Organic Farming for Sustainable Agricultural Production

Prof. Dillip Kumar Swain
Department of Agricultural and Food Engineering
Indian Institute of Technology, Kharagpur

Lecture - 32
Integrated Farming System and Urban Agriculture

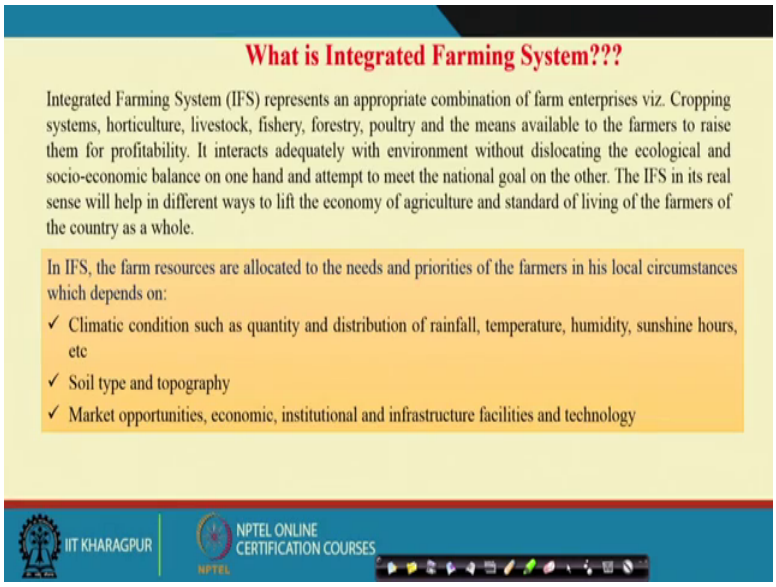
So, lecture 32 this is Integrated Farming System and Urban Agriculture. So, as we are discussing about organic farming. So, integrated farming system is a systems or the platform where this can be performed or the evaluated activity can be performed to through organic way only. So, interior permit system does not allow use of any chemical fertilizers chemical pesticides. This is a cyclic manner in a cycling. So, there are many enterprises.

If we discuss what is the integrated farming systems, so there are many components are there many enterprise. So, bi-product of one enterprise that becomes such a inputs of the other enterprise that means, the output or the waste materials of one enterprise that becomes useful of the input of the other enterprise, so that in that way so, there is no waste, no waste generation from these farming systems. And that also he says 0 emission concept with the less emission or no emission of the greenhouse gases to the atmospheres. So, is a healthy systems where the waste recycling system we can say. So, there is a no wastes, the waste of one that say input of the useful materials of the other components. So, this we will discuss about integrated farming systems, how we can arrange the resources.

And the second one urban agriculture, so as you know that we are moving to industrial agriculture I can say urban agriculture I say then cities the people or the people who want also face the vegetables and good quality vegetables. And to meet the requirement of the because city population is a growing over the years also. And to meet the need of the city population how can we cater the requirement of the best especially the vegetables we are not going for the urban agriculture for the cereal crops I would say the rice or the oil seeds pulses that are not included in urban agriculture, especially vegetable crops cash crops high value crops, which the village resident sorry city residents or the city population that needs on day to day basis vegetables.

So, can we meet the requirement of the city peoples, it is a urban agriculture. So that we will discuss also and that can be done through organics to have a very quality productions and that can meet the requirement of cities.

(Refer Slide Time: 02:25)



So, this we will discuss this integrated farming system. So, what is integrated farming systems? If you see the integrated farming system represents an appropriate combination of farm enterprises that is a cropping systems, horticulture, livestocks, fishery, forestry, poultry and the means are available to the farmers to raise them for profitability.

And moreover it interacts adequately with the environments without dislocating the ecological and socio economic balance on one hand, and attempt to meet the national goal on the other. And the IFS in its real sense will help in different ways to leave the economy of agricultural agriculture, and the standard of living of farmers of the country as a whole. So that means, as you discussed integrated farming system that interacts with many component that comes that integrates the many enterprises, you can as many enterprise as possible depending upon the locations and the climatic conditions.

So, the locations where you do belong what is the field area where you want to go for the integrated farming systems and the climate declare up to the climates and if technology available. Based on that, so you can have the crops, you can have the live stocks, you can poultry, fishery, piggery. So, the appear also beekeeping also one of the part of the integrated farming system. So that can be in because you know so that can be integrated

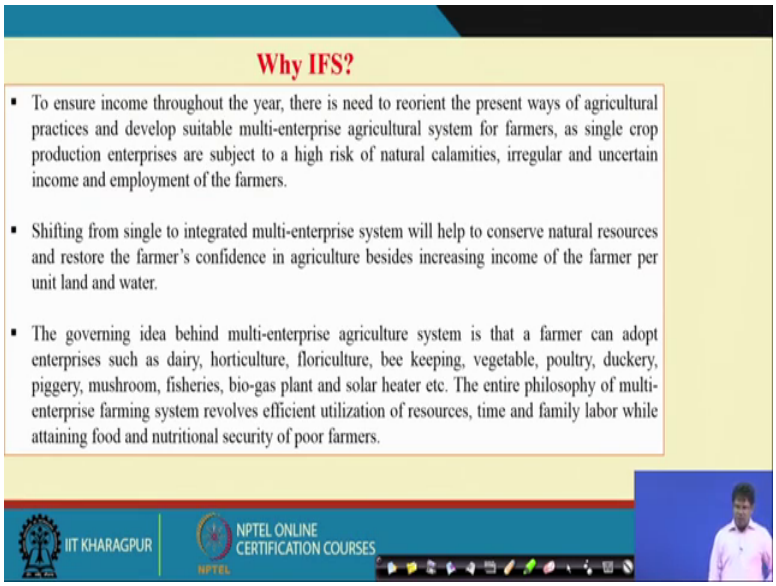
in a system so that means, the and that there is no use of the there is no need of using the external resources. So, only farm resources, farm output can be recycled the un farm resources can be used in this component to have a better productions, to have a healthy systems we can say or the health healthy crops.

