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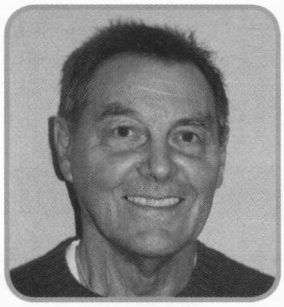


Upgrading the greenhouse water supply system

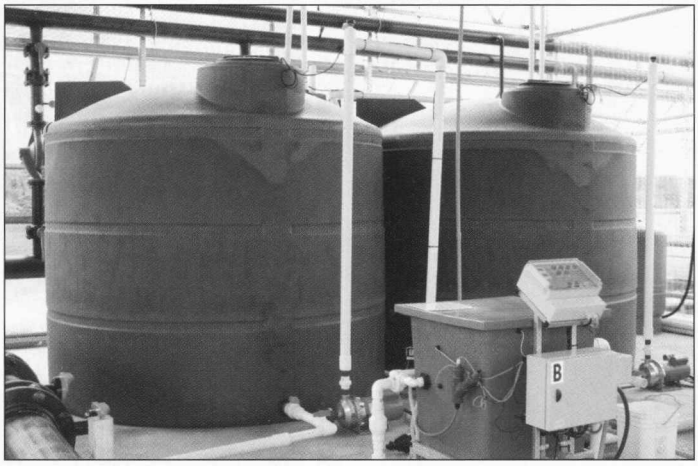
By John W. Bartok Jr.

As greenhouse operations grow and more automatic irrigation equipment is added, the water supply system frequently becomes overtaxed. Pumps, storage tanks and piping are often undersized for the increased demand. A review of some of the key components may be helpful.

Meeting your water needs

Many growers depend on a well for their water source. The amount of water available depends on the yield in gallons per minute (gpm). Some growers can get by with a low yield of 5 gpm. Others are lucky and have yields of more than 50 gpm.

Water demand is greatest during the late spring and summer. It may be as much as 0.4 gallons per square foot of growing area on a hot day when both transpiration and evaporation are combined. A 20,000-square-foot growing area may require up to 8,000 gallons per day or 22 gallons per minute if the crop is watered during a six hour, middle-of-the-day period. This means the well yield should be at least 22 gpm to keep up with the demand. The pump in the well should also be capable of delivering at least 22 gpm.



Water storage tanks help offset low-yield wells.

If your well yields less than the demand, an intermediate storage tank could be installed. This large tank (1,000-5,000 gallons or larger) is filled when there is no demand so that water will be available in larger quantities during the time when the plants need to be irrigated. A good source of large water supply tanks is Zwart Systems (www.zwartsystems.ca). Remember the pump in the well has to have a pumping capacity that is less than the yield, otherwise the pump may burn out from lack of water.

Handling water usage variation

A pneumatic pressure tank is often used where wide variations in water usage occur. A sink uses very little water as compared to a large irrigation system. A pressure tank stores water so that the pump doesn't have to start every time a little water is needed when a single hose is turned on.

The tank acts as a pressurized reservoir of water with 20-40 percent of the tank capacity available between the off and on setting of the pressure switch. In a 120-gallon tank with air volume control, 24 gallons will be discharged between switch settings of 30-50 pounds per square inch. If the tank is pre-charged, about 48 gallons will be available.

For most installations, a pressure tank with a total capacity of 10 times the pumping rate in gpm is adequate (e.g., a 120 gallon capacity tank for a 12 gpm pump). Standard tank sizes are 42-, 82-, 120-, 240-, 315- and 525-gallon capacity. Multiple tank installations can be used if greater capacity is needed. Tanks are available from local plumbing suppliers.

Where water demand is large, a pressure tank supplied by a jockey pump is used to supply a small demand. If the demand is greater than the jockey pump can provide, the pressure

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continues to drop and this starts a large main supply pump. This pump supplies the system until the demand is met and the pressure tank is recharged.

Proper pipe size

Even if the water supply is large enough, you may still have trouble getting adequate water in the greenhouse for irrigation. This may be due to the supply pipes being too small.

The pressure of water flowing through a pipe is reduced due to the friction of the sidewall. Friction loss varies with the size of the pipe and the quantity of water flowing through it. For example, at 10 gpm, 100 feet of pipe will have a friction loss of 8.8 pounds per square inch for ¾-inch pipe, 2.7 psi for 1-inch and 0.72 psi for 1¼-inch. This pressure reduction due to friction loss can affect the operation of a sprinkler system.

Friction loss is also affected by the roughness of the inner surface of the pipe. This roughness causes more turbulence. At 10 gpm, old 1-inch steel pipe may have a friction loss of 11.7 pounds per square inch; new steel pipe, 5.1 pounds per square inch and PVC or poly pipe, 2.7 pounds per square inch. This is why most growers now use plastic pipe.

Friction loss tables are available from irrigation equipment suppliers. Chemical buildup in the pipe can also cause friction loss from turbulence and reduction in pipe diameter.

Because too small a pipe diameter can cause excessive pressure loss, it is important to size the pipe for the flow needed.

Sizing pipe for required flow

If you install a sprinkler irrigation system that has 20 1-gpm nozzles, the flow required is 20 gpm. For these nozzles, the manufacturer recommends they operate at 25 psi to achieve a good water distribution pattern. If 200 feet of pipe are required for the system, friction loss using 1-inch poly pipe will be 19 psi. Using 1¼-inch pipe, the friction loss is only 5 psi. Friction loss for the fittings (elbows, tees, valves, etc.) is generally small amounting to 2-5 percent of the loss in the pipe.

Let's assume that the pressure tank on the water supply system is set for a 30-50 psi range. At the low end of the range (30 psi), there is inadequate pressure to overcome the pipe losses in the 1-inch pipe (30 psi - 19 psi = 11 psi) and still achieve good distribution. If the 1¼-inch pipe is used, then the pressure available to the nozzles is 30 psi - 5 psi = 25 psi. This water pressure meets the system requirements.

Efficient operation of an irrigation system can be affected by many factors. Assistance with designing an adequate system is available from watering system suppliers or a plumber.

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