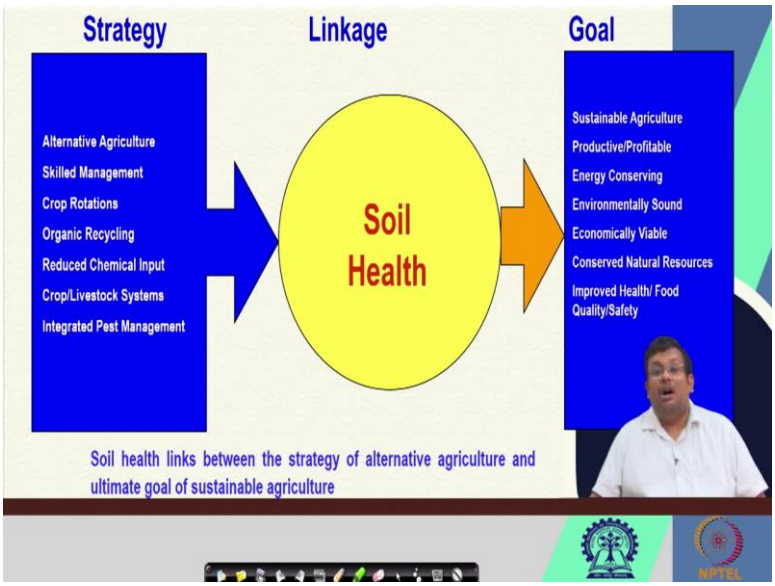

And soil health basically links between the strategy of alternative agriculture and ultimate goal of sustainable agriculture. So, if you see the different strategies that they are like alternative agriculture, scale management, crop rotation, organic recycling, residue chemical input, crop livestock systems, integrated pest management, so, these are very popular words nowadays in the agriculture domain.

So, the soil health basically links between the strategy and the goal. So, our goals are sustainable agriculture, productive or profitable, agriculture, energy conservation, environmental protection, economic, production and the conservation of natural resources and improve health food quality safety. So, the soil health basically maintains the link between the strategy and the goal, if the soil health is not maintained, then this goal will not be realized.

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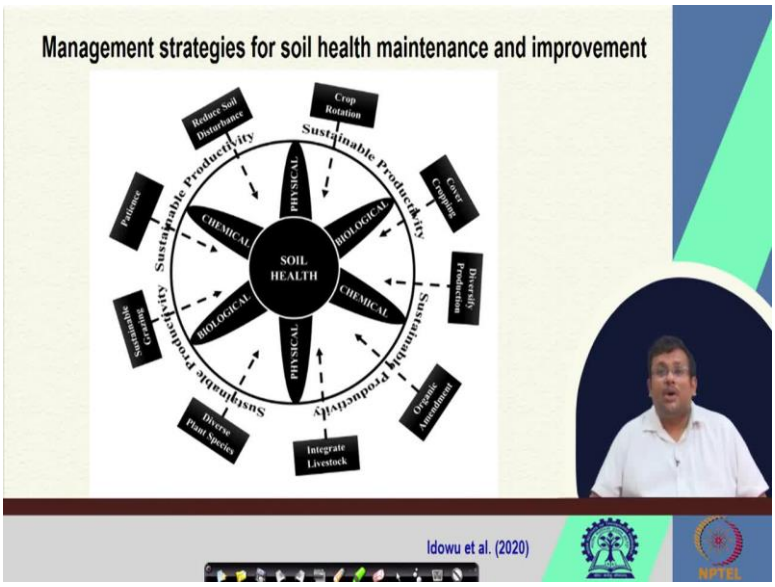

So, the management strategies for soil health maintenance and improvement you can see that soil health are basically chemical, it can be considered as a complex interplay between chemical, physical, biological properties. And you can see that these are different management strategies for maintaining or improving the soil health like crop rotation, cover cropping, diversity production, organic amendment, integrating livestock then diverse plant species, then sustainable grazing then also the reduction of soil disturbances. These are different management practices or strategies for attaining or improving the proper soil health or maintaining the soil health.

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Agriculture management practices and soil health you can see that you have to choose the practice that feed the soil organisms and protect their habitat. So no till or conservation tillage, cover crops, relay crops, diversity in crop rotation, perennial crops, organic fertilizer use, crop residue retention all these are different strategies for maintaining the habitat of soil microorganisms to maintain the soil health.

However, there are different types of negative or deleterious or hazardous process which can reduce the soil health like broad spectrum herbicide, excessive crop residue removal, excessive inorganic fertilizers use, annual crop, mono cropping and so on so forth.

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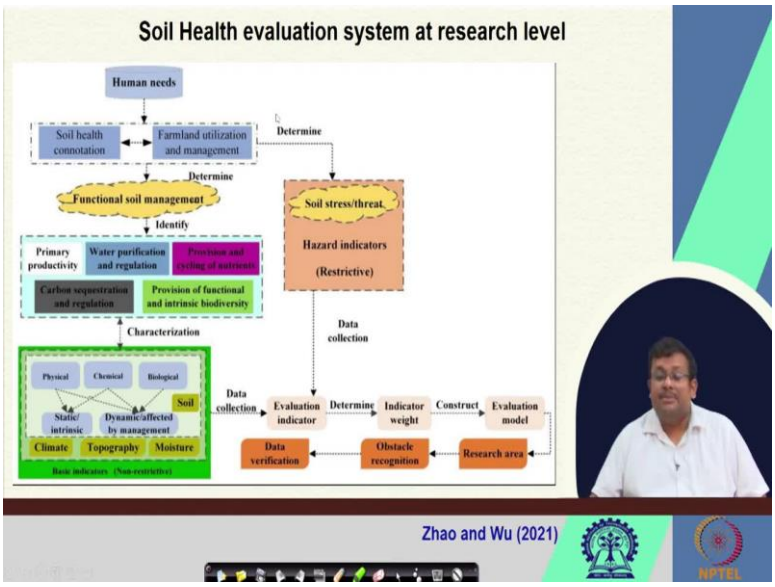