That means, in a higher case the farm resources are allocated to the needs and priorities of the farmers in this local circumstances, which depends on say climatic conditions. Such as the quantity and distribution of rainfalls, temperature, humidity sunshine hours and the wind velocity these are the some of the component that that determines your (Refer Time: 04:23) planning of the enterprise combinations or the structure you are (Refer Time: 04:26) to. Of course the soil type and soil type topography as you discussed.

You have also discussed the market so that is a very important the market opportunities what is the market situations, and the market potential, for a particular demand for the particular crop or the particular produce or the particular enterprise and economics the fund availability. And the institution institutional and the infrastructure support is available that means, the linkage with the institutions resource institutions, from where you can get regular advice regular training can be can be obtained and we can get the consultancy from the institutions and the availability of the facility as a infrastructural facility.

So, this is what to say integrated farming systems where the many components are integrated joined together to solve a that means, economic output to have a better economic output. And sometimes you have the sustainability, sustained productions and also this less impact, on the less on the environment.

(Refer Slide Time: 05:22)



So, why do go for a IFS there is integrated farming systems? There so that is to ensure income throughout the year because if you go for the suppose in case if we go for only crops right as the single farming. In case there is a natural calamity, there may be drought, there may be plots initiation or the democrat price slash lashes for that particular crop then there is a huge loss of the farmers.

On the other hand you have the many components. So, suppose there is the loss of crops the loss in crops can be compensated from maybe other enterprise, you have the live stocks, you have the horticultural crops, you have the live stocks, you have the poultry. So, this loss can be compensated from other. So, this is this is farmers are also well accounted with this because you know a tomato sometimes you see the tomato price that goes off it maybe a tomato or onion market it goes around 100 rupees more than 100 to 200 rupees. Beans also that goes recently market bean price is a 200 rupees a kilo and in some place in some period the tomato same tomato it is sold around 1 rupee, 2 rupees a kilo.

So, this type of market uncertainty the market fluctuation if some farmer is growing only tomato and the market price goes down or there may be the internal calamities. So, there is a complete loss. So, if there is a combinations of tomato or maybe chilli some other crops then it can because if there is a loss to some crops then this loss may be compensated with some other crops.

Even if I even if you know the sometimes that tomato the farmers do not want to plough the produce are they produced on the field let it spoil in the field itself because the amount of money you are spending reporting labors for harvesting and transport that per market you may not get that price will not get from the market. So that is what the integrated farming systems having different components together you can compensate the illness in case with the market price goes down or the market slash this is the pulse or there may be natural calamity. So, that the farmers should not bear the economy loss that means, this loss can be compensated some other entities.

So that is what the, to ensure the economy income throughout the year. There is a need to reorient to the present ways of agricultural practice and develop suitable multi-enterprise agricultural system for farmers, as single crop production enterprises are subject to high risk of natural calamities, irregular and uncertain income and employment of the farmer. So that is we have to go for the multi-enterprise. So, that you can get the return throughout the year, you can have the written at least you can there is a assured written you can get. And also same time that it can give the employment generation to the path of farm because that can give me the key the farmers employed throughout the year.

Shifting from single to integrated multi-enterprise system will help to conserve natural resources and restore to the farmer's confidence in agriculture besides increasing the income of the farmer per unit land and water. So, as per the if you go for the multiple enterprises. So, that is of course, there is a resource conservation that that builds the soil fertility and the natural resource conservations and also at the same time that is a more productions per unit of land and on water to.

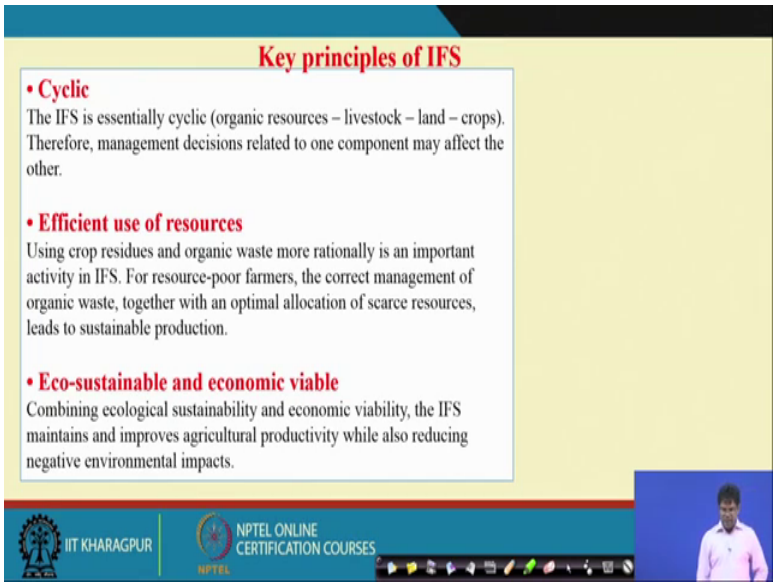
The governing idea behind the multi-enterprise agricultural system is that farmer's can adopt enterprise such as you know dairy, horticulture, floriculture, bee keeping, vegetables, poultry, duckery, piggery, mushroom, fisheries, bio gas plant and solar heater, solar plant. So, these are the components which can be integrated in a particular farm. And the entire philosophy for multi-enterprise farming system revolves efficient utilization of resources time and family labors while attaining the food and nutritional security of poor farmers that means, no you know as you are discussing also what is the food security. Food security does not mean that you to only feed your the family pack family peoples only cereals, like rice and wheat or the pulses know.

In this say balance nutrition not only for security it should provide nutritional security that comes when you the child we could now see that the malnourished child because of the nutritional insecurity there is no neutral proper nutritions. To have a balanced nutrition they should take carbohydrate they should take protein proper protein then proper fats, minerals, vitamins from other sources. So, that can be available many of the mix of bare fruits or vegetables.

