

## *Agricultural and Biosystems Engineering*

# **BASIC FERTIGATION FOR MICRO-IRRIGATION SYSTEMS**

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### **APPLICATION OF FERTILIZER THROUGH IRRIGATION WATER**

The application of fertilizer through irrigation systems is referred to as fertigation. Using fertigation, fertilizer can be directed towards the plant root zone with irrigation water. A liquid fertilizer solution is injected into the irrigation water at the desired rate. When injecting fertilizer into a properly designed micro-irrigation system the fertilizer will be carried to the plant root zone by the irrigation water.

Fertilizer is generally available in dry, suspension or solution forms. When using a dry material, only water-soluble compounds should be used. Dry water-soluble fertilizer must be dissolved into water before it can be injected. Dry fertilizers may be coated or use clay as a carrier, if so they must be decanted before injection. Suspension fertilizers may contain some undissolved constituents. Any undissolved material may cause plugging problems if allowed to reach the emitters. Solution fertilizers are completely dissolved. Fertilizer solutions come in many different blends. The material may require dilution with water in order to provide an adequate volume for uniform distribution to the crop. No matter which form of fertilizer you choose it should be tested with your irrigation water before injection into your micro-irrigation system. In a clear glass jar dissolve the fertilizer in

question in irrigation water at the concentration equivalent to the mixture that would be provided to the plants. Allow this mixture to set 12 - 18 hours in the dark. If the mixture is cloudy or forms a precipitant, it may clog your micro-irrigation system if injected. Remember that this test is specific to this water source.



## INJECTION METHODS

Fertilizer injectors can be divided into pumps and pressure differential methods. Pumps must develop a pressure greater than that of the irrigation line at the injection point in order to introduce the fertilizer into the system. Small positive displacement pumps or centrifugal units are usually used. Positive displacement pumps are very good because they can be accurately metered. Both electrical and water powered positive displacement pumps are available. Piston and diaphragm pumps are available which do not require electricity to operate. They utilize a portion of the irrigation water flow as motive flow. As with a pressure differential method some degree of system pressure is required to operate the unit. Suction line injection, venturi devices, and proportional mixers all require a pressure differential to operate. While suction line injection is a common method, it is not a recommended injection method. There is no way to accurately meter the injection rate using a pump suction line injection setup. Suction line injection should not be used due to the danger of back-siphoning the fertilizer into the irrigation water source if the pump were to stop. In addition, the fertilizer solution is pulled through the pump and comes into contact with the pump seals, which could shorten their effective life. The most common, recommended pressure differential method is the venturi. Venturi injectors are very economical and require no electric power to operate. Venturi injectors suitable for commercial vegetable production are available from \$50 - \$500. As a rule of thumb about a 20% pressure drop is required to effectively operate a venturi injector. With any chemical injection system a sound backflow prevention device must be in place to prevent accidental contamination of the irrigation water source. Any chemicals, including fertilizer solutions, should be injected up-stream of the filter system. If a precipitant of some type forms, it will be caught in the filters, rather than the emitters.

## FERTIGATION TIPS

- ❖ Be aware of the effects of storage time and temperature on fertilizer solutions. Many solutions may salt out at lower temperatures. For example urea-ammonium-nitrate solutions will salt out at about 60 °F.
- ❖ If injecting phosphorous and potassium, make sure you use soluble forms. White phosphoric acid and potassium nitrate are soluble forms of these nutrients.
- ❖ Be aware that phosphate will react with calcium to form a precipitant (make sure you test before you inject!)
- ❖ Always inject all fertilizers and chemicals before (upstream of) your filtration system.
- ❖ Inject fertilizer toward the end of an irrigation cycle, but allow enough time for clear water to displace the fertilizer in the irrigation system. This ensures all the fertilizer reaches the plants and reduces fertilizer build-up on or in emitters.

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