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ACID TREATMENT FOR DRIP IRRIGATION SYSTEM

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ABSTRACT

Drip irrigation means the drop by drop application of water directly to the plant root zone, Drip irrigation saves up to 50% of water on comparison to flood and furrow system of irrigation, Fertigation via Drip is 30% more effective than Flooding, The Combination of drip irrigation and Fertigation increases the productivity by up to 200% and in sugarcane by 133%, Saves the energy, Reduces the weed growth, Reduces the Incidence and Transmission of Pests and Diseases, When the Drip irrigation system is not Maintained properly, that is when day to day cleaning activities of Drip system is not performed, it leads to Blockage or Clogging of drip irrigation System, Majorly the problem of clogging arises due to the precipitation of the salts, to rectify this problem Acid treatment is Necessary, In the Acid treatment the selected acid is injected in to the drip system via the Venturi or fertigation tank, Where the Acidulated water remains in the laterals for 24 hours and then that Solution is driven out by the means of fresh water.

Keywords: Drip irrigation, Acid treatment, Acidulated Water, Clogging or Blockage, Precipitated salts, Laterals, Emitters, Throttle Valve, Suction, Flush Valves, End caps, Primary filters, Secondary Filters, Chlorine Treatment.

INTRODUCTION

Drip irrigation systems are prone to clogging or blockage due to improper maintenance, There are Several factors that are responsible for the clogging of drip irrigation system, They include

1. Presence of Microorganisms in the system (Bacterial slime, Algal growth).
2. Presence of Large Particles and the suspended particles (Clay and silt) in the water source, which enter and Block the Drip system.
3. Presence of Certain dissolved salts (Carbonates and Bicarbonates, Calcium and Magnesium, iron) where they precipitate and form deposits within the lateral pipes but sometimes they also lead to the blockage of the emitters.

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Filtration of the water through the Primary (Sand Filter (open water source) and Screen Filter (Borewell)) and Secondary Filters (Disc Filter (Costly) and Screen Filter (Cheaper)) do not remove the microorganisms and dissolved salts, The microorganisms interact with the sand particles and they lead to the clogging of the drip irrigation system, To rectify the problem of clogging, Acid or chlorine (chemicals) is injected along with the irrigation water, Hence this process is called as chemigation or Chemical treatment.

Acid treatment is used for Rectifying the problem caused by the Dissolved or precipitated salts, whereas Chlorine treatment is used for rectifying the problems caused by the microbial growth In the drip system, These Chemicals can be injected by using Venturi System, Fertigation tank and Fertijet Pump, frequently the Problem of clogging arises due to the dissolved or precipitated salts, So Acid treatment is necessary for rectifying this problem.

CALCULATION TEST FOR THE DETERMINING DURATION OF ACID TREATMENT

This test is performed only once to determine the duration of acid treatment, In this test we need to observe the time taken by the color dye to reach the last lateral and the last emitter, When the Color dye reaches the last emitter, that time is recorded and it is the proper duration for carrying out the acid treatment, Steps involved in this test are :

1. Run the drip irrigation system
2. Create a pressure difference for desired suction using the Throttle valve
3. Mix a color dye in the water and use it as an injection liquid
4. When the Suction starts then Switch on the stop watch for recording the time
5. Measure the time required by the color solution to reach the last lateral and last emitter
6. After recording the time, flush out the color solution by opening the end caps
7. Then perform the same test if there are any other sections in your field
8. Incase of the Multiple Sections, Note Down the section number and time required for the acid treatment

ACIDS THAT CAN BE USED FOR ACID TREATMENT

For Acid treatment any of the following acids can be used, Only phosphoric acid can be used in the standing crop, where as the other three acids should be used in the Off season, where there is no crop

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SNO	NAME OF THE ACID	CONCENTRATION REQUIRED
1	Hydrochloric Acid	35%
2	Nitric Acid	33%
3	Sulfuric acid	65%
4	Ortho Phosphoric Acid	85%

Hydrochloric Acid is readily Available in the market, it should be used only when 50% of the emitters are clogged or blocked, Hydrochloric Acid Should not be used for the chlorine sensitive Crops, This Should not be used in the standing crop.

