

UMass Extension

Greenhouse Crops and Floriculture Program

Fact Sheets

Greenhouse Management / Engineering

Sizing the Greenhouse Water System

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The availability of water is critical when planning for a new or expanded greenhouse facility. Some growers have had to abandon plans or move to a different site because adequate water was not available.

Also affecting the water supply is drought conditions in some areas of the U.S., especially in the Southeast this past year. Restrictions and water laws can also have an impact on production facilities as well as the use of plants by homeowners.

Water usage is affected by many variables. Most important of these is the level of solar radiation within the greenhouse. This varies from a low level during the winter months to two to three times as much during the summer. The design for the water supply has to be made for the peak use time of the year.

There have not been a lot of studies conducted on the water usage of plants. A rule of thumb is to have available 0.3 to 0.4 gallons/square foot of growing area per day as a peak use rate for the warmest day. For example a 30' x 100' greenhouse with 2400 square feet of benches would require a peak use rate of 720 to 960 gallons/day. This corresponds with the evapotranspiration rate for most areas of the country. The following factors can increase or decrease the amount of water needed:

Solar radiation – the level of radiation that reaches the plants is reduced by 10% to 40% due to the glazing and the structural members in the greenhouse. This reduces the transpiration.

Shading – adding shading outside or inside will reduce the radiation level on the plants. Depending on the level of shade, this will reduce evapotranspiration and therefore water needs.

Air movement – Fan ventilation and HAF systems increase the rate of evapotranspiration. Depending on location and nearby greenhouses or other buildings, sidewall vents and open-roof designs can also have an influence. A 5 miles/hour breeze can increase evapotranspiration by 20%.

Type and size of the plants – Seedlings or small potted plants require less water than a full-grown tomato or cucumber crop. A large root mass or heavy leaf canopy will increase water needs.

Type of irrigation system – only 20% of the irrigation water applied with an overhead sprinkler system may reach the soil in a potted plant crop with heavy foliage. On the other hand, all the water applied with an in-pot drip system gets to the soil. Uniformity of watering is usually best with a boom system. Ebb and flood systems, flooded floors and hydroponics conserve water by recycling and reusing the excess water.

Leaching – the recommendation that at least 10% of the water applied be allowed to leach out to remove excess fertilizer salts increases water usage. Often leaching accounts for a much higher

percentage and can increase water needs significantly. The type of growing mix used also affects the amount of water holding capacity and therefore the frequency of watering.

Other uses – In addition to plant requirements, water is needed for pesticide application, evaporative cooling, growing media preparation and clean-up. These should be estimated when designing the system.

Water Quality

Municipal system water and deep wells generally provide the best water source for greenhouse operations. Chemical treatment of the water may be required when pollutants, such as iron, sodium, dissolved calcium and magnesium or bicarbonates are present. Surface water such as ponds and streams may have more particulate matter, such as, suspended soil particles, leaves, algae or weeds that needs to be filtered out. A sample of a potential water supply should be sent to an irrigation water testing laboratory to get an analysis.

Water Law

All states have regulations related to water diversion and discharges. Many have restrictions that are put into place when a drought occurs. A permit may be required when water usage exceeds a specified level. For example, in Connecticut, using 50,000 gallons or a day from any source triggers whether you have apply for a diversion permit.

Getting a permit is quite involved and takes considerable time and costs significant money. An in depth application document that may cost \$50,000 in consultant fees and take a year or more to process is not uncommon. Accurate records of present water usage, the impact of the diversion on the area and the creative use of recycling are important. Complying the regulations can be an unpleasant experience that you may have to go through.

Extending a limited water supply

Water supplies can be extended by several methods. Most common is adapting low usage irrigation methods as described above. Zoning, applying the water to one area or section of plants at a time, will allow a low flow water source to irrigate a larger number of plants. Zones can be sized to utilize the flow from a well or municipal source so that irrigation takes place all day long.

Low flow wells can be set up to be pumped to a storage tank over a many hours. Water from the tank is then used to irrigate plants during the daylight hours.

Collection of rainwater to supplement a well or surface system is also possible. This works best with a gutter-connected greenhouse where the water from the downspouts is piped to an above ground or below ground storage tank.

From a conservation standpoint, keeping the piping system in good repair is important. A leak of one drop per second amounts to over 113 gallons per month.

Water is an important component of plant growth. Planning for its supply and use can help to insure that adequate quantities are available to meet plant needs.