

Micro Irrigation Engineering
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Lecture – 60
Micro Irrigation Engineering: Epilogue

Hello participants of Micro Irrigation Engineering subject, you attended 59 lectures. And, this has been journey of 12 weeks. In 12 weeks, you did large number of exercises. You attended all the subjects. And, this is the concluding lecture of Micro Irrigation Engineering. So, we will be refreshing something what we learned and what we covered in previous classes. So, this is the concluding lecture.

And, if we refresh our knowledge, when we started in the Lecture 1, we discussed about importance of Micro Irrigation Engineering, why we have developed this course. This course was not available in NPTEL platform, whereas lot of emphasis has been given by Government of India and various state government agencies. They are interested to implement this particular technology in their states.

So, we will be discussing something about refreshing your knowledge related to importance of Micro Irrigation Engineering. We will be also discussing, what are the Government of India's initiatives to promote micro irrigation in different states? What are the opportunities and scope of Micro Irrigation Engineering in India where the large number of engineers, scientist, agriculture extension workers and several NGOs will be involved? We will also briefly summarize this course content. So, this is the overall the coverage in this particular lecture we will deal with.

In these particular 59 lectures, if you look we have taken material which were available is scattered in different places. So, lectures covered in this course are compendium of the text materials collected from different sources such as books, research publications, dissertations, and proceedings of conference, technical reports, and the material available in government reports. So, these things we have tried to bring at one particular platform and which I tried to deliver you.

Now, coming back to I am just once again as I told you I am refreshing your knowledge. So, rationale of this particular course, this is related to agriculture because when we talk of irrigation means it is agriculture and the contribution of agriculture in GDP of our country as per the estimates of 2020-21, it is 19.9%. 15% of the export it is purport from agriculture.

Agriculture employs 55% of the workforce. That is the important means important part that it gives employment. Large bulk of the people those who are educated or skilled or unskilled persons. They it is employing. Now, when we look at the agriculture involves huge amount of water. That is your 84% of the total water available is being used for irrigation. Other sectors are there, but the demand from the other sector will also grow.

So, if we look that the right now I mean not now rather we say as per the figures available, 407 billion cubic meter water being used for agriculture in the year 1985. It will go to 740. Almost, it is coming to the 90% of the water will be required by 2025. But, available water is very limited. This is the thing. And then, demand from the other sector will also grow and which you see here, from other sector, Non Agri sector, the demand was 70 billion cubic meter in 1985. It has gone 4 times high. It will go 4 times high that is 280 billion cubic meter by 2025. So, this is the important part that how to get this water? How to use this water efficiently if the demand goes like this? And then, another information, it says that the groundwater is being extracted more.

It is the easily available source of water supply and 60% of the total groundwater is being you know it is used. In agriculture, when we are talking of the irrigated agriculture, groundwater support 60% and 40% it comes from surface water. Whereas, huge investment Government of India since before independence and after independence era, huge amount of the funds it has been spent for development of surface water and the reservoirs, canal development. This has been done. But, this water is it is only contributing to 40%. So, this is another important part that if we continues to withdraw water, there will be huge means water table will be declining and availability of water to the in general other sector as well as for the domestic sector it is going to be affected for drinking water also.

And then see the figure which I want to tell you that the total utilizable water is 1,030 billion cubic meter which is the summation of the available water of surface water 690 and 340 billion cubic meter of surface water and groundwater, which is 60%. So, this is also available resource. We are almost coming closer to the available water which is there for utilization. So, we need to use this particular water judiciously for agriculture purpose.

Now, the, another important part, which if you look that when we talk of water being used for agriculture purpose, water use efficiency is very low. You can see here it is only 30 to 40% water it has got water use efficiency. Means we can say here it is 60 to 70% of water, it is going as wastage. And, this is because we are using the canal irrigation system. Huge amount of water it goes from the canal that we cannot avoid.

I do not say that yes, we should not use surface water, we should not use canal water, but we are required to see that the minimum loss of water takes place that is from canal. And then, when it comes to the field, then in the field also field to field irrigation takes place so, then, proper water use management technology is to be adopted. Government of India has set up the National Water Mission that the water use efficiency should be enhanced, should be increased by 20% in all sectors.

