owners, many street and park plantings of coconut palms in Florida are trimmed regularly by municipal maintenance crews. The petiole injection could be applied conveniently to such trees at the time of trimming. Treatment should be repeated at 3-4 month intervals to maintain remission. The petiole injection technique might also be investigated as a means of applying exogenous nutrients in cases of mineral deficiencies in coconut and other palms.

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EVALUATION OF CALLISTEMON SPECIES FOR NORTH FLORIDA[1]

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Additional index words. Cold injury.

Abstract. **In 1974, seeds of over 20 species of** Callistemon **R. Br. were obtained from the Los Angeles Arboretum. The seedlings were grown in containers under field conditions in Gainesville, Florida. During the winter of 1976-1977, the plants were exposed to 42 nights of freezing temp. Mortality rates of 100% were observed with** C. viminalis, **and** C. pinifolius, **whereas** C. paludosus (C. salignus **var** australis), C. violaceus **and** C. brachyandrus **exhibited little or no cold damage.**

Callistemon have long been admired as landscape plants for tropical and subtropical areas. Their showy flowers are in a spike varying in color from white to cream to orange-red to red with long exserted stamens making them resemble a bottlebrush. The plant size, form and foliage texture vary greatly among species. Some species rarely grow taller than 6 ft. (ca. 2 m), while others grow as tall as 20 ft. (ca. 6 m). The graceful weeping form of *Callistemon viminalis* differs greatly from the stiff rigid upright form of *C. rigidus*. The leaves of some species are sword-like while leaves of other species are thin and needle-like.

Although the *Callistemons* are valuable landscape plants, there is little information in the literature on the cold hardiness of individual species. Therefore, this study was undertakened to determine cold hardiness of 20 species of *Callistemons*.

Materials and Methods

Seed of 20 species of *Callistemon* were obtained from the Los Angeles Arboretum in 1974 and germinated in the Ornamental Horticulture greenhouses at Gainesville, Florida. The seedlings were transplanted into 3 inch (7.5 cm) pots when they reached the two leaf stage. There after, they were maintained under standard nursery cultural practices.

In the fall of 1976, 20 plants of each species (Table 1) were planted in 2 gallon (8 liters) black plastic nursery containers and set outdoors on a white gravel bed in full sun. The plants ranged in height from 18 to 36 inches (45 to 90 cm).

Table 1. Effects of low temperature on degree of injury or survival of *Callistemon spp.* R. Br.

Species	Damage Rating[z]
violaceus	1.0
sieberii	1.0
jeffersii	1.0
hortensis	1.0
brachyandrus	1.0
semperflorens	1.2
speciosus	1.2
paludosus	1.3
acuminatus	1.6
citrinus	1.8
rigidus	2.0
pityoides	2.4
linearis	2.8
falcatus	3.0
rosea	3.0
saugaus	3.1
comboynensis	3.1
formusus	3.6
pinifolus	5.0
viminalis	5.0

[z]Rating 1.0—no damage; 2.0—slight damage to some leaves; 3.0—moderate damage—up to 50% of plant damaged; 4.0—heavy damage—up to 90% of plant damaged; 5.0—plants dead.

The plants were exposed to 42 nights of 32° F (0° C) or below with the lowest temp recorded being 19° F (−7° C). Some nights the plants were exposed to 12 or more hours of freezing temp.

The plants were observed all winter and were rated for damage on April 1, 1977, when new growth had developed. The rating system used was (1) no damage; (2) slight damage to some leaves; (3) moderate damage—up to 50% of plant injured; (4) heavy damage—up to 90% of plant damaged and (5) plants dead.

Results and Discussion

The winter of 1976-77 was one of the coldest winters on record. There were 42 nights of freezing temperatures as compared to the previous record of 33 days in 1975-76 and prior to that time the record for north Florida had been 24 days of temperature of freezing or below. The winter of 1976-77 did not have as low a temperature as 1962-63 when

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9° F (−13° C) was recorded in Gainesville. However, the long exposure to low temperatures severely injured many plants.

The effect of low temp on *Callistemon* species is shown in Table 1. Any plant with a rating of 2.0 or less would be well suited for landscapes in north Florida. Several of the commonly grown species, *C. citrinus, C. rigidus* and *C. speciosus,* were in this group. Other species which had ratings less than 2.0 were *C. acuminatus, C. paludosus* and *C. semperflorens.* There was no physical evidence of cold damage to *C. violaceus, C. sieberii, C. jeffersii, C. hortensis* and *C. brachyandrus.*

Plants with a rating of greater than 2.0 and less than 2.5 would be considered acceptable for use in north Florida landscapes. Plants in this group had damage confined mainly to the branch tips. *Callistemon pityoides* was the only sepcies in this group.