You have to take cereals daily, daily consumptions know a healthy a healthy human being or you can say healthy child to have a healthy child we should take the proper combination or the carbohydrates, protein, fats, mineral, vitamins and that can those can be available from sources of the fruits and vegetables you have the cereals, you have the pulses, you have the oil seeds, and at the same time you have the vegetables and also fruits you have take regularly. So, that there is a balanced nutrition that can give a nutritional security. Moreover if only you take the pulse crops or the cereal crops the cereal cost may not be utilized as we discussed the food security, the utilization of the food may not be proper if there is no balance right or there in balanced nutrition from other sources.

So that is what having an integrated farming system the farm family can get not only crops, you can get the crops, you can get the milk also, you can get egg as poultry you can get egg, you can get fish from the fish pond, can get fish and vegetables. And also porchard should have or orchard is the fruit crops can be. So that can give a balanced nutrition for the farm family to have a help to have a healthy because know the body is your say. So, the purpose of this subject is to make the to have a healthy diet so that body remains always with the human with the persons. So, you have to keep your body fit for a bit and if you are a bit fit enough then you can be more efficient to give you a better output or a better work.

(Refer Slide Time: 10:58)



Then key principles of integrated farming systems so that is a cyclic principle. So, we have discussed a lot about this that means, the so let us say organic the cycling organic resource livestock land crop that means, these are the resource organic resources or the waste of the output or the output of the one enterprise that becomes input of the other enterprise such as recycling principles.

Then efficient use of resources that also have this in case of the integrated farming systems; efficient crop residues and organic wastes are more rationally is an important activity of IFS. So, for resource poor farmers the correct management of organic waste together with an optimal allocation of resource scarce resources leads to sustainable production that means, the which type of the that means, that comes from crop planning or the farm planning.

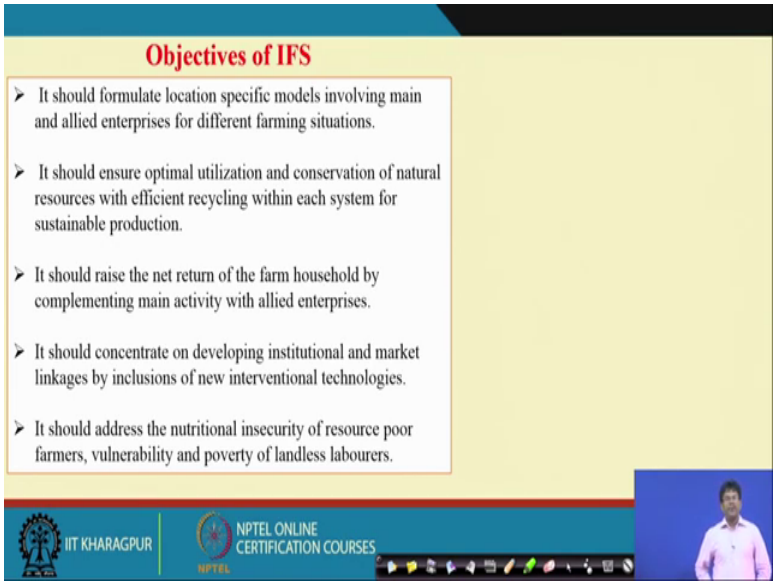
So, what type of enterprise you have to choose, depending upon the locations and the climates? So that gives a benefit means what type of the combination what how much area can be diverted to field crops or a vegetable crops or maybe the horticultural crops or maybe the ponds or the poultry. So, those optimum allocation that can decide, that can give a better returns.

Then eco-sustainable and economically viable that is the combining ecological sustainability and economic viability. The integrated farming system maintains and improves agricultural productivity while also reducing the negative environmental

impact that means, or we are having integrated farming systems. This is a waste recycling concept that means, there is no waste generation. In case in this system there is 0 waste that means, the waste of one input that becomes the one enterprise that becomes the input material for the other enterprise.

So, there is no waste generation in that case there is no emission or the no emission of greenhouse gases or to the atmospheres or there is less pollution of the air or less pollution of the ground waters. And the as the wastes are recycled to the in the systems they are used as a input management also there is a less use of the resources from the external resources. So, the with the un-farm resources we can we can manage the system interior farming system the components in a better way.

(Refer Slide Time: 13:11)



And the, what are the objectives of integrated farming systems? The objectives are it should formulate location specific model involving main and allied enterprises for different farming situation. That means, based on the locations that means, your land type soil type and the climate and of course, the market potentials in that you can have a plan.

So, the main with the main enterprise depending upon if you are going for the specially for the vegetable productions. The vegetable in the main enterprise then have the allied enterprise that may have the livestock or poultry or the fishery, fishery pond or maybe the field crops those are becomes the allied enterprise. So, you have to select the

planning, what type that depends upon the objectives. But what are we are setting your objectives based on the locations or the soil type and the climate and the technology available.

Then the IFS it should ensure optimal equalizations and conservation of natural resources with the efficient recycling within each system for sustainable production. So that is what the objective of the IFS that means, optimum utilization of the natural resources and efficient utilization of resources within the systems. So, that we have we have a sustainable production that is one of the objectives of the IFS. Then it should raise the net return of the farm household by complementing the main activity with the allied enterprise. That means, when you have the different combination of enterprise so that the objective is not only have a high productions at the same time it should be remunerative, you should provide the economy turns there should be profitable.

