

**Micro Irrigation Engineering**  
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**Lecture - 32**  
**Installation and Operation of Drip Irrigation System**

Hello, participants of Micro Irrigation Engineering subject. I invite you to Lecture 32. Lecture 32 deals with installation and operation of drip irrigation system. In previous lectures, we dealt about micro irrigation components. We dealt with filtration system. We dealt with fertigation system. We worked out some problems on this. Now, after the design of the micro irrigation system it is done we need to install and operate drip irrigation system so that it works effectively. We can achieve maximum benefit out of the system which has been installed in the field.

So, we will be dealing in this lecture about installation of surface drip irrigation system. We will also deal with how to operate different components which are joined with drip irrigation.

So, in this topic when we say installation of drip irrigation system means we need to install all the components, which are there in the head control unit. Now, head control unit, it consist of installation of the pumping set. It consists of several valves which are there in the system, installation of water monitoring device that is water meter, filters, fertilizer equipment, and flow control units. We deal with the installation of connecting with the mains, sub-main, laying of the drip tape, laterals, and also connecting drip emitters.

So, when we talk of head control unit, first important point in the head control unit is installation of the pumping system or overhead tank. But overhead tank has limited capacity or we need to lift water at adequate height for filling the tank, also we need to have a pump. So, commonly used pump is centrifugal pump. So, we need to install a centrifugal pump.

For any system which we talk of, it is the, what should be the suitable size of the pump. And once we have designed the size of the pump means we have found out the horsepower requirement to the pump then it should be properly installed at the suitable foundation and correct location. Now, type of installation, it will depend upon the type of water source. These water sources can be surface water or groundwater.

If it is groundwater, then it will also again whether water is being taken from an open well which is at shallow depth or it could be from a tube well which is at deeper depth. So, the depth of water is important, and accordingly the selection and installation of the system it can be made. Then it comes that what is the type of prime mover which we are using. So, prime mover as I told you it could be an electric motor or diesel engine to operate the pump.

Normally a centrifugal pump operate when the suction lift is limited to 5 to 6 meter. And it is further reduced if the length of the pipe of the suction pipe is increased.

So, foot valve is another component. It is installed at the suction side of the pipeline and then without which the movement of the pump water it is stopped or slowed down. So, all the water in the pipeline will run back through the pump making it impossible to restart pump unless pipeline is first refilled with the water. So, this is an important component of the centrifugal pump.

The next part, it comes is what is the suction limit? So, suction limit as I told you that it should be within 5 to 6 meter. To take care of the suction limit, we need I mean there should be proper flexibility that we can increase the delivery head and reduce the suction lid by lowering the pump at appropriate depth from the land surface.

If the delivery pipeline is long, it is also important to have another check valve or non-return valve at the pump outlet. So, this will take care of the particular whole pipeline it is filled with the water. And it is necessary because suddenly if the pump stops, flow will continue until the pressure drop enough to cause cavitation in the pipeline. And when upward movement is exhausted, the flow reverses, and cavitation bubbles implode creating severe water hammer.

So, other installations of the centrifugal pumps could be below the ground surface called sump installation. So, it can be above the ground level or it can be below the ground level.

So, you can see here when the pump is installed at the ground level and water is taken from a pond or from a river and it is lifted, it is lifted to some hilly part of the region and then water is supplied at that particular place. So, this could be another situation where the suction

installation of the centrifugal is done. Now, when we talk of the water level quite deep then the pump is kept near the water surface.

So, it is kept near the water surface that we call it as a sump installation and the motor is on the ground level. So, delivery head increases, in that case, means total head when we are talking static discharge head will be calculated based on, so, in order to get effective the total head, we need to lower the pump and then install in case of sump installation.

So, when we are installing filters, so, for installation of filters, a hard base made of concrete is constructed for installation of filters and other head control units according to size. One should take care that there should be minimum use of accessories such as elbow, reducers so as to minimize head loss. So, this is important part that as far as possible minimum connectors should be made in the pipeline.

