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TOXICITY OF CERTAIN FLORIDA WATERS TO CUT FLOWERS

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Abstract

The influence of 12 sources of Florida well water on vase-life of chrysanthemums and gladiolus was evaluated. Water sources exerted varying degrees of deleterious effects on vase-life of chrysanthemum leaves and gladiolus florets. The severity and rate of foliar deterioration of chrystanthemums increased as the total soluble salt content increased. However, two types of deterioration were apparent on gladiolus: (a) a specific ion effect or combinations of ions and (b) total soluble salt content. When chrysanthemum stems were placed in well water 1 day, 5 days or continuously, vase-life of the foliage was reduced approximately 20, 40 and 60%, respectively, depending upon the salt content of the water. Holding of gladiolus stems in toxic waters for 1 day was sufficient to reduce vase-life ratings up to 60% and lowered flower quality drastically.

Neither the addition of a detergent-disinfectant mixture or floral preservative nor the acidification to pH 4.5 or 1:1 dilution with distilled water eliminated toxic effects of well waters on either species.

Introduction

In many areas of Florida natural chemicals present in the water supply create agricultural as well as health and industrial hazards. These dissolved salts arise primarily from chemical weathering of the earth's crust. In coastal areas sea water intrusion is frequently a contributing factor. In a comprehensive survey of the fresh water of Florida, Black and Brown (1) reported that dissolved solids, mainly chemical, range from a few parts per million for surface water to many thousands ppm in deep ground water. The specific ions present and the degree of mineralization depend upon the geographic location and the underlying stone formations. Predominant ions usually present include calcium, magnesium, sodium, bicorbonate, chloride, and sulfate. Chemicals present in much smaller concentrations frequently include boron, fluoride, hydrogen sulfied, iron, nitrate, potassium, silica, and others.

Considerable attention has been given to saline problems associated with crop production; however, little information is available on post-harvest salt problems with floral crops (2). Frequently flower producers, as well as merchandisers and consumers, use highly mineralized water for holding cut-flowers.

This article summarizes 12 experiments conducted during the past year on the effects of water mineralization on the vase-life of chrysanthemum and gladiolus cut-flowers.

Materials and Methods

The effects of 12 Florida well water sources on cut-flowers were compared with distilled water. Other variables superimposed on water sources were acidification to pH 4.5 with HCl or H_2SO_4, 1:1 dilution, addition of detergent-disinfectant (Consan), addition of a floral preservative (Everbloom), and length of time flowers remained in various solutions. The ppm total soluble salts of waters were estimated by use of a solu-bridge and a conversion chart based on KCl as a standard.

Mature chrysanthemum flowers were cut to 24 inches in length and leaves were removed from the lower 6 inches. All gladiolus flowers

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were harvested in the tight bud stage and usually experiments started immediately. In most cases each experimental unit was composed of 3 stems per species and replicated 3 times. All tests were conducted in a well lighted laboratory at 74° F ± 4°. Usually a 5% detergent-disinfectant (Consan) was used at the rate of 3 drops per liter to retard microbial activity and enhance water uptake.

Vase-life of chrysanthemum foliage was estimated by recording the number of days when foliage was judged no longer acceptable because of chlorotic and/or necrotic appearance. Chrysanthemum flowers were discarded when 50% of the blooms were judged to be no longer useable by the consumer. The effects of solutions on gladiolus flowers were determined after 4 days by giving each spike a petal quality index rating based on 1 to 10 scale where 1 = severe floret tip burn and little floral development, 5 = lower 2 florets completely deteriorated and other florets showing marked marginal petal burn to water soaked appearance from base to top of spikes, 7.5 = moderate marginal petal burn to water soaked appearance from base to top of spike, and 10 = normal floret development without any marginal petal damage. A rating of 9.0 or greater was considered commercially acceptable.

Results and Discussion

The well water sources exerted varying degrees of deleterious effects on the vase-life of the 2 cut-flowers studied. The most pronounced effects were on chrysanthemum leaves and gladiolus florets; therefore, they were selected as evaluation criteria. Due to limited space only representative data are given in Tables 1 and 2 for illustrative purposes.

Table 1. Influence of well waters on keeping quality of chrysanthemum and gladiolus[1].