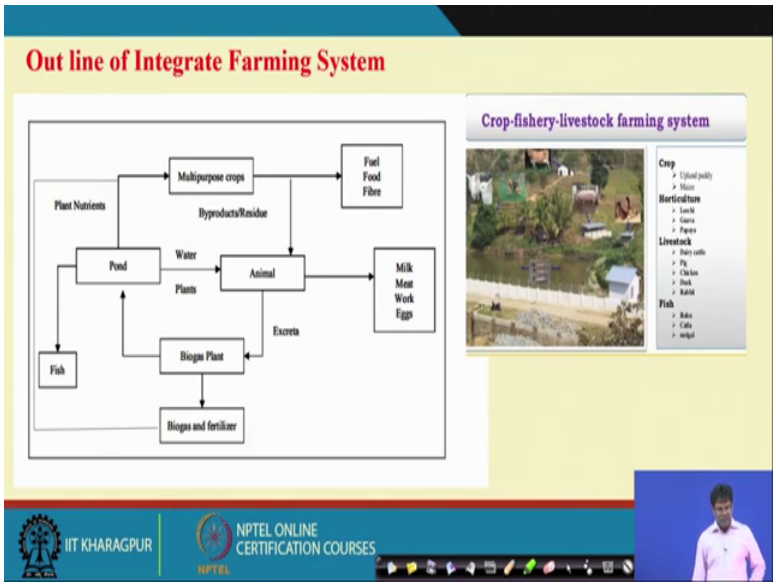
And it should concentrate on developing institutional and market linkage by inclusion of new inter interventional technology that means, having that that means, the when you go for the farming systems or the organic farming or the intake they say, as a integrated farming system say all organic concept then you should have the linkage with the institutions from where you can get the consultancy or the advice expert advice as on when you need because sometimes we may need the advice based on many factors where the irrigation management, or the nutrient management or the pest management or the processing post harvesting processing also. In that case we should have the support from the institutions and where we can get the regular consultancy.

And it should address the nutritional insecurity of resource poor farmers vulnerability and property of landless live that means, that is a very important in this case integrated farming system, that is the objective because in this case we are we are having the many enterprises so that the nutritional insecurity can be served. Because the farm the farm family or the farm children they can get proper diet, the proper diet and balanced diet he can get balanced diet.

So that you can have a healthy human being the raising the children from the beginning because know like plant also the children now see the nutrition with the; if you go for the what is say in case of the crop productions the you need to nourish the young seedling, young seedling requires the much attentions. Once the shielding grows established a root

system then you may give less attention because the root system is enlarged enough to take care of themselves. Similarly for the young children this should be proper nutrition this we should avoid the malnutrition and the a farm family should grow the balance of crops balanced so that can provide balanced diet at the beginning.

(Refer Slide Time: 16:27)



So, this outline of an integrated farming systems as you say. So, different components you can see here the you can have the multipurpose crops, you can have the either crops as a field crops that includes your these cereal, grains or the pulses, oil seeds or the vegetables or you can have the orchard crops where I can have the fruit trees. So, there is a multipurpose crops and the planning also know not necessary depending upon the farms farm types on where you can have the what type of crops depends suppose you have the up land, medium layer and low land area.

So, usually when you go for the vegetable crops or the special for the orchard crops we should choose for the upland area where water does not accumulate as you have discussed in the previous class. So, only if you have the lowland area that can be diverted either making a pond or the fishery or you can grow if the go think of the growing up the rice crops which can sustain under the lowland conditions and the high water stagnation conditions.

So, depending on the land type we can choose what type of crops can be chosen and the can be allocated to which land topography. This is one enterprise and it should have the

animal there is a live stocks that is second enterprise, and the pond that the fish production the third enterprise and also you have the biogas plant.

So, this goes materials can be utilized and recycled the bio gas plant that can provide electricity to the farm family, at the same time it can provide the fertilizers for these crop productions. So that means, the from the crops this crop residue can be used as a I can grow for the water crop of course, that can be used as a feeding material for the animals and you go for the pool system as the organic concept. No application of any particular chemical fertilizers or any synthetic pesticides.

So, everything the farm resource are recycled and put back in the farm itself. So, no external use of resources, only natural sources you can you can have the natural minerals can be used to meet the requirement of the crops only natural sources no chemical or the synthetic sources are used in the crops or grown organics and that is fed to the animals either you can have the livestocks or a poultry. So, that can be as you discussed that can be; so the produce can be sold as a branded as organic. They produce here as a milk meat or the eggs and the animals can be used for this may be for the cultivation purposes that the workforce. The produced can be labeled and stored as a organic products similarly for the crops or the food and fiber that can be labeled as a organic as you are growing organic concept.

And this is a bio gas from this in the waste that goes to the biogas plant and you have the energy for this maybe farm family also we can have the you can have the bio fertilizer. We can have a vermi compost farm, manmade manure productions and that can meet the nutrient requirement of the crops and also you have to supply the nutrient. Also you can sometimes you go for the vermi compost unit above the pond. So that the vermi compost leachate that can be entered the pond area that can as a new trend for the pond and the fish also that can be marketed as a organic because the fish field also produced from these crops what you are growing organically there is a feed material for the fish.

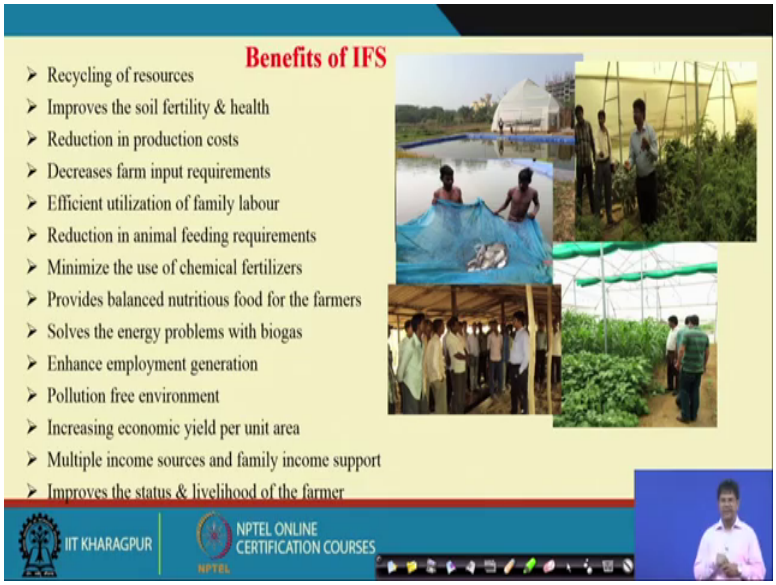
And also use the vermicompost leachates, as leachates that goes to the field pond also and the fish can be branded as organic and it is sold as a organic fish. And the water and pond water that is a nutrient rich water that can be used for the irrigation purpose of the crops the crops and also you can get the nutrient from the bio fertilizer from the compost you can get nutrients. So that means, so there is this concept is a 0 waste concept that

means, there is no waste on the output of one enterprise that becomes the input of the other enterprise this cycling manner, cycling, cycling manner and all the products from these systems that are sold as a organic.