That is the important target or mission. They have given goal they have fixed that it should increase. Then, the figure which I was just projecting that there is a demand of water which will be increasing 4 times, now, you can see here per capita availability of water will be going to be decreased. And, this is you can see here in 2004, the per capita water availability was 6,008 as compared to the initially it was 6,008 it decreased to 1,250 cubic meter in 2004 and it is likely to further decrease by 2025. So, this is another serious part that is availability of the water is going to be decreased. So, present problem is all about management of water resources in an efficient manner.

So, we need to use efficient water management practices so that the substantial area it can be brought under irrigation. And, one of the important technology where micro irrigation can take place, micro irrigation is one of the best water application method which can play an important role.

Now, these are the important component of micro irrigation system. Already, I discussed in Lecture 1. I have already given you the benefits of micro irrigation system. That is what I am telling I am refreshing you. These are the components in the blue color boxes. If you see these are the means, when we are using micro irrigation system, there is an improvement in the flexibility. Improves in the tolerance of the soil salinity if this saline soil is there to a certain extent, crops can be grown. It reduces the crop failure. Increment in the crop yield, crop quality, maximizing the water use efficiency. In previous slide, I was telling you about the water use efficiency 30 to 40%. Here, we can go for a very high. So, now then, when we come to the, this part, if you look here, there is a reduction in the energy, reduction in the cost, labor cost, reduction in the fertilizer use, reduction in the use. So, these are the other you know important component how the micro irrigation is useful.

Micro irrigation potential, if you look at the in as agriculture is the maximum water consuming sector. I am repeating this sentence again and again to make you understand that yes agriculture is assumed takes huge bulk of water for irrigation part. And, this should be utilized efficiently so that we can save and bring more area under cultivation. So, if we go for adopting, when we are telling we are telling that there is a saving in water. So, when we are adopting micro irrigation system, farmers without much technical resources can lead to increased yield, bring additional area under cultivation. After the farmers as well as the huge government programs, agriculture universities, technical institutions like IITs, Central Government fund agencies institutions like ICAR Institute, they worked day and night. They carried out research work.

Initially, when this particular thing it was there in 1980 it was only simply 1500 acre. But, because of the continuous effort by the government, continuous effort by the research institutions that has made quite a good impact that it has brought 90 lakh hectare under micro irrigation system. But, this is very meager as compared to the potential of 69.5 million hectare. Means, you can see here from 1980 to 2018. So, in 38 years, we, only this much area we have brought in. So, it is a very slow pace, we need to give more awareness, more activities among the farmers so that they can adopt these technologies.

So, Government of India has initiated lot of programs in order to bring more area under irrigation. So, as, MI was introduced in our country in 1980. But, it was at research stage. Only few farmers were taken and then these were demonstrated in the farmers' field. But, it was a very small. But, after recognizing the benefits of micro irrigation system, Government of India initiated subsidy scheme from 8th plan onwards.

A range of micro irrigation subsidy schemes were offered to small and marginal farmers for adoption of micro irrigation technologies. Then, Government of India set up a task force committee in 2004. And, this particular committee it recommended the more financial aid and then liberalizing the scheme making more flexibility so that this scheme can be further strengthened the MI adoption.

So, based on the success of centralized subsidy scheme in 2006, micro irrigation scheme was upgraded to a mission mode in 2010 by National Mission on micro irrigation. And then, in the National Mission on micro irrigation that is NMMI, this subsidy was given 50% to the state government where required to contribute. So, in 50%, 40% was from the central government, 10% was from the state government. And, some of the states were further giving subsidies to the woman farmers, to the Scheduled Caste, Scheduled Tribe farmers. They were giving subsidy to the tune of so, 40%, so, 90% subsidy was available in some of the states.

