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# Tolerance of Leyland Cypress and Red-Tip Photinia to Soil and Foliar Applied Sodium Chloride[1]

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## Abstract

NaCl at 0.15 N was applied 3 times per week as a soil drench or foliar spray to established container-grown plants of Leyland cypress [× *Cupressocyparis leylandii* (A. B. Jacks. & Dallim.) Dallim. & A. B. Jacks.] and red-tip photinia (*Photinia* × *fraseri* Dress 'Birmingham'). Soil-salt applications were more injurious than spray applications. Leyland cypress did not develop necrosis, but dry weights of plants drenched with salts were reduced. Photinia leaves were necrotic in both salt treatments but dry weight was reduced only with plants receiving soil salts. Tissue Na levels did not reflect the degree of injury while Cl levels correlated with injury. Leyland cypress displayed high salt tolerance and red-tip photinia low tolerance.

**Index words:** Woody landscape plants, salinity tolerance, osmotic, specific ion effects
**Species and cultivars used in this study:** Leyland Cypress [× *Cupressocyparis leylandii* (A. B Jacks. & Dallim.) Dallim. & A. B. Jacks.], Red-tip Photinia (*Photinia* × *fraseri* Dress 'Birmingham').

## Significance to the Nursery Industry

The number of salt tolerant evergreen plants for use in saline environments is limited. This study showed that Leyland cypress is able to resist foliar and soil applied salts. It would make an excellent screen, hedge or barrier plant in coastal climates from Zone 7 through 9.

The observed salt tolerance of Leyland cypress is related to the plant's ability to prevent excessive Cl accumulation. Photinia accumulated over 3.5% foliar Cl, a concentration toxic to most plants. The growth (dry weight) of Leyland cypress receiving soil salts was significantly reduced compared to control yet the shoots showed no foliar necrosis. Assessment of woody plant salt tolerance must include factors other than appearance. Growth indices and tissue Cl concentrations are most appropriate for assessing the degree of salt tolerance.

## Introduction

Leyland cypress is described as a salt-tolerant species and is used for screens and windbreaks along coastal areas (1, 9). The parents, Monterey cypress (*Cupressus macrocarpa* Gord.) and Alaska white cedar [*Chamaecyparis nootkatensis* (Lamb.) Spach.] grow naturally along the Pacific Coast of the United States. Leyland cypress, an intergeneric hybrid, should embody some degree of salt tolerance although the relative tolerance has never been quantified (9).

*Photinia* × *fraseri* 'Birmingham' is used in coastal landscapes in the Southeastern United States. The species is susceptible to *Entomosporium maculatum* Lev. [*Fabrea maculata* (Les.) Atk.] leaf spot which severely defoliates and disfigures plants (7). Leyland cypress offers an alternative to photinia for screens and hedges in coastal areas. Its fast growth, wide soil adaptability and heat tolerance permit successful culture in the Coastal Plain (5).

This study determined the relative tolerance of these taxa to soil and foliar applied sodium chloride to more accurately assess their use potential in saline environments.

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## Materials and Methods

Rooted cuttings of photinia and Leyland cypress were greenhouse grown in a bark medium in 15 cm (6 in) standard plastic containers for two months prior to treatment with the salt solutions. Plants were fertilized three times per week with 300 ml (10 oz) of 200 ppm N 20N-8.8P-16.6K (20-20-20) water soluble fertilizer. Temperatures were approximately 25/20°C (77/68°F) day/night and the photoperiod was natural.

Treatments consisted of foliar or soil applications of deionized water (control) or foliar or soil applications of 0.15N NaCl. For foliar applications a cardboard disk was inserted around the base of the plant to prevent the application from reaching the media. Spray was applied to run-off on the upper and lower surfaces of the shoots. Plants were placed on their sides until the run-off had subsided. Soil applications consisted of 300 ml (10 oz) of either deionized water or 0.15N NaCl applied to the media surface. The quantity was sufficient to thoroughly wet the container mass. Treatments were applied 3 times per week and on alternate days all plants were fertilized with 300 ml (10 oz) of a 200 ppm N 20N-8.8P-16.6K (20-20-20) solution. Plants were rated on Sept. 6 for appearance from one (1) representing no brown tissue to five (5) dead. The shoots (cut off at soil line) were removed, rinsed in deionized water, placed in paper bags and oven-dried at 60°C (140°F) for 3 days. Dry weights were then taken and the tissue ground through a 20-mesh screen in a Wiley mill. Sodium and chloride were determined by methods described previously (3). Electrical conductivities (dS/m) were determined by percolating 300 ml (10 oz) of deionized water through the container medium and catching the leachate in a beaker. The experiment was a completely randomized design with 5-single plant replicates per treatment. Treatments were initiated July 15 and terminated September 6, 1987.