Nitric Acid can be used in the Standing Crop, This is Recommended when the Clogging or Blocking severity is less, They also provide the Nutrients.

Ortho Phosphoric Acid can be used in the Standing Crop, This is Recommended when the Clogging or Blocking severity is less, They also provide the Nutrients, If ortho phosphoric acid is used to meet the Phosphorus Content (when used as a Nutrient source/ Fertilizer), There is no need of any acid treatment.

Sulfuric Acid should be used if the blockage due to salt Precipitation is severe, Sulphuric acid and Hydrochloric acids are most commonly used for the acid treatment as they are the strong acids.

MATERIALS REQUIRED FOR ACID TREATMENT

1. A Plastic Drum
2. Measuring Cylinder of 2 liter Capacity
3. Glass rod for stirring
4. A dropper with scale having the milli liters count
5. Litmus paper for observing the pH change
6. Any of the above Acid for Treatment
7. Goggles, Gloves, Full hands Shirt and Complete Trousers
8. Basic Medical kit (It can be used in case of Emergency)

STEPS FOR ACID TREATMENT

ESTIMATING THE REQUIRED VOLUME OF ACID

1. Take a 2 Liter Measuring cylinder and Clean it, After cleaning dry it for some time, Then fill the Measuring cylinder up to 1 liter mark with the water that is used generally for the drip irrigation.

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2. Wear the goggles, Gloves, Full hands Shirt and Complete Trousers
3. Add the acid drop by drop in this 1 liter water using the dropper
4. Stir the water well with the glass rod
5. Measure its pH value using Litmus paper (When litmus paper turns Light red or pink, the pH is 3)
6. Continue this process until the pH of the water is equal to 3
7. Note down the amount of acid (in ml) required to obtain pH 3
8. Note down the Nominal flow rate of the system that is written on the filter (like 25m3/hr)
9. Do the Final Calculation, For an example, if the amount of acid required to obtain pH 3 for 1 Liter of water is 2ml, As per the Calculation test (using Color dye) we came to know that within 20 minutes the acid is reaching the last emitter, the final calculation is as follows :
    - Total water flow in 20 mins as per nominal flow rate 25m3/hr – 25000/60 x 20 = 8334 liters of water approx.
10. Volume of acid required for 8334 liters of water – (8334 x 2ml)/ 1 liter = 16.6 liters of acid is required.

INJECTING THE ACID INTO THE SYSTEM

1. Start the drip system.
2. Set the desired suction rate, so as to inject the acid within the calculated time of treatment.
3. Take the required quantity of acid in the plastic drum.
4. By closing the throttle valve allow the acid to get mixed with the irrigation water, check the pH of the Acidulated water at the nearest dripper and adjust the throttle valve, if the pH is more than 3, then increase the acid suction rate by slightly closing the throttle valve, if the pH is less than 2, then decrease the acid suction rate by slightly opening the throttle valve, therefore regulation of the throttle valve is important as the desired pH can only be maintained through it.
5. When the water mixed with acid has reached the last emitter, then turn off the drip irrigation system, Don't use the system for 24 hours, In that time the salts dissolve in the acid mixed water.
6. After 24 Hours open the end caps of the laterals, open the submain flush valve and then switch on the pump and flush out the entire acid water contents, where the salts that are dissolved in the acid water are driven out.
7. Close the Flush valves and end caps of laterals after complete flushing and then use the system carefully.

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CONCLUSION

1. Acid treatment is recommended when Electrical conductivity (EC) of the water is above 0.5
2. Irrigation water of EC above 2.5 is not suitable for drip irrigation, if used the system will collapse due to severe clogging frequently.
3. Acid treatment is not necessary if purely water soluble fertilizers are used for fertigation.
4. When no acid injection occurs check whether throttle valve is fully closed, if it is fully closed then open it fully and start closing again till the desired suction rate is obtained.
5. Venturi system Should be leakage free, if it is leaking, then replace the old venturi with new venturi.

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