So, soil health evaluation system at research level if we see that then first we have to determine what is the human need? And then from there, we have to see the interaction between soil health connotation and farmland utilization and management. And then we have to determine at 2 levels in the first stage we have to determine the functional soil management and then we have to identify the primary productivity, water purification and regulations and then provision and cycling of nutrients, carbon sequestration, provision of functional intrinsic biodiversity.

When we identify all these factors then we can characterize like different types of physical, chemical and biological factors. So, these are called indicators, which we are going to discuss in our upcoming for estimating the soil quality. So, there are physical indicators, chemical indicators, and biological indicators subsoil. So, we can analyze them we can collect the data and also at the same time, we should also determine the soil threat and stresses and what are the hazard indicators, which produce different types of soil stresses and soil disturbances.

So, we also should collect the data and then we do the indicator evaluation and then we determine the indicator weights and then we construct the evaluation model and based on this evaluation model, we should identify the research area, we should also recognize the obstacle and finally, we could also do the data verification. So, this is the framework of soil health evaluation at the research level.

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Now, the next question comes to our mind what is soil quality? Now, soil quality is the capacity of the soil to function and the soil quality index helps to assess the soil quality of a

given site or ecosystem and enables comparisons between condition at plot, field or watershed level under different land uses and management practices.

So, soil quality is a very important concept and soil scientists have developed different methods to identify and quantify the soil quality index using different methods to assess the soil capacity, soils capacity to function. So, we are going to wrap up our lecture here and in the next lecture, we are going to discuss more about this soil quality and how we can calculate the soil quality index using different methods, how to do the scoring what are the different indicators and also what are the MDS and all these different approaches and also we are going to learn what is soil resilience, what are the what are the methods of soil resilience assessment in our next lecture. So, let us wrap up our lecture here and let us meet in our next lecture.

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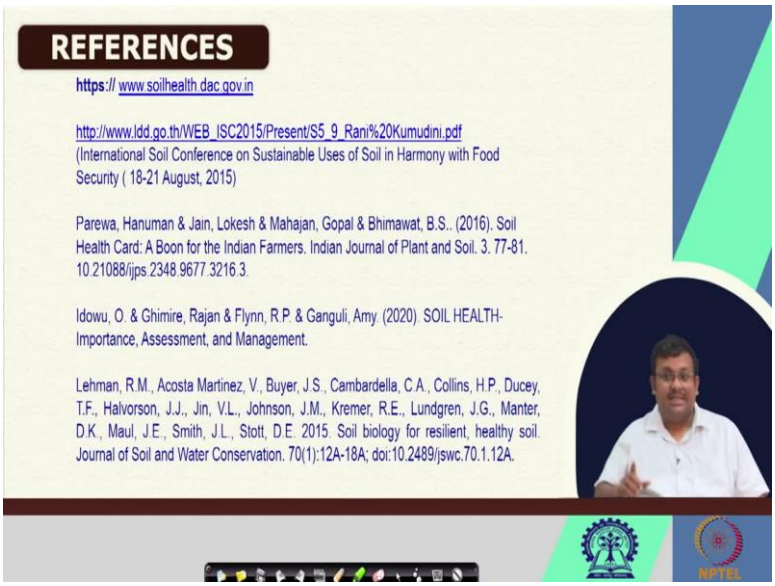

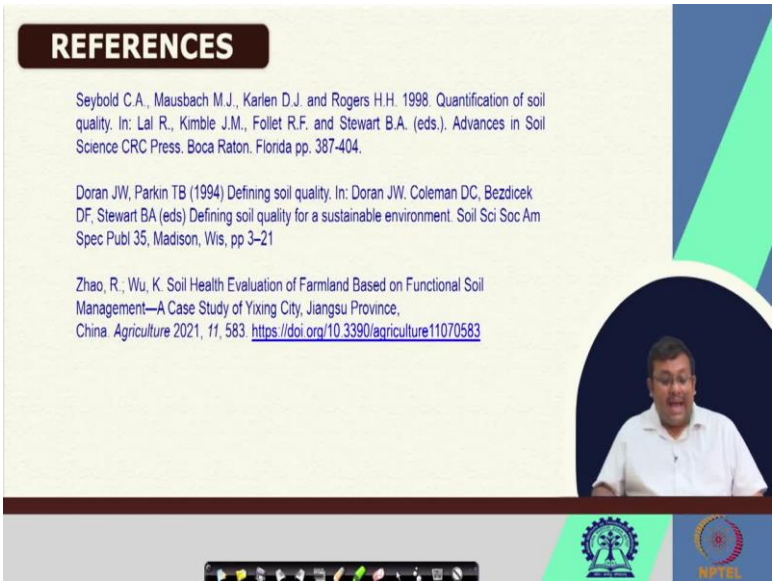

But, these are some of the… I just want to show real quick these are some of the references of this lecture. And you can go through these references to get more information, but, we are going to discuss the soil quality and calculation of the soil quality index in more details in our upcoming lecture. Thank you very much. Let us meet you in our next lecture.