The Best Irrigation System for Cut Foliage Production

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We are frequently asked what is the best irrigation system to use for cut foliage production. This is, of course, a trick question since there is no such thing as a “best” system. When deciding on an irrigation system design many factors should be considered, including:

- What crop(s) will be grown?
- Will production be in containers or in-ground? If in containers, what size? If in-ground, what is the soil type?
- Where will the crop(s) be grown — outdoors or in a shadehouse or greenhouse?
- Is the irrigation system going to be used to apply only irrigation water or will it be used for cold protection and/or to apply chemicals (chemigation, fertigation)?
- What is the water source and how is the water quality (alkalinity, etc.)?
- How much should you spend on an irrigation system given the value of the crop?

What crop(s) will be grown? Is foliar wetting a problem because of potential disease problems? Examples of bacterial diseases that are aggravated by foliar wetting are Pseudomonas leaf spot of Florida/Holland/Israeli ruscus (Ruscus hypophyllum) (reference 1) and Xanthomonas leaf spot of English ivy (Hedera helix) (reference 2). Micro irrigation (drip/trickle/spray-jet), rather than overhead irrigation, should be used for these crops.

Will production be in containers? Most cut foliage crops that are grown in containers are big enough in size and are held long enough to warrant the use of micro irrigation. These systems conserve water, energy and nutrients, and, as mentioned above, may help reduce foliar disease problems. However, micro irrigation systems are more costly to install and maintain. It is necessary to have high quality water and to perform regular maintenance for these types of systems to be successful. (Reference 3 provides information about micro irrigation systems.)

Many cut foliage growers are unaccustomed to container production and may forget to take into account the potential for foliar wetting and disease problems. Micro irrigation systems can help reduce these issues and improve crop quality. It is important to carefully consider the factors listed above when deciding on an irrigation system for cut foliage production.
consideration the limited water holding capacity of the restricted growing medium volume in containers. Containerized plants may need to be watered more frequently than in-ground grown plants that have more extensive root systems.

Most in-ground production occurs on sandy soils with low water-holding capacities and relatively little lateral water movement. Therefore, irrigation systems must be designed to uniformly wet the surface of the crop rootzone on an as-needed basis. Remember, water and nutrients that are applied to non-crop areas (aisles, road, space between containers, etc.) are wasted.

**Is the crop grown in a structure?** Water is used to cold protect crops like leatherleaf fern (*Rumohra adiantiformis*) and sword fern (*Nephrolepis exaltata*) that are often grown under artificial shade. Because of this, overhead irrigation systems with low angle sprinkler trajectories must be used to apply water so that ice does not build up on the shade fabric and structure and cause mechanical damage due to its weight. Further, fertilizer and pesticides are applied using irrigation systems for these and many other cut foliage crops. Therefore, it is critical that these overhead irrigation systems apply water uniformly. Knowing this, the question emerges, what overhead irrigation system is the most uniform?

Perhaps you have already guessed that there is no one “most” uniform system, but there are many systems with good uniformity. The Natural Resources Conservation Service (formerly Soil Conservation Service), working for the St. Johns River Water Management District, tested the uniformity of 148 overhead irrigation systems used for cut foliage production. They found that only 16 systems (11%) had distribution uniformities (DUs) of 80%, the recommended minimum, or greater. DUs are a measure of how evenly the water is distributed in the space between a set of adjacent sprinklers and does not address uniformity of the entire irrigation system. (For information on how to determine DUs, see reference 6.) Although the overall performance of the irrigation systems was disappointing, some useful information was learned about the better performing systems.

Did the better performing systems use a particular sprinkler? No, the top performing systems used Nelson R2000 sprinklers, or Rainbird 20A or 20AH sprinklers, or Weather Tec 1015 or 10-30 sprinklers. Could other sprinklers from these and other manufacturers have achieved similar high marks? Of course, if the systems were designed properly.

What about orifice sizes? Orifice size varied from 13/128" to 20/128" (5/32") for the most uniform systems. This range was essentially the same as for the 12 worst systems, those with system DUs of less than 50%! Orifice size is only one factor used to design irrigation systems. On the better performing systems, the orifice sizes were appropriate for the sprinkler types, spacings, operating pressures and riser layouts used.

Was uniformity correlated to sprinkler spacing? No. Was uniformity correlated with system pressure? No. Was uniformity associated with water application rate? No. Top performing systems had application rates ranging from 0.10"/hr to as high as 0.49"/hr (a similar but somewhat wider range than the twelve poorest performing systems). Then what did the top performing systems have in common? They were competently designed, properly installed, well-maintained and operated at the appropriate pressure.

**Water quality considerations** – Irrigation water quality is of concern regardless of the system used to apply it because of the effects it can have on plant growth and quality (see
Concerns about the chemistry of water — alkalinity (total carbonates), pH and salinity (electrical conductivity) — transcend application method. However, as orifice sizes get smaller, the need for higher quality water increases because of concern about system clogging. Clogging can be physical (debris), chemical (scale) and/or biological (algae and bacteria). While most cut foliage crops are currently irrigated using impact sprinklers with large diameter orifices, those using and/or planning systems with small orifice emitters should pay particular attention to concentrations of bacteria, carbonates, dissolved and suspended solids, hydrogen sulfide, iron and manganese in their water. Water source concentrations posing a plugging potential and measures to deal with these problems are given in reference 5.

**How much should you spend on an irrigation system?** - Unfortunately, penny wise and pound foolish is often the case when irrigation systems are “designed” and installed. Poorly designed and/or operated systems can result in serious cultural problems and difficulties in controlling pathogens and pests. All new systems should be designed with systemwide application uniformity and piping volumes (clear times) taken into consideration. The amount that should be spent is whatever it takes to properly design and maintain a system that will meet all the needs of the crop and the grower. Remember, for many firms, the irrigation system is the most used tool for producing saleable plants.

**Where can you go to get help designing a new or retrofitting an existing irrigation system?** Try the local office of the University of Florida’s Agricultural Extension Office and/or United States Department of Agriculture’s Natural Resources Conservation Service. Another resource is system designers that are members of the Florida Irrigation Society (FIS). Members can be located by going to the FIS website (fisstate.org) and checking out their list of members for the region of the state in which you live.

There are also computer software programs available that can help you make irrigation system design decisions. These programs run the gamut from useful utilities to full-blown computer-aided design system programs for irrigation professionals. Prices, likewise, vary greatly — from free to thousands of dollars. These programs are available from irrigation system supply companies and other sources. For example, Nelson Irrigation offers IRRICAD (www.wwics.com/~nelsonirr/html/irricad_design.html) and Senninger Irrigation sells Irri-Maker (www.senninger.com/mm). Senninger also has a free program (WinSIPP) that helps in the selection and spacing of their sprinklers. Several other programs are available from the California Agricultural Technology Institute’s Center for Irrigation Technology (www.atinet.org/newcati/cit/good/). For other choices, point your Internet web browser to www.wiz.uni-kassel.de/kww/irrisoft/irrisoft_i.html. There Dr. Thomas-M. Stein has assembled a searchable database containing 105 programs. And for those of you with skill at using spreadsheet software (for example Corel Quattro Pro, Lotus 1-2-3, Microsoft Excel, or even WordPerfect tables), much of the irrigation system piping design can be done using your spreadsheet and a few equations to determine friction losses and clear times.

Water is an essential, limited, and precious resource that we should all strive to use wisely.
References


† available on the World Wide Web at http://edis.ifas.ufl.edu
‡ available on the World Wide Web at http://www.mrec.ifas.ufl.edu/cutfol/cfg.htm