It could be from the pump nipple means from the pump side that from the pump. And when we are coming to the main pipeline, sub-main pipeline, lateral pipeline so, in these units as far as possible there should be minimum connection so that head does not reduce much.

Filter size should be in accordance with the capacity of the system. The capacity of the system means our pumping system and the filter candle, it should match each other so that there should be proper matching with these units. The other point is that the delivery pipe of the pumps should be connected directly to the hydrocyclone or media filter or sand filter. So, hydrocyclone filter or the media filter, it should be connected with the pump, or that could be followed by the fertigation unit and then screen filter then connected with the main pipeline.

So, this means your layout of system one should make so that there is a minimum head loss takes place and effectiveness of the entire system, it can work efficiently. Now, once the sand or screen filters are installed in the correct position or in a proper means correct alignment, the arrangement for backwashing of filter is one of the essential requirement.

You can see here, this is the media filter in which the sand, the coarse gravel then medium-sized gravel, coarse sand, and then medium sand it is filled. This is a vertical media filter which we have installed in our farm to connect with the micro irrigation system. And this

system is being used for irrigating vegetables as well as other crops. Now, the water is brought from you can see here the water is brought from the pump.

Then this is the inlet end of the pump, water is brought from the inlet end means from the pump to this unit. And then, this water will pass from the filter media, and then it will go to the main pipeline. It is connected with the main pipeline. Now, when we find that the head loss in the filter, it is more than the prescribed limit that is 70 kilopascal, then the water is supplied from this end.

And then, this valve is closed. This valve is made open and then water will come out from this and then backwashing is done. So, this is the arrangement what we are seeing here. The water is brought from this end. So, this is the part which is coming from this end. So, this is the supply end. Then it comes to another filter. This is a screen filter and then it is connected to the main pipeline.

So, before it goes to the main pipeline, a water meter is connected. And we are able to monitor how much amount of water it is passing through. So, one can know that what is the volume of water. At the same time, one can know, what is the rate of flow in a given time? It can be calculated. So, then it goes to the main pipeline. And from main pipeline, sub-main and other units they are connected.

Then, we come to the fertigation equipment installation. In the pressurized irrigation system, the fertilizer injection unit is located between the sand filter and screen filter. Of course, it will depend upon the field location and then the quality of the water. The general recommendation is that fertilizer solution should pass through at least two 90-degree turns to ensure adequate time for thorough mixing it can take place so as to remove the precipitate with the help of a screen filter.

And, it is a must that a fertigation unit is installed at the upstream end of the screen filter so as to filter the undissolved matter present in the fertilizer solution. So, if at all there is some chemical reaction it has taken place, so, this should be taken care. And then it should be screened out by using the screen filter.

Here is what you see that the water distribution network. What we see is that there is an installation of the main pipeline and sub-main pipeline. Both the main and sub mains are installed below the ground level at a minimum depth of about 0.5 meter. So that they are unaffected by cultivation or by the movement of heavy harvesting or any other intercultural operation machinery.

So, they are normally kept at about 0.5 meter to 0.6 meter below the ground level. And this is what you see that the main pipeline has been laid below the ground level. This is also we have installed in our farm for irrigating the crop. Mainly, vegetable crops and other crops are also being irrigated by using this particular drip irrigation system. So, lateral with online emission devices, these are portable. They are removed at the end of each season. Generally, sub-main pipeline, it runs across the direction of the plant rows.

As per the recommendation of USSCS, that is United States Soil Conservation Service, they have recommended that what should be the depth at which such pipelines should be laid. So, this will depend upon the, what is size of the pipeline? Larger the pipeline size, then it should be laid more, means, depth of the placing the pipeline it should be more. So, this is what we see if it is 12 millimeter to 60 millimeter dia pipeline. Normally, it is placed 45 centimeter below the land surface. And then if the pipe size is of 60 to 100 millimeter size, then it is placed about 2 feet below the ground level. And when it is greater than 600 millimeter diameter pipeline, then this is placed 75 centimeter below the ground level.

