Micro Irrigation Engineering
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Lecture - 33
Maintenance of Drip Irrigation System

Yes, dear participants. Welcome to Lecture 33 of Micro Irrigation Engineering subject. Lecture 33 is on maintenance of drip irrigation system. In previous Lecture 32, we learned about installation and operation of drip irrigation system. The installation, we discussed how each unit should be properly connected and one should take care how to operate the system. Now, once the system is in operation for some time, it needs regular maintenance, routine checking so that we can get full efficiency of the system. And mainly, it is important in case of drip irrigation system that all the drippers they give highest emission uniformity. And this is only possible when we are keeping full care and full maintenance of all the components of drip irrigation system.

So, in this particular Lecture 33, we will discuss about maintenance of filtration system, maintenance of main pipe, sub-main pipe, maintenance of lateral pipe and drip emitters. So, let us go in deeper part of the particular topic. So, maintenance requires periodic preventive checking of the system for successful operation of micro irrigation system. Functioning of drip emitter, how does it wet, leakage from the pipeline, valves, fittings? It should be checked regularly. If we are applying water say in a previous day and then next day morning when you go you see how the wetting it has been formed.

If it is in a proper uniform circle all throughout the drip lateral you observe then you can know that whether all the drip emitters they have given uniform discharge. If some circles these are smaller in size some circle these are in larger in size, it means the drippers are not delivering uniform discharge. So, another part is placement of dripper. Sometime what happened while working, while intercultural operation, while putting the mulch. It may get disturbed. So, it should be properly placed at appropriate location near the plant root zone.

This is mainly in surface drip irrigation system. Leakage through filter, gasket, lids, flushing valve, these are as well as you know there are several other connectors and fittings. This should be monitored regularly.

Filter cleaning, we know as the name says filter means removal of undesired soluble material in the filter system in the drip irrigation system. So, filter is the heart of the drip system and its failure is non-functioning. They are partial functioning, will lead to clogging of the system. So, pressure differential across the filter is to be checked regularly. This will give us the idea that how the filter is effectively working. So, we can accordingly set the timings.

Hydro cyclone filter is one of the types of filter. And this should be installed before sand and screen filter. So, hydro cyclone filter requires relatively as compared to other filters it requires relatively less maintenance. For cleaning the dirt inside the underflow chamber, we need to open the back flushing valve daily. This is just a few minutes work. And then flush the chamber by opening the flush valve or cap thoroughly.

Sand filter, it should be backwashed daily for 5 minutes to remove all the silt and other dirt material which is accumulated on previous day irrigation. Once in a week, while backwashing, backwash water should be allowed to pass through the lid instead of backwash valves. So, sand in the filter bed is stirred up to the filter candles without damaging them. Otherwise, the grading of one particular grade of the sand, if it is misplaced, it will not work effectively.

Dirt accumulated deep inside the sand bed should be allowed to go with the water through the lid. There is a need to use backwashing. And the pressure drop between the inlet end of the filter and at the exit end of the filter. If it exceeds 70 kilo Pascal, we need to backwash the filter. This is as per here it is given ASAE that is American Society of Agricultural Engineers.

Now, this has changed to the American Society of Agricultural and Biological Engineers, ASABE. Earlier, it was ASAE.

So, here you are seeing that how the filter is backwashed. So the backwashing is done. We are opening and allowing the water to go from this end and then closing the valve here and then opening this valve. So, this particular view is backwashing is in progress.

The screen filter flushing at a schedule daily interval is necessary to maintain screen filter. And it is recommended that screen filters should be cleaned if the pressure drop it exceeds

more than 0.5 kg per square centimeter. So, this is another important thing that one should see these values. And then the, before the start of drip irrigation system, flush valve on the filter lid should be kept open so that the dirt and silt is flushed out.

The filter element is taken out from the filter and it is cleaned in flowing water, or by using the soft plastic brush when we are rubbing on the surface of the screen it can be cleaned by using these things. And then again it should be replaced if it has got damaged. You can see here how the cleaning of screen filter it is taking place in case that is the screen filter it is being shown here.

Then, maintenance of fertigation unit, so, before and after fertigation, any system not only the Venturi but all other ways of fertigation mechanism which I have explained to you that whether it is a pressurized tank whether it is a Venturi injector whether it is an injection pump, it should be cleaned with clean water for 10 to 15 minutes so that all the components are washed.

And there is no chemicals they remain in the fertigation unit. If it remains there it will clog the suction port of the Venturi. So, it is important to note that the equipment is to be acid resistant. The lid of the fertilizer tank should be fully tightened while operation. Otherwise, there will be leakage. In order to check leaks between the body and bell housing in a fertigation pump, clean the seals seating and put back the seal or change and keep the position of bell housing at upright.

Sub-main, lateral and bi-wall flushing, so, sometimes silt escapes through the filter and settles in the sub-main pipeline and lateral pipeline. And this causes the growth of algae, bacteria, formation of slimes, and paste in the pipeline. So, this is to be taken care. So, what happened? We need to flush these systems to remove these formations in the sub-main pipeline.

