



IRRIGATION SYSTEMS CAN OFFER ALTERNATIVE USES

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The elements of every landscape should have more than one singular purpose. Trees can provide shade, fruit and homes for birds and entertainment for adventurous children. Lawns are a vision of paradise and the perfect surface for volleyball, soccer and Sunday picnics. Lighting shows off the sculptural form of a tree and aids pedestrians in getting safely home at night. Irrigation systems, too, can be multi-faceted, delivering nutrients and safeguards to plants if the system meets all of the basic rules and guidelines. Nicknamed by the soluble materials that the irrigation system can deliver, fertigation and chemigation offer turf, landscape and nursery managers unique opportunities to effectively deliver more than just water to monocultural turfgrass, landscape plants and nursery stock.

To best understand the possibilities for expanding the use of an irrigation system, let's review the hybridized names of the different applications. Whereas the system that delivers all of these materials is an irrigation system, definitions for each type of material delivered are different. Chemigation is the broad umbrella term given for several different materials applied: fertigation describes the application of fertilizers, insectigation of insecticides, nemitigation of nematicides and fungigation of fungicides. You also can inject other materials such as gypsum, acids and acidifying materials, as well as wetting agents, through irrigation systems. As professionals disagree on pure definition, we'll use chemigation to describe the general process related to all applications.

Is chemigation for you?

Although the materials delivered through an irrigation system may vary, every landscape and nursery manager should review the following primary requirements for these methods for successful, cost-effective use:

- Is the coverage of the existing irrigation system sufficient? None of the applications described previously will increase irrigation efficiency. Although fertigation is touted as a viable alternative to "green striping" that mechanical application of granular fertilizer can produce in overlap areas, you'll still get green "doughnuts" around a full-circle head if you don't have good head-to-head coverage with which to begin. Remember, too, that some venturi-

Experience has shown that the distribution uniformity of the dissolved chemicals is about the same as the distribution uniformity of the water. For this reason, you should perform a coverage test to determine irrigation efficiency. By performing the can test used in most irrigation audits, you can ascertain the coefficient of uniformity, or design uniformity (DU) (see "How to: Evaluate sprinkler-irrigation uniformity," Grounds Maintenance, June 1997). Most case studies show that you'll get the best results from chemigation of any sort when you apply it through a system at 80 percent (or higher) DU. If the DU is less than that, you should make adjustments to the system until you meet that basic criterion. In addition, determine the precipitation rate (PR) for the type of irrigation head, or gallons-per-hour rate for drip emitters. You can do this through related product-specification catalogues. The PR will need to correlate with the delivery solution of the specific chemical used and with the infiltration rate of the site soils.

- Will local regulatory agencies permit their use? Because any chemical has the potential to cause harm if you don't use it correctly, regulatory agencies want to make sure that any chemical applied through an irrigation system will not negatively affect plant and animal species around the use site. Water purveyors want to make sure that no chemicals are back-siphoned into drinking-water supplies, and they demand the best backflow prevention possible. In the same way, regulatory agencies want to be assured that chemical by-products, such as nitrates, do not escape an application site and negatively affect water-courses and other native animal habitats. Before you install an injection system, review your intended use with regulatory agencies to make sure you can effectively meet what might be stringent, and costly, guidelines for use.
- Does chemigation best serve your maintenance needs? Although the technology of fertilizer and chemical injection has greatly improved in terms of system diversity for almost any application, the true bottom line for any system is whether it best serves the specific needs of the individual plant.

Yes, in best-case scenarios, injection systems can provide more exacting applications of soluble materials to landscapes and container stock, and at a greater cost saving, than the traditional mechanical applications can. As a specific case in point, southern Florida has thousands of injection systems on its golf courses and turf landscapes. For example, every square foot of turf on Isla Del Sol, a small island across the bay from St. Petersburg, receives fertigation during the winter. Why? The sandy soils of that region do not hold nutrients well. Thus, they seem better served by lighter, more frequent applications of fertilizer to green up the ryegrass sown over the dormant warm-season grasses in winter. Fertigation serves their needs perfectly, whereas it may not in a clay soil in the West.

All agree that the best way to assess your chemical-injection system needs is to have the site soils and water supplies tested by an analytical laboratory to best determine efficiency.

- Best-case scenarios. Because fertilizer and chemical requirements vary greatly by plant species and operational environment, fertigation and chemigation work their absolute best in monocultural plantings with uniform operational environments. For example, turfgrass with uniform soil and shade, or one species of nursery stock in a shade house, are good examples of the mutual use of fertigation and chemigation.