Well waters			'Iceberg' chrysanthemums			'Valeria' gladiolus	
Source	pH	Salts (ppm)	No. days foliage	No. days flowers	Water uptake[2] (ml/100 g)	Petal rating[3]	Water uptake[2] (ml/100 g)
Distilled water	5.9	--	14.0c	16.3c	395d	10.0d	114b
Expt. Station west well	6.6	235	8.7b	12.7ab	302bc	4.3a	101ab
Expt. Station east well	6.8	510	10.0b	14.0bc	318c	6.0abc	102ab
Cortez, Fla. well No. 1	6.8	880	6.3a	12.0ab	264ab	8.7cd	94a
Ft. Myers, Fla. well No. 1	6.7	1490	6.2a	12.7ab	233a	7.0bc	101ab
Palma Sola, Fla.	6.7	1550	6.0a	11.0a	226a	5.7ab	98a

[1]Means within columns followed by the same letter(s) are not significantly different at 1% level.

[2]Water uptake determined after 10 days for chrysanthemums and 4 days for gladiolus and was based on original fresh weight.

[3]Petal ratings were made at the end of 4 days and based on scale of 1 to 10 where 10 = normal florets, 7.5 = moderate marginal petal burn on all florets, 5 = lower 2 florets completely deteriorated and marked marginal burn on others, and 1 = severe floret tip burn with little floret development.

Effect of well waters on chrysanthemum foliage.—The severity and rate of foliar deterioration increased as the total chemical content of the well water increased (Table 1 and 2). Phytotoxicity symptoms first appeared as marginal and then general leaf chlorosis followed by necrosis. The primary symptom on chrysanthemums in water from low salts wells listed in Table 1 was a semi-wilted condition of the leaves and flowers which contributed to a poor appearance and reduced vase-life. This condition was reduced but not eliminated by use of the disinfectant-detergent and was attributed to chemical effects and/or microbical clogging of the vascular tissue. Water uptake by chrysanthemums generally decreased as the salt content of well waters increased (Table 1). The use of a floral preservative, 'Everbloom,' in the holding solutions for 4 continuous days reduced the vase-life of the chrysanthemum foliage from 40 to 60% depending upon the salt content of the well water (Table 2). Previous studies have shown that continuous exposure of chrysanthemums to solutions of 'Everbloom' was detrimental to the foliage, but that 12 to 24 hour exposure immediately after harvest was slightly beneficial (3).

When chrysanthemum stems were placed in well waters for 1 day, 5 days, and continuously, the vase-life of the foliage was reduced as much as 20, 40, and 60%, respectively, as compared to distilled water (Table 2). Leaf toxicity symptoms were reduced somewhat, but not eliminated by 1:1 dilution of the well waters with distilled water. Neither acidification of toxic waters to pH 4.5 with HCl or H_2SO_4 nor addition of 3 drops of Consan/L reduced the toxicity.

Effects on gladiolus florets.—The degree of toxicity to gladiolus flowers depended upon the water source and did not always increase proportionately with total salt content. This is apparent from data in Table 1 where the well with the lowest total soluble salt content had the greatest adverse effect on petal quality. Toxicity symptoms on all varieties of gladiolus tested included (a) a marginal petal deterioration which first appeared as bleached, water-soaked margins followed by dehydration, darken-

Table 2. Effects of well water on the vase life of 'Blue Chip' chrysanthemum foliage and keeping quality of 'Valeria' gladiolus florets[1].