So, it is a only in Northeast India there is a crop fishery livestock farming systems, Northeast parts there is a very successful farming system in northeast regions and the crops where you can go up land conditions we can go for the upland, upland paddy. On upland also he can go up they can grow maize crops also there are many the horticultural crops lychee, guava and the papaya, horticultural crops. Livestocks they have dairy cattle, pigs, chicken, duck and the rabbits as a live stocks and the fish different fish (Refer Time: 20:33) catalan miracle, the fish are grown also. So, having this, so in a in a small the farmers are they around having two hectare of lands or a 2 to 3 hectares of land say land size.

So, he can he can keep all the enterprise and with the optimum combination of the resources so that the farm family can get a diet, also healthy diets or the you can say balanced diet we can say at the same time you can get the remunerations maximum, maximum profit from the farm and you can you can help in the improving the living standard of the farm family.

(Refer Slide Time: 21:08)



So, what are the benefits? See the benefits of an integrated farming system as you see this one the, this is very recycling of resources you have discussed because the resources

are because there is no waste generations. So, this is the waste recycling so that means, the biproduct of a one inter end price that becomes has a input for the other enterprise then improves the soil fertility and the soil health of course, as you are going for organic systems. So, there is a gradual improvement in the maintaining the soil fertility.

Reduction in production cost because we are not using any external resources only the farm resources are recycled back, so that way we are we are minimizing the production cost decrease a farm input requirement of course. Efficient utilization of family labor that means, as you have the many enterprises and you have the output from there from throughout the years and then also the engagement requires throughout the years. So, that is a full time engagement for the family labors.

Now, reduction in animal feeding requirement as because you know on the we are getting from the same farm, and minimize the use of chemical fertilizers of course, provide the balanced nutrition food for the farmers as you discussed now. So, solve the energy problems with a biogas because as you have the waste material. So, they can have the biogas plant, we can have bio gas the energy and also you can provide electricity for the farm family.

Enhance employment generation because you are leaving the throughout the year employment to the farm family, then pollution free environment because here there is no use of chemical fertilizer chemical pesticides. So, there is no pollution either ground water or the air pollution is also, also avoided this reduced. Then increasing economic yield per unit area because the same area you have the many enterprise and also we are not keeping the land vacant, because the crops are grown throughout the years, like the multi cropping systems. So, the land as the land is vacant and resources because the resource is not kept unutilized. So, as a use of resource efficient use of resources, so that causes the increasing economic yield per unit area.

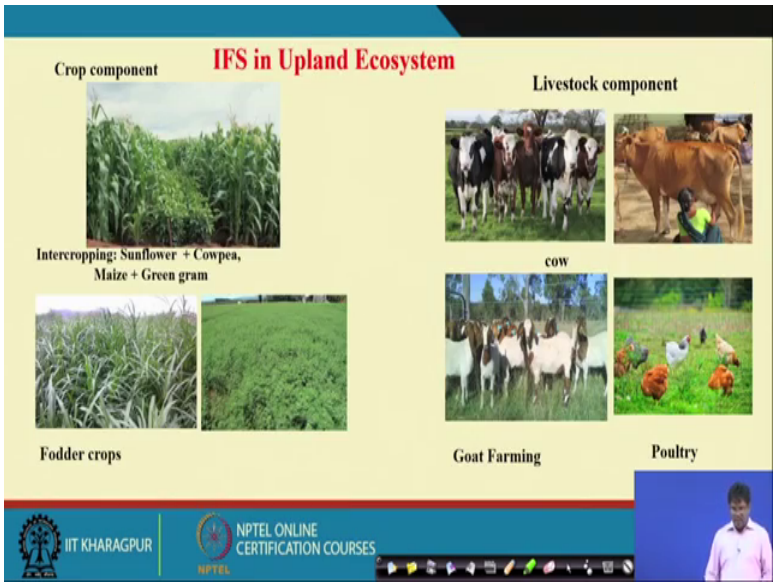
Then multiple income source and the family income support as because there are many many enterprises are there, so there is income source are multiple then improve the status and livelihood of the farmer by the way doing the interior farming system. So that enhances the living status are liable to the farmers for life though you can have the inter farming system we have a farm pond where you have the fish.

And also at the same time we should we most of having a greenhouse is also a must for a for a particular farmer, because you know in greenhouse required to protect as it not only as a shelter because in case of the rainy seasons we can grow offseason crops in the greenhouse and that can be highly remunerative, that can (Refer Time: 23:40) to the income of the farmers having herbs and crops inside the greenhouse or the plastic house.

So that is a plastic house may should be is essential for every farmer to have a better income. And the fishes they are also inside the greenhouse we can grow the crop because in the winter season. So, we can grow crops it can give you a better a yield is higher, and better quality because the crops inside greenhouse are protected from the pests and diseases, less pests and diseases. And you can use whole organic concept to grow the crops inside the greenhouse, vegetables, special vegetables you can have luxurious vegetable the growth of you can a sweet corn, and the pulse crops their growth is very luxury and growth in green house because they get temperature good temperature at the same time, they are protected from the rainfall no and also there the pests and diseases.

And we have the of course, the compost unit vermicompost is there. So, the regular training can be prevent given to the farmers on the vermi composting how can they use composting, how can they as you discussed earlier so that that training can provided. So, having a integrated farming system consider the farmers can get training from the multiple enterprises, making the ponds, making the having the greenhouse production that is how what is the proper planning, how can I grow the crops in the greenhouse. And the those type of the they can get a holistic training can be given to farmers to the multiple because benefit they have the good return as well as the good food for the farm family.