So, it is important to clean mud and other impurities which are deposited in the pipeline before fitting of mains and sub-main as well as gate valves. A ball valve is provided at the inlet end of the sub-main. And after the ball valve, the air release valve is connected on the drip tape or sub-main pipeline so that whatever air entered in the pipeline or entrapped in the pipeline, that can be removed by using the air release valve. A flush valve is required at the end of each sub-main pipeline to facilitate sub-main flushing.

We need to lay the lateral pipeline. So, once the grommet take-offs are fixed on the sub-main, lateral laying is done as per the design. So, for this, holes are drilled on the sub-main according to the grommet takeoff. So, if the size of the grommet takeoff is 8 millimeter, then 11.9 millimeter dia drill bit is used. And then, if it is the grommet means this pipe size is 13 millimeter, then it should be large because we need to put the grommet for connecting the

lateral pipeline. So, these are some basic arrangements this is needed to properly connect the lateral pipeline with a sub-main pipeline.

Laterals are fixed to one end of the takeoff. Lateral placement is done according to the row distance with sufficient shrinking allowance and extra provision is made so that the length of the lateral is given a little longer. The drippers are punched on the top of the lateral as per the crop requirements. So, the size of the dripper and then particularly what should be the direction of the flow? That is also important. It can be taken care depending on the type of drippers.

Generally, laterals are laid on the ground for surface drip system and underground in case of subsurface drip system. Usually, laterals are placed along contours on sloping land in case of a surface drip system. The downstream side of the lateral can be closed by simply folding back the pipe and closing it with a ring larger diameter pipe which we called it an end plug. This can be easily slipped for flushing the lateral.

Here you can see how the surface drip laterals are being installed on the land surface where there is an arrangement and then there is a pool means where the laterals are placed. In this pool, as the tractor is being forwarded, this pool also drives, and then it is placed at an appropriate spacing. So, depending on the crop row spacing, these pools are being it is coming above the ground level and laterals are being placed.

You see here, how the laterals are coming over the land surface when the surface drip laterals are being driven. That is mechanically driven for a larger area. When it is to be laid below the ground level that is sub-surface lateral, so, this is also done mechanically by putting, so there is the particular pool on which the laterals are placed, and then when the tractor is being driven, it is placing below the ground levels. After it is placed, so, one end of the subsurface lateral is connected with the sub-main pipeline. This is what you see. And this is the connection where it is being made. And then depending on the root zone of the crop accordingly the subsurface laterals have been placed.

Now, punching of laterals and fixing of drip emitters. So, punching of laterals, it should start from sub-main end means from the upstream side of the lateral, we will start attaching drip

emitters. Water should be allowed to flow through the laterals so as to get bulging effect in the pipe which makes it easy for punching the lateral.

The dripper position is fixed as per the crop spacing means depending on the spacing of the crop and then number of drippers needed, it is decided. The drippers are fixed on laterals as per the arrows marked. And it should be towards the sub-main side means water is being taken in the lateral pipeline from the sub-main pipeline. So, accordingly this thing one should take care of when we are fixing the drippers. While fixing the dripper push it inside the lateral and pull it slightly. The end of laterals should be closed with an end cap.

Here I am demonstrating to you how to attach lateral with sub-main pipeline. So, in installation, this is one of the important task. The main pipeline supplies water to the sub-main pipeline. So, main pipeline is usually larger in size so as to supply more water. And pipeline could be made up of PVC or HDPE. Now, here I am showing you, this is a sub-main pipeline which is made up of HDPE.

Now, in this pipeline, when we want to attach lateral pipeline, so, we will make a hole by using the drill bit. Now, this is a field operation because this pipeline will be laid below the ground level and in the field. Just to demonstrate you, I am showing you separately to learn about how the lateral pipeline is attached with the sub-main pipeline. So, in sub-main pipeline, we are using a drill bit. So, using this drill bit a hole is will be made.