So, like this, there the lot of emphasis is being was given in 2014. This particular scheme NMMI was subsumed to National Mission on Sustainable Agriculture. That is NMSA. So, with the On Farm Water Management with the more focus on micro irrigation was given. NMSA scheme was undergone further change in the introduction of Pradhan Mantri Krishi Sinchayee Yojana which focuses on water to every farm. 'Har khet ko pani' this was the slogan of honorable Prime Minister with this shift focus on more crop per acre or to more crop per drop. So, this is the scheme. And, this scheme is initiated in the May 2015. And, this scheme is continuing and in the year 2021-22 budget 5,000 crore rupees fund has been allocated under micro irrigation for micro irrigation which is being implemented by NABARD.

And, for promotion, an, another 5,000, once this fund is exhausted. So, total 10,000 crores rupees have been kept for promotion of micro irrigation system. Now, success of these schemes will require large number of trained engineers. These engineers will be agricultural engineers, civil engineers, scientist, horticulturist from the horticulture, agronomy, soil science, extension worker, agriculture extension, and management professionals will be needed to implement this scheme.

Now, these engineers and social workers as well as scientists they are supposed to deal because what we find in the field there are some certain use. So, they are supposed to convince farmers because that farmers are still they need motivation to adopt micro irrigation system. And then, of course, there is a, another important thing that the banks are supposed to come forward and promote financing machineries to the beneficiaries so that this scheme can be implemented successfully. We keep on changing the policy that is of course program. I have very little role to play. But, yes, this is also important that such schemes should not keep on changing so frequently. And then, this should be implemented more in effective means so that the large number of farming community they should be benefited.

There are lot of opportunities and scope for implementing micro irrigation system. The, one opportunity from the implementation point of view I can tell here, it is the horticultural crop that has given lot of boost to using micro irrigation system or we can say that they are so, means there is a good match with the horticultural crops and micro irrigation schemes. So, over the years, you can see here, horticultural crops growth it has gone up. And, horticulture, when we talk of the GDP part, one third of agriculture GDP is it is from the horticultural crop which is cultivated from one fifth of the agricultural land area. One fifth, it comes under horticultural crop. But, it is contributing to the one third of GDP. Micro irrigation plays an important role in the development of horticulture. This is what I am telling.

The growth it has come because of the implementation of micro irrigation. And then, means some of these things which are important that is the development of nursery, development of fruit crops and then vegetable and flowers. It has huge scope for bringing large area which is falling under the waste land. So, that can be brought under micro irrigation with limited water. Some crops can be grown which is lying idle and that can be brought. And then, it can

be used for the area which are saline area, degraded land, difficult terrain. These are all can be brought under the micro irrigation. Implementation of MI is happening in new emerging areas. Mainly, I told tell you that precision agriculture where the there is a scope for all other disciplines.

Other discipline I mean, so, besides agriculture engineering discipline, there are many other disciplines. They can come forward in the area of precision agriculture. And then, implementation of solar powered irrigation system and integration of information and communication technology, IoT based MI system for automation of micro irrigation systems. So, other disciplines of engineering, they can also play very important role. So, there is a good scope exist for micro irrigation system.

Now, let us come to the concluding part. Now, in concluding part, let us see that what we have learned over the things. So, in view of the above stated facts, this course has been developed to educate and transfer knowledge to young budding engineers and other stakeholders of micro irrigation technology.

We have covered in this particular course, there are total 11 modules and, in Module 1, we are talking fundamentals of fluid mechanics. Here, we are not really giving the course of full fluid mechanics. Only we are refreshing your knowledge what has been taught in your basic course of fluid mechanics which can be which is applied in the migration system. Only those things are being discussed. So, these are the topics which are given in this one. That is fluid properties, Bernoulli's Principle means energy equation, continuity equation, Navier Stokes equation and then concept of the basic fundamentals of the soil water concept, then, water movement to the soil. All the things are discussed in the Module 1. That is your fundamentals of fluid mechanics and soil water.

Then, water requirement of crops where we have discussed about the evapotranspiration. And then, the determination methods of ET, the crop types and there, for their, you know, finding out their water requirement, then crop coefficient. The, another important part is that yes you have been exposed for the different types of agro metrological instrument to a these instruments which are installed in the field that has been given you enough coverage.