Well waters			Days chrys. remained in solution				Days glads. remained in sol.		
Source	pH	Salts (ppm)	1 day	5 days	4 days + 10 g/L Everbloom	Continuous + disinfectant-surfactant	1 day	Continuous	Continuous + 10 g/L Everbloom
			Vaselife in days				Rating index[3]		
Distilled water	5.9	--	18.3^b	18.0^d	8.3^a	19.3^d	10.0^e	10.0^d	10.0^c
Dover, Fla.	7.3	105	15.8^a	16.3^{cd}	8.0^a	19.3^d	9.8^e	9.8^d	10.0^c
Stuart, Fla.	7.2	203	16.5^b	15.5^{bc}	12.2^c	19.3^d	10.0^e	10.0^d	10.0^c
Expt. Station west well	6.6	235	15.3^a	12.0^a	12.0^c	17.7^{cd}	4.3^a	3.7^a	6.4^a
Sun City, Fla.	7.3	440	17.0^b	16.7^{cd}	10.8^b	16.7^{bc}	8.5^d	7.4^c	9.7^c
Cortez, Fla. well No. 2	7.2	650	17.5^b	16.0^{cd}	10.0^b	15.0^b	5.7^b	4.5^b	7.1^{ab}
Cortez, Fla. well No. 3	7.1	980	15.2^a	15.3^{bc}	8.3^a	14.8^b	7.1^c	6.7^c	7.9^b
Palma Sola, Fla.	6.7	1550	14.8^a	13.7^{ab}	8.3^a	11.0^a	7.3^c	6.8^c	8.0^b
Ft. Myers, Fla. well No. 2	6.9	1582	15.8^a	13.0^a	7.8^a	11.0^a	7.1^c	6.7^c	7.7^b
Sign. level[2]			5%	1%	1%	1%	1%	1%	1%

[1]Flowers were held in well lighted laboratory at 70° F which accounts for long vaselife of chrysanthemums.
[2]Means within columns followed by the same letter(s) are not significantly different.
[3]Petal ratings were made at the end of 4 days and based on scale of 1 to 10 where 10 = normal florets, 7.5 = moderate marginal petal burn on all florets, 5 = lower 2 florets completely deteriorated and marked marginal burn on others, and 1 = severe floret tip burn with little floret development.

ing color, and death, (b) a failure of florets to open and develop normally, and (c) in severe cases a floret sheath burn. Toxicity symptoms were much more pronounced on dark colored than on light colored varieties. Water uptake by spikes was less in well waters than distilled water, but did not necessarily decrease as salt content increased (Table 1). Neither acidification to pH 4.5 with HCl or H_2SO_4, 1:1 dilution with distilled water, nor addition of 3 drops per liter of a detergent-disinfectant prevented toxicity symptoms. The addition of 10 g/1 of a floral preservative failed to eliminate toxicity symptoms completely (Table 2), but floret size and water uptake increased. In all cases where the presenvative was used, however, petal colorbreak similar to that attributed to bean-yellow mosaic virus was accentuated. Exposure of spikes to well waters for 1 day was *sufficient* to induce severe phytotoxic effects (Table 2). In general whenever water uptake was reduced, keeping quality was reduced accordingly.

Two types of toxicity to gladiolus were apparent: (a) a specific ion effect or combination of ions, and (b) total salt content. Therefore, laboratory research is being conducted presently to determine the specific ions or ion combinations which induce petal burn in low-salt wells.

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REDUCTION OF PRODUCTION COSTS IN A GLADIOLUS FLOWER OPERATION BY SUPPLEMENTAL CORM PRODUCTION

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INTRODUCTION

Gladiolus corm production has been largely limited to the northern and western part of the United States and Holland. The term "Bulb" will be used here as in the commercial trade in place of the word corm. From the above sources the Florida commercial gladiolus grower has relied upon for bulbs over the past thirty-five years. In recent years the Florida grower with the advent of hot water treatment of bulblets has been able to produce a healthier stock of bulbs. Florida grown bulbs have several advantages over those from other sources, namely, bulbs are in the right growth cycle for winter flower production, less spread of viruses, and summer dug bulblets can be hot water treated (1).

The bulb growing operation of the company was started in the 1964-65 growing season with the bulblet crop and the subsequent planting stock crop was grown in the 1965-66 season plus another bulblet crop. Only previous literature available on cost of production of gladiolus was done in 1947-48 season on a flower crop (2), this work was recorded in man hours per acre plus tractor hours, horse hours, and truck hours. There has been a 15% reduction in man hours and still approximately the same number of tractor and truck hours. As far as can be ascertained no previous study can be found on the cost of bulblet or planting stock production. This cost study was designed with the assumption that the company could reduce their costs by producing a substantial amount of their bulb requirements.

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DESCRIPTION OF ITEMS

The various items included in the study with a description of the particular item are as follows:

Preparing ground consists of all tractor work done from the time the new ground was cleared. This includes leveling, ditching, and bedding operation.

Planting includes the sowing by machine of both bulblets and planting stock and the covering of same.