(Refer Slide Time: 25:02)



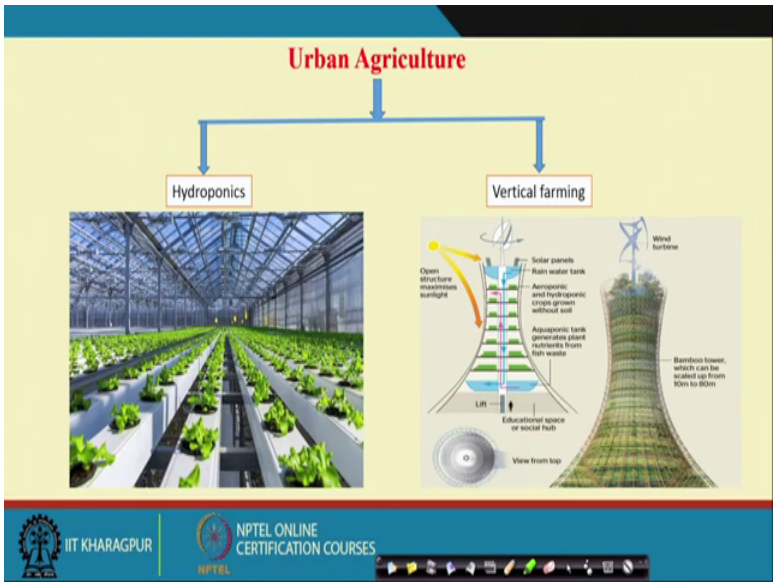
And there are some of the examples of this is the integrated farming systems in upland ecosystems say as there is a discussed water is available used the high volume. So, I can have a intercropping of crops like as we discussed for the rain fed area or maybe the and there is a less what water, low water area low rainfall areas or the up land ecosystem where you can have the inter cropping system.

Either sunflower cowpea or maize green gram depending upon the location and the climate you can intercropping you can have the livestocks, we can have the cows and you can have the goat farming and poultry through, and we have the fodder props we can meet the requirement of the of the fodder of the of the cattle because I discussed. Because if you go for the organic cattle production at least 60 of these deliberations to come from the press for us the press, the grasses the grass feeding systems. So that way they are that enhances the quality of the milk and the meat also better having the crisp products. So, if you go for the integrated you have the crops, integrated crops, livestock and the gotary and the poultry that can make a integrated farming systems concept.

So, this is how say the farming systems are as in village at rural area, as you can go up every the farmers having land of 2 hectaresm 2 hectare to 3 hectare are they can also cooperative farmer can join together. Thus different farm, many farmers they can join together to have a integrated farming system concept where. So, there is no use of any chemical fertilizer pesticides you can get a variety of returns variety of a items because

many enterprise you can be taken and the returns comes throughout the years. And you have the water source for irrigating at least the source of water to have a irrigation for the crops and also you can get a healthy food throughout the throughout the year.

(Refer Slide Time: 26:51)



And this is allowed the integrated farming system I discussed about urban agriculture. So, as you are moving to cities because no other so that the population of city is growing. So, how can the people in the city they can get a good quality or the trace vegetables are the healthy vegetables, usually for the urban agriculture that is confined limited to growing vegetable crops especially, vegetable crops are maybe the unlamented the floriculture crops, floriculture and vegetables there is a common for growing in urban agriculture.

So, there are two systems or two type of farming that can be done for the that can (Refer Time: 27:24) it for the urban agriculture or the cities to meet the need of the cities one is called the hydroponics the other is vertical farming. So, in this hydroponics that means, the this is a soilless culture where the crop is grown without any soil that is not through the nutrient solution. So, these are the types are there perforated hollow, hollow pipes where the nutrient is supplied through these pipes and the crops are grown in grown in this part sling stage.

And here see there is a because continuous supply of nutrients the crop needs nutrients throughout the growth especially the vegetables crops and as we can supply the nutrients

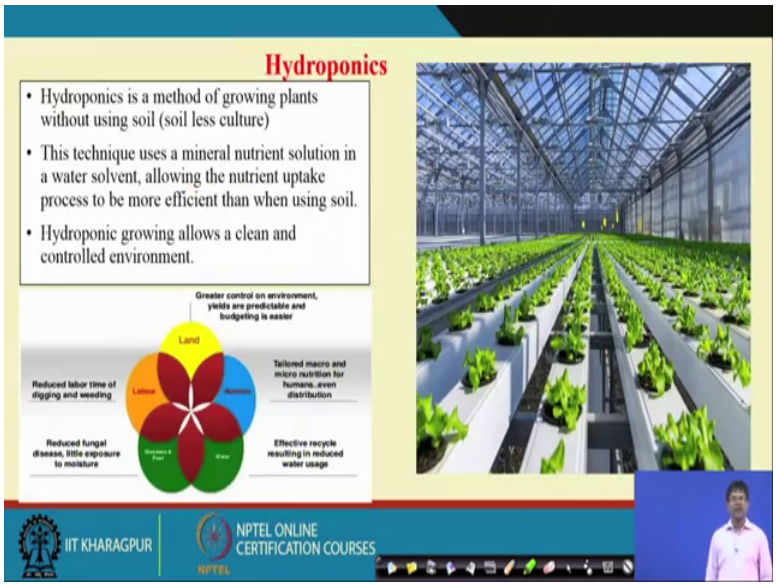
through ionic farm, through different sources you can meet the requirement and we can have better growth in a confined chamber like a the glass house, glass house where you can have the productions or the good quality. Because those crops are less affected by pests and disease as there is no soil there is a less pest and disinfestation and is a confined chamber.

And this is the hydroponic system, so we can do and if you come to about vertical farming that is also in cities. So, this is like this is the structure of vertical farming there are different structural of vertical farming where the mainly the hydroponic the crops are grown, hydroponic systems are accommodated in vertical farming. So, you go for the growing the by the aquaponics or hydroponics the crops are grown, and here you can have the rainwater tank to collect the rainwater.

