



Chemigation and Fertigation of Vegetable Crops Grown in Florida in the BMP Era¹

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This publication is one of a series entitled Fertilizer and Irrigation Management in the BMP Era.

This series is divided into nine principles described in the Introduction Chapter (HOS-897). This publication is part of Principle 2, "Soil Test and Follow the Recommendations." BMP implementation requires a global approach to production management. However, for presentation purposes, each aspect of vegetable production is described in a separate publication.

The use of irrigation systems for the application of agrichemicals (chemigation) offers several important advantages over traditional means of chemical application and has become a common practice during recent years. Chemigation is often less expensive than other methods of application and allows chemicals to be applied only when needed and in precise amounts. This "prescription" application method follows plant needs more closely than traditional methods and may minimize loss due to leaching. Chemigation also improves safety to operators, reduces the amount of chemicals required, and reduces chemical costs.

Working Definition

Chemigation is the process of chemical application through the irrigation system. Fertigation, which is a similar, but more specific term, refers to the application of fertilizer to crops through the irrigation system.

Irrigation System Design – Things to Do

- Select equipment that is designed or adapted for the injection of chemicals into the irrigation system at a controlled rate.
- Select irrigation system components that are compatible with the chemicals to be used.
- Locate the injector so that relatively small amounts of water are delivered to the field before the material reaches the crop. This will reduce the potential for over-watering a crop and subsequent chemical leaching.
- Design the irrigation system to maximize application uniformity.

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- Design the system with appropriate backflow prevention devices.

Injection Periods and Calibration – Things to Do

- If the injection period exceeds the maximum irrigation period, use split applications to prevent over-irrigation and chemical leaching.
- Always calibrate the irrigation system to be used with the injection system.
- Calibrate the injection system while the irrigation system is operating since irrigation system operating pressures and flow characteristics may influence the injection rates.

Chemical Mixture and Injections – Things to Do

- Depending on the chemical, apply either as a precise concentration or as a bulk mass of chemical with possibly varying concentration levels.
- When using a mixed solution of fertilizer, formulate with the following factors in mind: crop nutrient requirement, the soil-test-predicted amount of fertilizers to be applied, and the pumping capacity of the injection system.
- Bring the drip irrigation system up to operating pressure before adding fertilizer in a non-continuous fashion such as once per day or once per week.
- Operate the irrigation system long enough after completion of injection to ensure proper flushing. If complete flushing cannot be achieved without excessive water applications, the flushing period might be the next irrigation cycle of the day.

Fertigation with Drip Irrigation System – Things to Do

- Begin the fertigation program one or two weeks after planting if nitrogen and potassium was applied pre-plant.

- Inject fertilizer on a daily or weekly basis depending on the fertilization and irrigation schedule.

- For maximum effectiveness, use highly soluble fertilizer with drip irrigation injection. Nitrogen sources include ammonium nitrate, calcium nitrate, various nitrogen solutions, and potassium nitrate. Potassium sources include potassium nitrate, potassium sulfate, or potassium chloride.

Fertigation with Overhead Irrigation System – Things to Do

- Use fertigation mostly on sandy soils that require small but frequent water applications. Use fertigation through sprinkler systems on crops with close row spacing, such as leafy greens or corn.
- Begin fertigation only after the crop has developed enough to ensure the root system has advanced into the inter-row area in order to intercept nutrients.

Things to Avoid: Potential Pitfalls

- Do not use a chemical/fertilizer concentration that is damaging to any part of the irrigation system or crop.
- Do not exceed manufacturers recommended application rates for the irrigation system.
- Avoid excessive irrigation that could cause nutrients to be leached below the root zone.
- Do not inject materials that might clog the irrigation system (such as P fertilizers).

Applicable Technical Criteria

Before injecting any chemicals into an irrigation system, verify that the system includes the required backflow prevention devices for the type of chemical to be injected. The general rules for backflow prevention in Florida are presented in IFAS Bulletins listed in the reference section. In addition, local ordinances should be checked since they may be more restrictive.

Operation and Maintenance Issues

- Include in the maintenance schedule an inspection of the mechanical components as well as the irrigation lines.
- On a frequent basis, record the flow rate and pressure delivered by the pump as well as the energy consumption of the power unit.
- Maintain records on at least a bi-weekly or monthly basis.
- Check large deviations from the normal operating characteristics with a repair specialist.
- Continuously monitor the filtration equipment for clogging and clean as necessary.
- Inject acid, chlorine, or a commercial water treatment chemical to remove chemical precipitates or organic growth. In low volume systems, clean the drip lines and emitters as needed to prevent clogging.

Other Considerations

- Water quality can be an important factor to consider in the design or adaptation of a chemigation system, as some water supplies require chemical amendment to prevent bacterial growths or chemical precipitants from clogging the system.
- Concentrated chemical solutions can be advantageous because shorter injection cycles are required to inject the same amount of chemical.
- Phosphorus and micronutrients should generally be applied directly to the soil instead of by injection. This is because these chemicals, in combination with Florida's high calcium carbonate waters, can result in significant chemical precipitation.
- Weather conditions have a great effect on the solubility of fertilizer solutions. Higher concentrations of nitrogen and potassium can be maintained in solution under warm weather conditions.

- Growers wishing to investigate the possibility of formulating their own fertilizers should thoroughly investigate the technique. When formulating nutrient solutions, one should take into consideration the associated problems with maintaining nutrients in solution under various conditions as well as ensuring that the solutions are made according to desired specifications.

Additional Readings

Injection of Chemicals Into Irrigation Systems: Rates, Volumes, and Injection Periods, Bull. 150, Fla. Coop. Ext. Ser., IFAS, Univ. of Fla.
<http://edis.ifas.ufl.edu/AE116>

Microirrigation on Mulched Bed Systems: Components, System Capacities, and Management, Bull. 245, Fla. Coop. Ext. Ser., IFAS, Univ. of Fla.
<http://edis.ifas.ufl.edu/AE042>

Fertilizer Application and Management for Micro (drip)-irrigated Vegetables in Florida, Circ. 1181, Fla. Coop. Ext. Ser., IFAS, Univ. of Fla.
<http://edis.ifas.ufl.edu/CV141>

Causes and Prevention of Emitter Plugging in Microirrigation System, Bull. 258, Fla. Coop. Ext. Ser., IFAS, Univ. of Fla.
<http://edis.ifas.ufl.edu/AE032>

Chemical Injection Methods for Irrigation, Circ. 864, Fla. Coop. Ext. Ser., IFAS, Univ. of Fla.
<http://edis.ifas.ufl.edu/WI004>

Commercial Vegetable Fertilization Principles, Circ. 225E, Fla. Coop. Ext. Ser., IFAS, Univ. of Fla.
<http://edis.ifas.ufl.edu/CV009>