Lysimeter, the different types of Lysimeter which in the laboratory, how to determine the water requirement of the crop by using the Lysimeter. That has been covered in this particular thing and that was demonstrated to you.

We also discussed in the Module 3 about the irrigation water management, irrigation scheduling, and instruments for water monitoring in soil and plant, measurement of water, so, all these things which we have discussed in the Module 3. Module 4, water lifting devices. And then, in all these lectures, we have been telling about the also solving numerical problems to give you more exposure, give you confidence on these topics. So, this we have discussed now. In all these, if you see Module 1 to Module 4, these were the basic fundamental, basic concept. And, these basic fundamental concept, we are using it in the micro irrigation system development.

So, the different types of micro irrigation system, we demonstrated in the field. We demonstrated you the drippers. We demonstrated you micro sprinklers. We have demonstrated you how to evaluate the micro irrigation drip emitter, the soil water movement under drip emitters. This is a research topic. This is not only simply just learning but how the water is moving. So, students from means postgraduate students as well as PhD research student, they can take up their research topic, when the water not only water when the fertilizer is added with the water.

So, solute transport through the soil that can be understood by these things, so, this is a good scope it exists. Then, filters, the fertigation system, how to design the economic system, so, there are micro irrigation industries, they should come forward and then they can also take part in the design of drippers. They can take part in the design of the drippers, the, how to economically design the filters, how to economically design the fertigation system.

That is an important part. So, micro irrigation industries as well as for the students those who are attending this course, it is useful for them. Sprinkler irrigation system, the theory part, it has been covered. Also, we have given a numerical problems and then evaluation by the experiments. So, experiments has been conducted and you have demonstrated in this one.

Then, the Module 7 is Standards and Quality Assurance of Sprinkler Irrigation System, Drip Irrigation System. That has been covered which is an important aspect of this course. Any material which is being manufactured, it should be passed through the standards so that its life it can be tested and it can operate for a longer period.

Then, the solar PV operated micro irrigation system is dealt in Module 8. There are large number of electronics engineer, electrical engineer, they are needed to design the system. They are needed for designing the design of the solar PV systems so that economical system solar PV system that can be developed. And then, that can be used for irrigation systems, so, integration of solar PV system with micro irrigation system that has been also taught in this particular course.

Then, the automation of micro irrigation system, this is another important part where electronics, electrical engineers, agriculture engineers should learn about the basic electronics course, electrical engineering course so that they can become confident on operating and designing the automated irrigation system. That has been covered in Module 9. Module 10 is for the economic evaluation of micro irrigation system. This is a very important component. Any system will be economic. Unless, it is not economically viable, it will not be accepted by the society. It will not be accepted by the stakeholders. So, this is important components and different terminology which are there. This has been done in Module 10.

Module 11 is precision agriculture. This is another important interesting topic where micro irrigation system has been used. And then, other disciplines of engineering, plant science people, plant pathology persons, they are needed for precision agriculture. So, this particular course discovers this part also. And then, we are concluding the, this particular thing. That is your epilogue of migration system. That is in the Module 11.

Now, it is now my duty to thank and mainly I want to thank the authors of the various books which I have used. And, their book chapters, I have used. Research papers, I have referred. And then, the proceedings of the conferences, images, animations, which I have taken from the internet that has helped me in developing this course which is purely the purpose is only for the educational and academic purpose. So, that the more and more person, they can work

in this area. They can develop the confidence. And then, this can go to the farming community in a large way.

Now, I want to thank the NPTEL authorities at the IIT Madras, at IIT Kharagpur and then the all the staff of NPTEL. They have helped me in developing this course. So, I want to thank them. My research scholars, Mr. Mahesh Hadole, he helped all throughout from Lecture 1 to Lecture 60. All the lectures in developing the PowerPoint presentation, helping me in conducting the laboratory classes, so, I thank Mr. Mahesh and Miss. Chitra Shukla. She also helped in developing this course content.

Now, since, this is the last lecture, so, at the end of this particular course, all the students, you have already undergone the various lectures and submitted assignment. So, there will be online examination to pass this subject. So, thank you very much and I wish you good luck. Best of luck, Thank you.