And the ground floor we can have the aquaponic tank where you can the fish rearing, and the water can be stored and this water can be lifted to different floors or many floors are there and the crops are grown in different floors, through hydroponic the vegetables are grown, through hydroponic systems and that that irrigation water can be supplied from this pond to different different floors.

So, this is how the in case in urban agriculture or the cities, as there is a need there is a demand for the healthy vegetables or the good quality vegetables, good quality a regular supply of a need of the vegetable, so that the hydroponics and the vertical farming is as expected to meet the need of the city population.

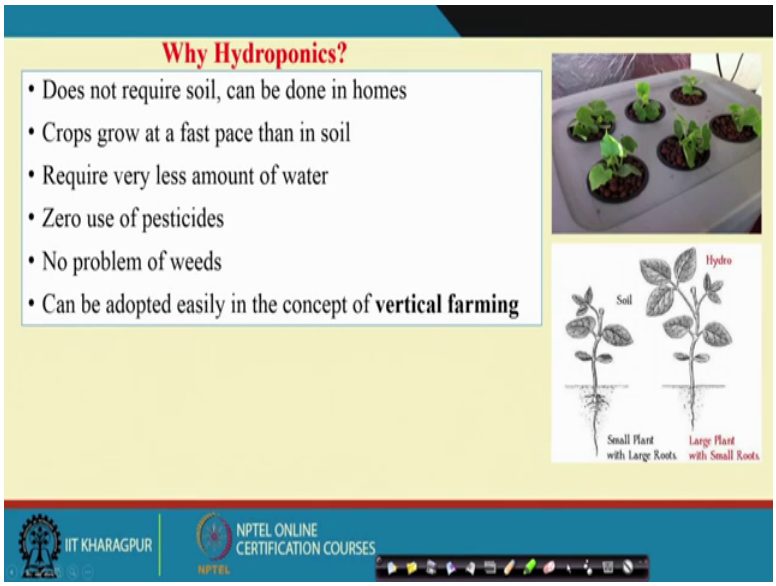
(Refer Slide Time: 29:26)



So, as you see hydroponic, what is hydroponics? Hydroponic is the method of growing plants without using soil that is a soilless culture we discussed. So, this technique uses the mineral nutrient solutions in water solvent, along the nutrient uptake process to be more efficient and then when using through soil. So, hydroponic growing allows a clean and controlled environment as see the hydroponic systems. So, the land the land, nutrition, water pests and diseases and labor they are all controlled here because you are not in very controlled environment here.

So, there is a less waste, and easy to manage. And the nutrition means is a tailored macro and micronutrients are formulated and supplied regularly to the crop lands and the water there is a less use of water, because the water is recycled. Here in case we are not same water nutrients are recycled back to the; into the plant the plants, so there is a less use of water. No (Refer Time: 30:17) disease as it is a confined area, there is no soil medium the confined environment, less pest and disease and this is a reduced labor time, because there is no other operation like a maintenance like a disease, weeds no matter no need of this control or weed control so unless labor requirement.

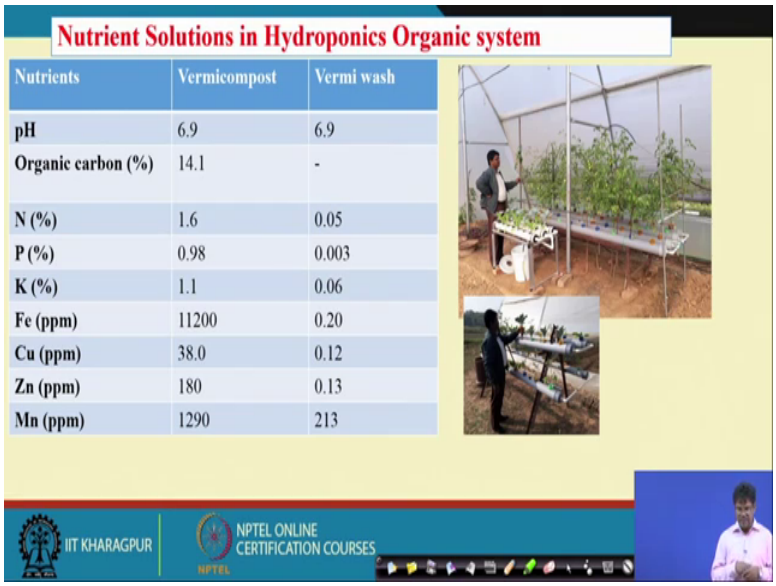
(Refer Slide Time: 30:35)



So, it is a hydroponic system, so why do go for hydroponic because you see the see the (Refer Time: 30:37) crops and this is the crop with soil the small plant with the large because when you have the growing in soil roots goes in the sorts of a nutrients. So, root the root grows deeper and deeper, when in case of the hydroponic as you are supplying nutrients to the root medium regularly root growth is less, but at the same time you have the better growth of the crop.

So, these are the does not require soil can be done in home sequence cities, you can home or the courtyard we can do we can have a system hydroponic systems. Crops grow at fast place in amin in soil require very less amount of water and 0 use of pesticide then no use of pesticide for hydroponic, and 0 there is no weed problem at all. So, can be adapted easily concerned in a vertical farm, as you go hydroponic the is a component of the vertical farming.