Even if the irrigation system has a DU of above 80 percent, you also must achieve a correct mixing of water and application chemicals. Several other considerations can affect the correct mixing of inflow water and chemicals, primarily the characteristics of the material in the chemical storage tank: chemical nature, temperature, concentration, specific gravity, rate of flow, solubility, etc. whereas professionals differ in which type of application works best overall, all agree that having specialized help in selecting and implementing chemigation programs is money well-spent; most equipment and fertilizer companies offer some sort of related service to help you get going.

Basic components

Several basic groups of chemigation equipment are available: Venturi, or siphon, types that include one-step and venturi pump; proportional tank types; and proportioners and metering pumps. Every one of the systems described below is effective as long as you correctly select it for a specific use and according to the conditions of the specific-use location.

- One-step venturi. The simplest (no moving parts) and least-expensive equipment opportunity, one-step systems use the venturi principle of creating a siphon by decreasing the size of the irrigation delivery line where the fertilizer inlet port is located. The system draws fertilizer directly from a container, which can be open, into the irrigation water for delivery to the landscape, field or nursery.

Despite its ease of operation and low equipment costs, this system has three primary drawbacks. For one, it is the least accurate of the primary systems in terms of fertilizer proportioning at different irrigation flow rates. Second, by constricting the irrigation delivery line to create the venturi section, the system experiences an overall pressure loss within the irrigation system. Third, if water pressure is too great, or varies too much, erratic suction pressure can "blurp" too much fertilizer into the delivery lines, which can burn fertigated plantings. Manufacturers of venturi-type systems advise grounds managers to add about 20 pounds per square inch (psi) to the base operating pressure of the irrigation system to correct for venturi losses.

- Venturi pump. This equipment couples the basic principles of the one-step venturi with a tube parallel to the primary siphon line at a slightly lower pressure, creating a pressure differential.

- Proportional tanks. Proportional tanks use irrigation-system line pressure to inwardly compress fertilizer inside a rubber bladder. Fertilizer then enters the irrigation system under pressure resulting from inward water pressure.
- Proportioners. Proportioners are the most efficient devices for injecting fertilizer and other chemicals in direct proportion to the actual flow of the irrigation water. They achieve this through the use of a water-motor-driven proportioner that increases or decreases the portions of fertilizer based on actual water flow. External power is needed for this system. It can be mobile or field-located.
- Metering pumps. Metering-pump systems use electric motors and mechanical pumps to deliver precise amounts of chemicals in relation to exact time intervals but irrespective of water flow rates. These systems maintain a high degree of accuracy of feed as long as the flow rates are constant within the irrigation system. This system's external power supply needs can limit its use location.

Chemicals and their use

If you have effectively achieved a DU of more than 80 percent in the irrigation delivery system, and if you've selected the correct injection system for your chemigation needs, the next task is the proper choice of chemicals. As previously stated, soil, water and leaf-tissue analyses can help best determine the match for chemical use, as can the help of pest control advisors and other field specialists.

You can introduce many different chemicals into growing environments based on your site's specific needs. Turf managers using fertigation praise the technology's abilities to deliver fertilizers, pH-adjustment chemicals and soil penetrants reliably with each irrigation. Because soil does not store some nutrients well, such as nitrogen, potassium and sulfur (known as mobile elements) as easily as other nutrients (this is especially true in sandy soils), the frequent, light applications possible through fertigation systems can keep turfgrass healthy and green. Whichever chemical you specify for use, professionals agree that the material's solubility is perhaps the most critical criterion for successful operations. If a pure solution of a desired chemical is not available, proper mixing and downstream filtration of any undissolved chemical is a must for successful delivery.

As each irrigation system differs in components, ultimately the orifice size of the irrigation head will determine the amount of solution quality-control needs for problem-free use. For example, a 1-inch nozzle on a rain cannon could pass a piece of gravel, but the micron-sized orifice of a drip emitter requires extreme purity for continuing service.

A technology worth looking into

Chemigation works best if you can meet three primary criteria:

- The delivery irrigation system provides coverage of 80 percent DU or better.
- The injection equipment used provides the tailored accuracy that the specific end-use demands.
- The chemicals to be delivered meet the specific needs of the plants, are accurately proportioned to prevent waste and are as soluble as possible to pass through irrigation heads or emitters.

To help determine feasibility of use, start-up procedures and continued problem-free operation, consult with specialists: irrigation designers and water auditors can help with coverage and irrigation efficiency; injector-equipment manufacturers' representatives and local equipment suppliers can help with the selection, purchase and set-up of equipment; and analytical laboratories, chemical suppliers and pest-control advisors can help determine specific product need and use.

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