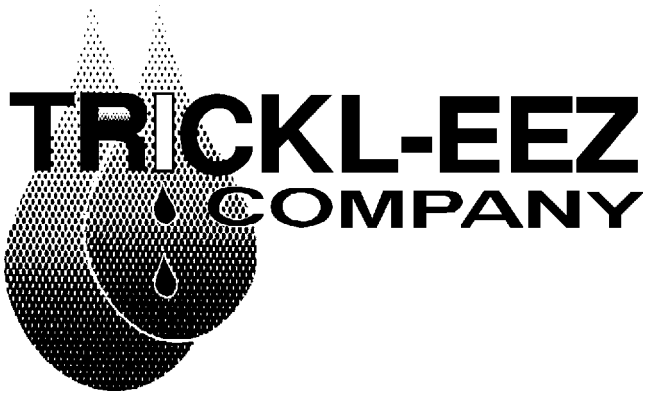

The University of Georgia College of Agricultural & Environmental Sciences
Cooperative Extension Service

Drip Chemigation: Chlorine

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Chlorination to Control Algae and Bacteria

Algae and Bacteria

Algae — Fresh water algae are microscopic green plants that require light for growth. When we see algae in ponds, we are actually looking at colonies of algae. If algae get inside irrigation lines, they reduce water flow through pipes and eventually clog emitters. Because algae require light for growth, they do not grow in buried pipelines, in black polyethylene laterals or in other conduits that effectively prevent light penetration.

Although enough light may enter exposed white PVC pipes or fittings to permit algal growth, this problem can be prevented by painting PVC pipes and fittings with a blue gloss paint. If algae are growing in your irrigation pond, apply chemical treatment according to the recommendations in the current Georgia Pest Control Handbook. Treatment of the water source and adequate filtration will prevent the introduction of algae into your chemigation system.

Bacteria — Some bacteria can live inside pipelines and drip tubes. They form bacterial slime, which clogs emitters. Bacterial clogging problems in drip irrigation systems are usually caused by sulphur and iron bacteria. These bacteria and the nutrients required for their growth can be present in both well and surface water.

Chlorine Injection Interval

Chlorine injection will prevent clogging of lines and emitters by algae and bacterial slime. Continuous injection of small amounts of chlorine maintains low concentrations of chlorine in the system and prevents their growth. However, periodic injection of larger amounts of chlorine is the preferred treatment for controlling algae and bacteria in drip systems.

You do not need to inject chlorine if you are using municipal water that is already chlorinated. However, if your irrigation water has not been chlorinated, you should be prepared to inject chlorine as needed. Vegetables are often sequentially cropped with the same drip system. In these situations, it is advisable to chlorinate the system at the end of each cropping season or more often if bacterial clogging occurs. If water quality is extremely poor, it may be necessary to chlorinate at the end of each irrigation cycle. Experience is helpful when determining the appropriate intervals between chlorine injections.

Recommended Chlorine Formulations

Liquid sodium hypochlorite (NaOCI) is the easiest form of chlorine to handle and is the type most often used for treatment of drip irrigation systems. It is readily available in supermarkets and other stores as common household bleach (5.25% chlorine). Liquid chlorine is also available from some swimming pool companies as a 10% chlorine solution.

Chlorine gas (Cl2) can be injected. Although it is an inexpensive source of chlorine, chlorine gas is more difficult to handle and requires more expensive injection equipment. In addition, chlorine gas is very poisonous and must be handled with extreme caution.

Caution: Powdered calcium hypochlorite Ca(OCl2), also called High Test Hypochlorite (H.T.H.) Is a dry powder commonly used in swimming pools. However, H.T.H. is not recommended for injection into drip irrigation systems. When mixed with water (especially at high pH), the calcium contained in H.T.H. can form precipitates.

Initial Chlorine Injection Rate

As chlorine is injected, some of it reacts with bacteria (as it destroys the bacteria) and other forms of organic matter in the irrigation lines. This “reacted” chlorine is chemically bound or “tied up” and is no longer antibacterial. Chlorine that has not reacted remains as “free residual chlorine.” Only this free chlorine is available to destroy bacteria and to continue treatment of the system.