Plants with ratings of 2.6 or higher would not be suited for landscapes in north Florida. The bark of many of these species was split just above the soil surface, and they did not survive even when severely pruned back. Species in this group were *C. falcatus, C. rosea, C. saugaus, C. comboynensis* and *C. formusus.* All plants of species *C. pinifolus* and *C. viminalis* were killed.

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NUTRIENT REMOVAL BY WATERHYACINTHS FROM SOLUTION CULTURES[1]

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Abstract. **Effects of 3 rates of Cu, Mn and Zn were evaluated on growth, leaf and root tissue nutritional levels of** Eichhornia crassipes **(Mart.) Solms (waterhyacinth) grown in 50% Hoagland's solution. Number of plants increased from 10 to 35 after 7 weeks in solution culture. Leaf and root tissue levels of N, P, Fe, Mn and Zn were increased after 7 weeks.**

Eutrophication of natural waters by soluble nutrients is a serious pollution problem. Nutrients stimulate over production of algae and microbes which ultimately result in O_2 deficits, undesirable taste and odor of water (3). Tertiary treatment of sewage waste water to remove nutrients is an expensive and sophisticated procedure (1). It has been proposed that certain aquatic plants could be used to remove nutrients from water resources. Rogers and Davis (7) found that a single plant of waterhyacinth absorbs up to 20.8 mg N per day and they proposed that 1 hectare of waterhyacinths under optimum conditions could absorb the average daily N and P waste production of over 800 people. Conceivably aquatic plants such as *E. crassipes* could be utilized in municipal sewage treatment facilities to aid in excess nutrient removal. This research was conducted to determine the effectiveness of *E. crassipes* in absorbing the heavy metals Cu, Mn and Zn.

Materials and Methods

Ten uniform *Eichhornia crassipes* (Mart.) Solms (waterhyacinth) *plants were* placed in 15 L glazed crocks containing 10 L solution on October 1, 1976 and grown in glass greenhouses maintained at a minimum temperature of approximately 21° C.

Solutions contained 50% Hoagland's I formulation (4), except *Cu, Mn* and Zn levels were varied at 1.0, 2.5, 5.0 and 10.0 mg/l. Solutions were aerated, maintained at pH of 6.0 and changed weekly. The experiment was completely randomized with 5 replications and 1 crock (10 leaf-plants per crock) as the experimental unit.

Nutrient analyses of root systems and the most recently matured leaf blades were taken at the outset and termination of the experiment after 7 weeks. Number of plants was also recorded at the beginning and termination of the experiment. Data were analyzed by analysis of variance method and treatment means separated by Duncan's New Multiple Range Test.

Results and Discussion

All treatments showed an increase of approximately 25 plants over a 7 week period. Penfound and Earle (6) estimated that 10 plants could produce 655, 360 plants in a single season, so a 25 plant increase is low and possibly due to short days and the 21° C glass house temperature.

Differences in foliar and root nutrient levels from initial and final sample collections are shown in Table 1. Increases of N and P in leaf tissue were 410 and 114% respectively

Table 1. Foliar and root nutrient content of *Eichhornia crassipes* before and after 7 weeks in aerated 50% Hoagland's solutions.[z]

Treatment	N (%)	P (%)	K (%)	Ca (%)	Mg
Leaves					
Initial	1.08	.57	4.39	1.520	.890
Final	5.51	1.32	4.04	.975	.461
Change	+4.43	+ .75	— .35	— .545	—.429
Roots					
Initial	2.15	.53	1.28	.780	.360
Final	2.71	.94	3.10	.419	.301
Change	+ .56	+ .44	+1.82	— .361	—.059
	Cu (mg/g)	Fe (mg/g)	Mn (mg/g)	Zn (mg/g)	
Leaves					
Initial	25	215	513	691	
Final	21	238	1645	765	
Change	— 4	+ 23	+1132	+ 74	
Roots					
Initial	29	3230	230	799	
Final	23	11393	4000	881	
Change	— 6	+8163	+3770	+ 82	

[z]Initial leaf and root sample taken at outset experiment and final after 7 weeks.

[1]Florida Agricultural Experiment Stations Journal Series No. 824.