Grower 101:
Get Cultured

How to adjust irrigation water pH.

By Donald J. Merhaut

Chlorine treatment of nursery irrigation systems is probably one of the most popular methods utilized for the control of pathogens. This article will address the different types of chlorination systems and the proper procedures required for effective control of pathogens.

CHLORINE 101

Chlorination is a chemical method of treating water to kill both plant and human pathogens. Effectiveness of treatment depends on six factors:

Chlorine concentration. The greater the concentration, the more quickly it disinfects. However, too much chlorine may also kill plants. Most plants are safe if residual chlorine concentrations are less than 100 ppm; however, some floriculture crops are very sensitive to chlorine. Be aware: If you are uncertain about a particular crop, please check with your local farm adviser.

Duration of pathogen exposure to chlorine. Effective exposure times may range from one minute to 24 hours.

Initial cleanliness of water. Dirty water ties up chlorine, reducing disinfectant efficacy.

Water pH. Chlorine is more stable and therefore more effective when irrigation water has a neutral pH.

Pathogen type. Effectiveness will differ depending on the type of pathogen.

Water Temperature. Relatively high (greater than 68° F) or low temps (less than 50° F) may decrease the effectiveness of chlorine.

When chlorine is added to the water supply, aside from killing pathogens, it may also bind to organic matter or chemicals such as ammoniacal nitrogen. If chlorine binds to those components, the chlorine is considered unavailable for pathogen control. Therefore the effective or "residual" chlorine concentration is reduced. This is the reason chlorination is more effective with water sources that are not heavily contaminated with organic matter. When most pathogens are exposed to high enough concentrations of chlorine for a sufficient period of time, they will be killed. Pathogen populations and residual chlorine concentrations should be routinely monitored to ensure that disinfection is sufficient and that residual chlorine concentrations are not dangerously high for plant production.

ADVANTAGES

Chlorine has its advantages, like operation costs, since chlorine injection requires limited energy. Capital costs are also low because most costs are for chlorine. Exposure time is limited since most pathogens are killed within a few seconds to a few minutes of chlorine exposure. Also, there are few technical components if sodium or calcium hypochlorite is used.

Required maintenance is also reduced. If chlorine gas is used, the injection system will need to be inspected periodically. Chlorine is very adaptable to small and large production systems. Properly performed chlorination should not affect the chemical nature of the water. Besides chlorine storage, no additional space is required. This type of system has a low-labor input. Manual additions of liquid chlorine can be done, and some labor is required to routinely check equipment if chlorine gas is used.

DISADVANTAGES

Residual chlorine can kill plants. Some plants are more sensitive than others. However, except for hydroponic systems, organic matter in water and media usually ties up excess chlorine before significant damage can occur on crops. With most herbicides and pesticides, chlorine will not breakdown or remove them from plants. Remove floating debris, especially larger suspended debris, so that free chlorine is not inactivated by organic matter. Also, dissolved organic matter and acids are not eliminated so coloration is not eliminated.

METHODS

There are three methods of incorporating chlorine into irrigation water:

Sodium hypochlorite. Commercial bleach has 100,000-140,000 mg chlorine per liter, and is often used in the industry. Use caution when applying to plants. Sodium may accumulate in closed, recirculating production systems. In these cases, sodium levels should be monitored to prevent sodium toxicity. Sodium hypochlorite can be explosive. If stored improperly, sealed vessels and sodium hypochlorite begins to breakdown and results in an explosion.

Calcium hypochlorite. Calcium hypochlorite has 350,000 mg chlorine per liter. This is occasionally used, especially if sodium buildup is a concern with the use of sodium hypochlorite.

Chlorine gas. This is the least expensive of the three products. However, chlorine gas is dangerous to work with, and there are many regulations that dictate its storage and use. If chlorine gas is considered, check with local agencies for the necessary permits.

Please be advised that chlorine as a disinfectant for water has been banned recently in some European countries. The ban was enacted due to the fact that chlorine will react with humic compounds to form trihalomethanes, which are toxic to human health. GPN

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