CONTROL OF *PHYTOPHTHORA* AND *PYTHIUM* BY CHLORINATION OF IRRIGATION WATER

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Lancaster Farms is a 100-acre container nursery operation that is located in southeastern Virginia where there is actually more water than land area. The paradox of water, water everywhere but not a drop to drink was never more true as far as our irrigation water is concerned. Our many rivers are brackish and wells are unsuitable for irrigation purposes. In order to have sufficient water, we recycle our irrigation water by draining every possible square foot of growing area and collecting this water in our ponds.

The worst part about recycling water is the buildup of pathogens and their subsequent distribution back into the nursery. *Presently, chlorination is the best and least expensive way to con*trol these organisms. It is just a matter of time before the collection and recycling of irrigation water will be forced on this industry in order to control environmental pollution by fertilizer and agricultural chemical runoff.

Chlorine gas is an extremely dangerous chemical. Therefore, we still use what we think is the safest Cl_2 injector system available on the market. We bought a series V-500 remote vacuum chlorinator manufactured by Wallace and Tiernan, a division of Pennwalt Corporation, 25 Main Street, Belleville, NJ 07019.

The injector system consists of three major parts:

1. A *vacuum pressure regulator,* that is attached directly to the top of a 150 lb. Cl_2 cylinder. It regulates the release of the chlorine gas from the cylinder only under a vacuum.
2. A *V-500 control* unit, that regulates the amount of chlorine flowing through the system.
3. An *injector.*

To automate the system we use a 1-in. irrigation control valve that is connected to the pressure side of the irrigation pump. When the pump is turned on, the valve is activated. Water from the valve goes through the injector. As soon as a flow rate of 2.1 g.p.m. (gallons per minute) of water is obtained, the injector creates a vacuum that pulls the chlorine from the cylinder into the water line. This highly chlorinated water is piped into the lake.

The water is dispersed through a header 18 in. long, with ¼ in. holes 1 in. apart. The header is above and 1 ft. in front of the intake screen. The highly chlorinated water and lake water are mixed as they are drawn into the suction line of the pump.

Our contact time is the time it takes the water to move from that point to where our fertilizer is injected. This is approximately 20 sec. It ends at that point because the fertilizer immediately ties up any remaining free available chlorine (FAC). If you are not on a fertilizer injection program, the contact time would continue until the water reaches the irrigation nozzle.

Chlorine is tied up because it reacts with any impurities in the water such as organic matter, fertilizer and colloidal materials. Chlorine demand is the difference between the amount of chlorine added to a given quantity of water and the amount of FAC remaining at the end of a given contact time.

All bodies of water have different concentrations of impurities. Therefore, the chlorine demand always varies. Because of this, no specific rate of chlorine injection can be given based solely upon the flow rate of the water. The determining factor is to insure that some FAC remains. This will tell you that there is still a quantity of FAC that can react that was not consumed by the impurities in the water, including *Phytophthora* and *Pythium*.

The levels of chlorine and the length of contact time to treat potable water supplies are much higher than what is necessary to kill *Phytophthora* and *Pythium*. Therefore, you should not think that chlorine at the rates we are using to treat irrigation water is in any way making this water suitable for drinking purposes. The following rates for chlorine injection are presented only to give you a place to begin testing a particular water supply. Adjustments will most likely have to be made to comply with your own water source.

Take the g.p.m. of your pump and divide by 15. The number that you get should be the rate of flow on the control unit, which is calibrated in pounds of chlorine per 24 hours of continuous operation.

For example: 500 g.p.m. ÷ 15 = 33.3

Therefore, 500 GPM will be treated at 33.3 lb./24 hr. This gives you a chlorine concentration of approximately 1.5 ppm.

The chlorine tester we are using is a Lovibond 2000. It is a color comparator using the D.P.D. method that is used in most swimming pool testers. However, it is extremely accurate and will measure levels of FAC as low as 0.02 ppm.

Presently we are trying to maintain an FAC level of 0.05 ppm. This level is much lower than the 0.3 ppm level presented in an earlier paper. The difference in the two levels is due to initially using an inexpensive swimming pool tester instead of a higher quality Cl_2 tester. We have not actually lowered our level of chlorine gas being used.

Chlorine equipment is referred to by the maximum pounds of chlorine per 24 hours that it can handle. When we began chlorinating nine years ago, the V-500 was the industry's standard for safety

and reliability. The price for this unit is $2100. The V-75, originally a pressure unit, was redesigned in 1980 to become a vacuum unit and is comparable to the performance of the V-500. Its cost is $1850. The V-200 (essentially a down-sized V-500) was developed five years ago and currently sells for $1650. While not as good as the more expensive model, it is still an acceptable unit.

Within the last five years several new companies have entered the chlorine equipment business mainly competing for the swimming pool trade. These companies are forcing the development of a 100-lb. unit that will sell for less than $1000. It will be considered a disposable and nonrepairable unit. Even though it will handle the Cl_2 rate required by most nurseries, it should be avoided.

Chlorine was $0.22/lb. when we started chlorination. Presently, we are paying $0.60/lb. A significant part of this cost increase has been caused by much higher insurance rates and by much stricter federal regulations of the chlorine industry. This year chlorine will cost us approximately $42 per irrigated acre.

Chlorination will control *Phytophthora* and *Pythium* in irrigation water but is not a "cure all." These organisms can be brought into the container by inoculated liners, used pots, or by recycled potting media. Chlorination will not significantly help these plants but it will reduce further spread of these organisms.

We feel that chlorination has reduced the cost of our fungicide program by approximately 30 percent. Finally, we feel that chlorination is a major key to the production of high quality container nursery stock at Lancaster Farms.