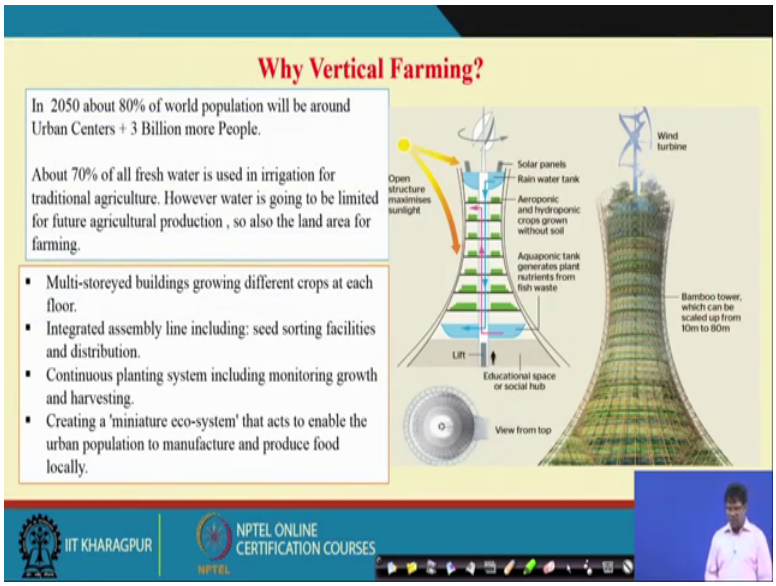
(Refer Slide Time: 31:22)



So, these are the nutrient solutions can be used hydroponic the vermi as the vermi compost can be made tea, vermicompost tea can be grind the with a mixer you can mix with water and the tea vermin compost tea can be use the nutrient solutions or the vermin compost they contain less nutrients. It is better to have the vermin wash tea has a higher nutrient content as compared to vermin wash. The tea can be prepared from the vermi compost and the vermin compost tea can be as a system the system they can be a tank here, where the nutrient can be stored with a motor is there and that can be circulated to this pipe and this also can be recycled back to the tank itself.

So, there is a regular recycling of the nutrients and you have to judge the quality of the nutrient solution, so the pH, and other nutrient content and that if necessary that has to replaced in regular intervals to avoid any adverse effect on the growth of the crop.

(Refer Slide Time: 32:11)



So, likewise you can go for the say vertical farming. So, in 2050 about 80 percent of the world population will be are around urban centers and plus 3 Billion population more. So, most of the water is used around 70 percent fresh water used for agriculture, but the however, the water is going to be limited in future due to climate change. So, and also land area is also going to limited.

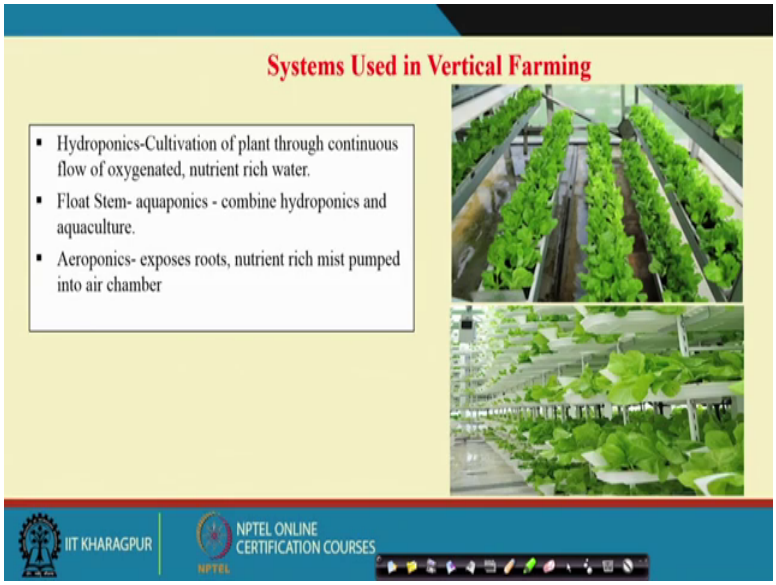
So, you have to go for the production the limited lands. So, hydroponics are the vertical farming, one of the opportunities where you can we can progress much we can do much progress to tell any issues of the land degradation or the shrinking of the land area and the availability of water for the future agricultural productions.

So, multi-storeyed building growing different crops at each floor integrated assembly assembly line including the seed sorting facilities and distribution. So, we have different floors, we can have the different crops and different activities in different floors, continuous planting system including monitoring and growth harvesting. Creating and maintenance of eco-system that acts to enable the urban populations to manufacture and produce food quality.

So, in case of vertical farming, so different layers are there, we can have the different activity when the nursery regimes or the supplying the nursery to different different nursery can be raised also in many floors. Seed materials, seed regimes are not sterilizing and also different vegetable can be grown in different layers. And there is system of we

can supply water, as the water can supply to all the floors and water is collected from the rooftop having the rainwater tank and can be collected fish can be grown. Of course, if I am going for the aquaponics also here you can have the floating, aquaponics. So, here the vegetables can be grown under aquaponics system also, with hydroponics with the aquaculture system.

(Refer Slide Time: 33:46)



So, these are the systems used vertical farming. Usually the hydroponics is a component of vertical farming can go for the nutrient less, sorry soil less nutrient solution culture is used for the hydroponics and also floor systems as a aquaponics combined with hydroponics. So, in the pond we can have the fishery you can have aquaculture at the same time and the pond also you can grow the vegetable crops using some structural materials, and the nutrient solutions vegetables can be grown over on the pond also.

Then aeroponic also that is here you can have a spraying of the nutrient solution by the mist and nutrient solution through the air, the root system root can be kept moist throughout through the aeroponic systems. So, these are the some of the high tech agriculture I can say, for this say urban areas, areas where there is a need the some group of population they want. Because many of many people are very interested to have a healthy vegetable good quality vegetables which can be for supplied to the cities by having hydroponics or the vertical farming in cities can be established and that can meet a target certain group of a peoples who can afford because (Refer Time: 34:49) that can

be expense seed crops as compared to normal soil, but yield is a higher. So, this can meet the requirement of the cities.

At the same time you go for the interior farming systems for the rural areas where we can have a mix of the enterprises, many enterprises can be taken and the whole systems either hydro either the interior farming systems or the hydroponics or the vertical farming, whole system comes on the organic concept organic farming concept so that we can have a better quality of produce. So, we can avoid use of the synthetic fertilizers and pesticides. So, with this I close this lecture.

Thank you very much.