It should be flushed by opening the flush valve which is provided at the end of the valve. A lateral lines should be flushed by removing the end cap. By flushing, even the traces of accumulated salts will also be removed when we are flushing because water is coming in pressure through with the flow all the dirt all the salt which are deposited. And this will help in the proper functioning. Proper operation of the emitters also.

The flushing is stopped by closing the system after some time and then one should see that the water coming out of the lateral pipeline, sub-main pipeline, and main pipeline. When it looks clean, then it should, one should stop the cleaning part.

The other part is chemical treatment. So, clogging or plugging of emitters, orifices bi-wall, it happens due to precipitation or accumulation of certain dissolved salts due to carbonates, bicarbonates of iron, calcium, manganese, and all other kinds of salts. So, clogging is also due to presence of microorganism which I already I have told you about the requirement of filters when we were discussing.

So, the presence of microorganism and the related iron, sulfurs slimes due to algae and bacteria. So, these affect. So, clogging or plugging is usually removed by chemical treatment. And chemical treatment in the drip irrigation system include addition of chlorine means by using the chlorine or some acid means, sometime the low concentration of the sodium hypochlorite, the low concentration of the HCL, these are used. Or, this kind of a compound they are used to as a chemical treatment.

The frequency of chemical treatment on the degree of clogging and quality of water. So, as a general rule, treatment is performed once in 10 days and chlorine treatment is done once in 15 days. But depending on the quality of water, this can be done at further interval. Only thing that, it should be intermittent or continuous for few minutes almost every alternate day that can also be done.

Acid treatment means HCl that is hydrochloric acid is injected into micro irrigation system at the rate suggested by water analysis report. The acid treatment is performed till pH of water is 4. Means, this is the, another thing that it should not go beyond 4. Otherwise, it will be harmful to the plant. It will be harmful to the soil. And after achieving pH of 4, system is shut off for 24 hours.

Then, next day, system is flushed by opening the flush valve and lateral end cap. So, whatever dirt it is deposited in the lateral pipeline, once it is flushed, it will take out this dirt material deposited in the pipeline.

Chlorine treatment, it is in the form of bleaching powder. And it is perform to inhibit the growth of microorganism like algae and bacteria. Bleaching powder is dissolved in water and this solution is injected into the system for about 30 minutes. The system is shut off for 24 hours. After that lateral end caps, flush valves are opened to flush out the water with impurities.

The recommended chlorine doses of 0.5 ppm to 1 ppm; concentration is applied continuously at 20 ppm 20 minutes at the end of each lateral for algae. So, this is for when we are using slimes, 1 ppm free residual chlorine is maintained at the end of each lateral. So, this is to be observed carefully because acid treatment, chlorine treatment, these are important and then maintenance of this system will be effective and it should be maintained at regularly.

Particularly for iron precipitation, so, it will depend upon the type of quality of water. So, iron mainly in the lateritic soil zones, the iron precipitation is the major problem and the 0.64 times the iron content are used to maintain 1 ppm free residual chlorine at the end of each lateral. Efficiency of chlorine injection is related to the pH of water that is required to be treated.

When it is more acidic water, more chlorine may be required for high pH water. So, particularly for high pH places where certain salts have been added in that case means chlorine content or the amount of chlorine may be required to apply in a more quantity. Rate of liquid chlorine or acid depends on the system flow rate. So, rate of injection is estimated and that can be determined by using the equation as stated below.

So, what you are seeing here the rate of injection of chemical into the system. It can be given by the desired concentration. The concentration it is desired in the irrigation water. And then, what is the supply rate? Means, means the system supply rate, means the pump discharge divided by the concentration of chemical solution that is to be injected. This is given in percentage. So, this expression is that the rate of injection of chemical in liter per hour can be expressed.

$$q_c = 6 \times 10^{-3} \left(\frac{U \times Q_s}{C}\right)$$

where

q_c = Rate of injection of the chemical into the system (L h^{-1})

U = Desired concentration of chemical in irrigation water (ppm)

Q_s= Supply flow rate (L min^{-1})

C = Concentration of chemical in the solution to be injected (per cent)

So, this particular expression is used to calculate the rate of chemical injection.

So, we you can refer these books for this particular topic to go in detail. And then these books say the book by A M Michael, this can be referred as a textbook. And then these are some other books which are very important books that can be referred for this particular topic.

So, let us summarize this particular lecture. This lecture, we dealt with the maintenance of filtration system. We dealt with the maintenance of water distribution network. That is your irrigation pipeline, main pipeline, sub-main pipeline as well as lateral pipeline. Then, how to prevent the clogging of drip emitters, we discussed, and how to chemically treat these emitters to prevent further clogging.

Now, in the forthcoming lecture, we will deal with soil water movement through a drip emitter, which we will be discussing in detail in the coming lecture. So, thank you very much.