
CHLORINE TOXICITY OF GREENHOUSE CROPS

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Many of the public water systems have recently experienced high levels of bacterial growth in the water even after it has been chemically treated. As a precaution, chlorine levels in some of the public waters have been raised from the normal concentration of 0.1-1.0 ppm to 5.0 ppm (\pm 3.0 ppm)(Smith, 1984).

To determine if these levels of chlorine would be harmful to greenhouse plants, an experiment was designed to evaluate various chlorine concentrations on two greenhouse

species in soil-based and soilless media. The experiment was conducted in the fall of 1984 and repeated in the spring of 1985.

The plants used were *Zinnia elegans* 'Border Beauties' and *Chrysanthemum marifolium* 'Bright Golden Anne'. The zinnias were started from seed and the chrysanthemums (donated by Stafford Conservatories) were obtained as rooted cuttings. Once the first true leaves appeared on the zinnias they were planted into four-inch plastic pots as were the chrysanthemums and the chlorine treatments started. At that time, the chrysanthemums were given long nights. The media treatments were Pro-Mix (pH 5.5) and 1:1:1 (soil:peat moss:perlite) (pH 5.2). All pots had osmocote 14-14-14 incorporated.

The chlorine treatments were applied at each watering. The chlorine source was sodium hypochlorite and was applied at 0.0, 0.2, 0.8, 3.0, and 15.2 ppm Cl during the first trial and at 0.0, 3.1, 7.6, 10.1, and 15.2 ppm Cl during the second trial. There were nine replications of each medium and six replications of each species per chlorine treatment. After all plants were in flower they were evaluated for differences in height, leaf chlorosis, and flower number.

The zinnias reacted to chlorine levels at 7.6 ppm and higher. At 7.6 ppm, plants grown in the 1:1:1 mix were shorter, had less flowers and had slight veinal chlorosis on the top half of the plant; plants grown in Pro-Mix had only slight veinal chlorosis at this chlorine level (Table 1). At the two highest chlorine levels, 10.6 and 15.2 ppm,



Fig. 1. Veinal chlorosis on chrysanthemum irrigated with water containing 15.2 ppm chlorine.

zinnias in both Pro-Mix and 1:1:1 were significantly shorter than the others, had less flowers, showed leaf curl, and had severe veinal chlorosis on all leaves.

The chrysanthemums were not affected until 15.2 ppm level was reached (Table 2). Their height and flower number

Table 1 The effect of various chlorine levels on zinnias in two media.

Chlorine Concentrate (ppm)	Pro-Mix				1:1:1			
	Average Plant Height (cm)	Flower Diameter (cm)	Leaf Curling	Veinal Chlorosis	Average Plant Height (cm)	Flower Diameter (cm)	Leaf Curling	Veinal Chlorosis
0.0	46	5.0	---	---	49	6.7	---	---
0.2	50	5.7	---	---	45	5.0	---	---
0.8	49	6.2	---	---	50	5.3	---	---
3.0	53	5.5	---	---	52	6.1	---	---
7.6	40	5.0	---	+	26	4.0	---	+
10.6	28	3.0	+	+++	27	2.0	+	+++
15.2	26	1.3	+	+++	27	3.1	+	+++

Table 2 The effect of various chlorine levels on chrysanthemums in two media.

Chlorine Concentrate (ppm)	Pro-Mix				1:1:1			
	Average Plant Height (cm)	Flower Diameter (cm)	Leaf Curling	Veinal Chlorosis	Average Plant Height (cm)	Flower Diameter (cm)	Leaf Curling	Veinal Chlorosis
0.0	39	7.7	---	---	36	8.5	---	---
0.2	39	8.3	---	---	39	6.8	---	---
0.8	39	8.0	---	---	35	7.3	---	---
3.0	38	8.2	---	---	40	8.8	---	---
7.6	40	8.0	---	---	33	7.9	---	---
10.6	40	7.9	---	---	40	8.9	---	---
15.2	37	6.7	---	+++	38	9.8	---	+++

were not affected but severe veinal chlorosis did appear in both media (Fig. 1).

Differences between the zinnias and chrysanthemums can be attributed to the developmental stage of the plants when the chlorine treatments began. This could indicate that plants at the seedling stage may be more sensitive than plants which are propagated by cuttings. Nevertheless, as long as chlorine concentrations do not exceed 5 ppm, greenhouse plants should not be affected even though it is applied at every irrigation.

Reference

Smith, Daryl. 1984. Personal communication. South Central Connecticut Regional Water Authority. New Haven, CT.