And in the hole, we will be placing, this is a gasket, we will be placing gasket. And then there is a GTO. GTO is practically it is a grommet takeoff. So, grommet takeoff is of different sizes. If I want to attach a 16 millimeter pipeline so 16 millimeter pipeline will be attached with the grommet takeoff. So, normally, what is to be done? The water which is coming say from this direction, so, the direction of the grommet take off inlet which will be in this direction.

Means perpendicular to the direction of the flow where the water will be entering. And then a lateral pipeline will be attached with the grommet take off. And on the lateral pipeline, we will place the dripper at appropriate location. This is your dripper. And dripper will be attached with the help of a punch. So, you can see how the hole is being made by using a drill bit and then how the grommet takeoff is being inserted inside the sub-main pipeline.

This is a hole which has been made with the help of a drill bit. Now, you can see here after the hole was made, a washer has been placed in the hole so that water does not leak from this place. Now, the grommet takeoff has been placed in the hole by attaching this particular washer. And then the important part if the flow is coming from this direction, so, this arrow is shown.

So, this arrow is basically it is showing the water will be entering from this end. So, this is the inlet end of the pipeline where the water will be entering. And then on this, a lateral will be attached. So, you can see here a lateral has been attached with this sub-main pipeline. Now, on this lateral, means wherever the position required, we want to give water in the plant root zone. So, exactly at that place, hole will be made.

So, this is the thing when we have attached the lateral pipeline with the sub-main pipeline and then the dripper has been attached with the lateral pipeline. So, one can see that after attaching the drip emitters, how the water it is emerging out of the drip emitter. So, the water which is coming out of the drip emitter, it will depend upon the pressure available in the pipeline and particularly pressure available at the tip of the nozzle. Means, at this particular place, how much is the pressure available? So, this has to be monitored from the inlet end of the lateral.

Now, you can see here when the lateral, when these particular drippers, when we have attached and when we are supplying water, so, the water which is coming out from one end to the other end, it forms the wetting circle. This is the wetting circle it will form. So, when we are observing, one part is that observing the amount of water which is delivering out of the drip emitter. But all the drip emitters, water cannot be collected. So, only few sample places, this water is being collected for finding out the uniformity of water discharging out of the drippers. So, if we take observations, just visual observation, how the wetting circle it has formed. So, if it is of uniform in size, all it is, all throughout field if you see, if it is of uniform size, it shows that the drippers have given uniform discharge.

Now, we will learn, what are the important operational part which are there in the drip irrigation system components? And this should be taken care. So, basically, for the proper operation of a drip irrigation system, one should acquire complete information from the



designer. When one wants to operate the system so, a designer or dealer, he should have a complete record, complete information that how to operate all these components. The person who is operating, he should know when to irrigate means when the irrigation system should be put on. Then, how long the pump or drip irrigation should be operated? Means, this will depend upon the type of crop. This will also depend upon the number of drippers which has been placed to each plant.

So, dripper capacity and the requirement of the water of the crop, accordingly, the time of irrigation one should have the full knowledge about this. Checking the water meter reading, recording the values, and also accurately setting the hydraulic measuring unit means, one should know what is the amount of water which is flowing? So, for all those metering parts, one should have the data.

Now, operating the head valve to begin irrigation, checking the system along with all components for proper operation, beginning with pressure gauge reading at the head end side. And then finding out how much is the discharge it is giving, at least on a random basis. Such data should be collected. One should visit the farm at different points. And then see that whether all the drippers are delivering the discharge as per the recommended value.

Then setting and operating the chemicals and fertilizer injection equipment accordingly as per the guidelines. So, this should be another point one should take care. So, having understood these parts, one can operate and install the system properly.

Now, to learn more in detail, these are the books textbooks as well as the other reference book one can refer to get the full knowledge about the design, about the installation part, about the operating the different components.

So, to summarize this particular lecture, we discussed about how to install the pump, how to install the filter unit, how to install the fertigation unit, and how to operate these drip irrigation system components. And these points, one should take care of to get the maximum benefit or full efficiency of the system. Now, in the forthcoming lecture, we will discuss about maintenance of drip irrigation system. So, thank you very much.