

UMass Extension

## Greenhouse Crops and Floriculture Program

### Fact Sheets

#### Greenhouse Management / Engineering

#### Is Your Water Supply Adequate?

John W. Bartok, Jr.

Extension Professor Emeritus & Agricultural Engineer

NRME Department, University of Connecticut, Storrs CT 06269-4087

A question that frequently comes up when I visit growers is "How can my water supply be improved so I can water faster?" An efficient water supply is important to a greenhouse operation. Lets look at a few ways that it can be improved.

#### Water service

Most growers depend on a well for their water source. The amount of water available depends on the yield in gallons per minute (gpm). I know growers that get by with a low yield of 5 gpm. Others are lucky and have yields of over 50 gpm.

Water demand is greatest during the late spring and summer. It may be as much as 0.4 gallons/sq ft of growing area on a hot day when both transpiration and evaporation are combined. A 20,000 sq ft growing area, for example, may require up to 8000 gallons per day or 22 gallons per minute if the crop is watered over a 6 hour period. This means that 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 22 gpm.

If your well yields less than the demand, you could install an intermediate storage tank. This large tank (1000 - 5000 gallon) stores water during the night so that it will be available in larger quantities during the day when the plants need to be irrigated. Remember that the pump in the well has to have a pumping capacity that is less than the yield, otherwise it may burn out from lack of water.

#### Pressure tank

Should a pressure tank be used? A pneumatic pressure tank is often used where wide variations in water usage occur. The pressure tank will store water so that the pump doesn't have to start every time a little water is needed, for example, when a hose is turned on. The tank acts as a pressurized reservoir of water with 20% - 40% of the tank capacity available between the off and on setting of the pressure switch.

For example, in a 120 gallon tank with air volume control, 24 gallons will be discharged between switch settings of 30 - 50 psi. If the tank was precharged, about 48 gallons would be available.

For most installations, a pressure tank with a total capacity of ten times the pumping rate in gpm will be adequate (12 gpm pump; 120 gallon capacity tank. Standard tank sizes are 42, 82, 120, 240, 315 and 525 gallon capacity. Multiple tank installations can be used if needed.

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 will

continue to drop and this would start a large main supply pump. This pump supplies the system until the demand is met.

### **Pipe size**

Even if the water supply is large enough, you still may 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' of pipe will have a friction loss of 8.8 psi for ¾" pipe, 2.7 psi for 1" and .72 for 1-1/4". This pressure reduction 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, an old 1" steel pipe may have a friction loss of 11.7 psi, a new steel pipe, 5.1 psi and a PVC or poly pipe, 2.7 psi. This is why most growers now use plastic pipe. Friction loss tables are available in the book "Greenhouse Engineering" or from irrigation equipment suppliers.

Because too small a pipe diameter can cause excessive pressure loss, it is important to size the pipe for the flow needed. Let's look at an example.

If you install a sprinkler irrigation system that has 20, 1 gallon/minute (gpm) nozzles, the flow required is 20 gpm.

For these nozzles, the manufacturer recommends that they operate at 25 psi to get a good distribution pattern. If 200' of pipe are required for the system, friction loss using 1" poly pipe will be 19 psi. Using 1-1/4" pipe the friction loss is only 5 psi. Friction loss for the fittings (elbows, tees, valves, etc.) is generally small amounting to 2 - 5% 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" pipe (30 psi - 19 psi = 11 psi) and still get good distribution. If the 1-1/4" pipe is used, then the pressure available to the nozzles is (30 psi - 5 psi = 25 psi). This will meet the system requirements.

As you can see, the efficient operation of an irrigation system can be affected by many things. Help with designing a system is available from the watering system supplier or a plumber.