For chlorination **to be effective, you should maintain 1 to 2** ppm free chlorine in the system for 30 to 60 minutes. Usually, an initial concentration of 5 to 6 ppm is required in order to maintain 1 to 2 ppm free chlorine. Samples for determining the initial chlorine concentration should be taken near the point of injection. However, samples should be taken far enough past the point of injection that the chlorine is uniformly mixed in the irrigation water.

The following equation can be used to calculate the injection rate.

Injection rate gal/hr = 0.03xGPM divided by % chlorine.

Example: The desired initial chlorine concentration in irrigation water just past the point of injection is 5 ppm. Assume a drip irrigation system with a total flowrate of 100 gallons per minute (gpm) and that common chlorine bleach (5.25% chlorine) will be injected.

Injection rate = 0.03xGPM divided by %chlorine
= 0.03 x 100 divided by 5.25
= 0.57 gal/hr

The chlorine solution must be in contact with algae and bacteria for at least 30 minutes to successfully treat the drip irrigation system. To ensure that all parts of the system receive a minimum of 30 minutes’ contact time, inject chlorine for one hour.

For convenience, the injection rates (gal/hr and oz/hr) required to give an initial concentration of 5 ppm chlorine have been calculated for selected flow rates in Table 3.

Table 3. Chlorine Injection Rate* (gal/hr and oz/hr) for an initial concentration of 5 ppm chlorine.

	5.25% Chlorine Solution		10% Chlorine Solution	
Water Flow (gpm)	gal/hr	oz/hr	gal/hr	oz/hr
10	0.06	7.7	0.03	3.8
20	0.11	14.1	0.06	7.7
30	0.17	21.8	0.09	11.5
40	0.23	29.4	0.12	15.4
50	0.29	37.1	0.15	19.2
75	0.43	55.0	0.22	28.2
100	0.57	73.0	0.30	38.4
150	0.86	110.1	0.45	57.6
200	1.14	145.9	0.60	76.8
250	1.43	183.0	0.75	96.0
300	1.71	218.9	0.90	115.2
350	2.00	256.0	1.05	134.4
400	2.29	293.0	1.20	153.6
450	2.57	329.0	1.35	172.8
500	2.86	366.0	1.50	192.0

* During chlorination, the injection rate should be adjusted to maintain 1 to 2 ppm free chlorine at the emitter farthest from the point of injection.

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Maintaining Free Residual Chlorine Concentration

During chlorination, maintain 1 to 2 ppm free chlorine at the point in the system where the concentration is lowest (usually at the point farthest from injection). If the irrigation water has a pH of 7.5 or less, 1 ppm free chlorine is sufficient. However, for alkaline water with a pH above 7.5, maintain 2 ppm. The free chlorine concentration drops as the chlorine reacts with organic matter in the lines. Therefore, to maintain 1 to 2 ppm free chlorine in the lines farthest from injection, it is often necessary to maintain a concentration of 5 to 6 ppm free chlorine near the point of injection. The specific concentration necessary (near the point of injection in a given zone) depends on water quality and the quantity of bacteria, algae and other organic matter in the lines. Maintain the recommended free chlorine concentration at the most distant emitter for 60 minutes. This requires frequent testing of the free chlorine concentration and subsequent adjusting of the chlorine injection rate if needed.

To ensure that the free chlorine concentration is maintained at 1 to 2 ppm, measure free chlorine concentration at the emitter most distant from the injection point approximately 10 minutes after injection is initiated. This can be done by using a D.P.D. (N,N Diethyl-P-Phenylenediamine) test kit, which measures only free residual chlorine. These test kits are available from chemical suppliers and from most drip irrigation dealers.

Caution: The orthotolidine type test kit, often used for swimming pools, measures total chlorine content (not free residual chlorine) and, therefore, cannot be used satisfactorily for drip systems.

In cases where the injection pump cannot be calibrated low enough to inject 5.25 percent or 10 percent liquid chlorine at the desired rate, dilute the chlorine solution prior to injection. This permits the use of a higher injection rate within the capacity of the injector pump.

Example: Assume you need to inject gallon of 5.25 percent chlorine into your drip system during a one-hour injection period. If your injection pump can inject no less than 2 gallons per hour, add 1 gallons of water to the 5.25 percent chlorine to give a total chlorine solution of 2 gallons. Then set the injector pump to inject 2 gallons per hour.

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