## Results and Discussion

The appearance of Leyland cypress was not adversely affected by the treatments (Table 1). The foliage of all Leyland cypress had rich bluish green leaves. The photinia

Table 1. Appearance and dry weight of Leyland cypress and red-tip photinia as affected by salt treatment.

| Treatment | Appearance | | Dry wt. (g) | | |
|---|---|---|---|---|---|
| | | | Leyland | Photinia | |
| | Leyland | Photinia | Shoot | Leaf | Stem |
| Soil control | 1 a[y] | 1 c | 17.3 a | 9.7 a | 4.7 a |
| Foliar control | 1 a | 1 c | 14.4 ab | 8.2 a | 4.1 a |
| Soil salt | 1 a | 3.2 a | 8.2 b | 4.7 b | 1.8 b |
| Foliar salt | 1 a | 2.2 b | 14.4 ab | 8.7 a | 3.9 a |

[z]1—no tissue browning; 5—dead.

[y]Means not followed by the same letter or letters within a column are significantly different by Duncan's Multiple Range Test, 0.05 level.

leaves were necrotic in the spray and soil-salt treatments. Assessing salt damage by visual means is misleading (6, 8) and growth parameters such as dry weight, height, and width must be used to corroborate injury.

Dry weights of Leyland cypress and photinia were significantly reduced by the soil salt treatments (Table 1); however, dry weights of both species were not adversely affected by foliar salt treatments (Table 1).

Sodium tissue concentrations were low in Leyland cypress (Table 2). The 0.15% and 0.19% in the soil salt and aerial salt treatments, respectively, are less than that observed in many plants under "normal" soil conditions (2). Photinia, on the other hand, accumulated high levels of Na in the leaves and stems. Sodium levels in the soil-treated plants were greater than the foliar-treated plants. Photinia has a waxy cuticular leaf surface which may have acted as a barrier to Na penetration. In previous studies Na tissue levels did not correlate with the degree of injury (3, 4, 6, 8, 10).

The Cl tissue levels of Leyland cypress and photinia were greater in the soil-salt treatments compared to the other treatments (Table 2). Photinia accumulated greater Cl than Leyland cypress. For many plants a range of 2 to 3% shoot or leaf Cl induces necrosis (4, 10). The 3.59% and 2.17% in photinia leaves treated with soil and foliar applied salts, respectively, were sufficient to induce necrosis. Obviously, Leyland cypress does not accumulate high levels of Cl, a factor that contributes to its salt tolerance. Francois (6) and Townsend (8) corroborated the author's theory (4) that woody plant salt tolerance is related to the plant's ability to prevent Cl accumulation. Whalley (9) sprayed container grown Leyland cypress with 0, 4, 40, and 400 mg/l NaCl 3 times during the winter yet was unable to induce injury. Sodium and Cl analyses were not performed.

Separating specific ion effects from osmotic effects is difficult (4). The dS/m of the salt treated soils was significantly greater than the other treatments (Table 3). The combination of high soil osmotic potentials and/or Cl tissue levels reduced the growth (dry weight) of Leyland cypress. Chloride tissue levels of Leyland cypress treated with spray salts were not sufficiently high to induce dry weight reductions (Table 1). The ability to prevent Cl accumulation could be related to the waxiness of the needles, presence of salt excreting glands and/or lack of an active Cl uptake system (4).

Table 3. The electrical conductivity of the media leachate as affected by salt treatment.

| Treatment | Electrical conductivity, dS/m | |
|---|---|---|
| | Leyland | Photinia |
| Soil control | 0.50 b[z] | 0.40 b |
| Foliar control | 0.42 b | 0.36 b |
| Soil salt | 5.76 a | 5.12 a |
| Foliar salt | 0.48 b | 0.50 b |

[z]Mean separation within columns by Duncan's Multiple Range Test, 0.05 level.

Photinia showed poor soil salt tolerance. The high tissue Cl level (3.59%) and osmotic potential of the soils contributed to decline. Photinia was moderately tolerant to spray salts.

Leyland cypress is an ideal plant for use in coastal environments where spray salt deposition and, less frequently, soil salinity pose cultural problems.

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Table 2. Sodium and chloride content of Leyland cypress and red-tip photinia as affected by salt treatment.

| Treatment | Na, percent dry wt | | | Cl, percent dry wt | | |
|---|---|---|---|---|---|---|
| | Leyland | Photinia | | Leyland | Photinia | |
| | Shoot | Leaf | Stem | Shoot | Leaf | Stem |
| Soil control | 0.02 b[z] | 0.01 c | 0.02 c | 0.63 c[z] | 0.80 c | 0.13 c |
| Foliar control | 0.02 b | 0.02 c | 0.02 c | 0.48 c | 0.85 c | 0.14 c |
| Soil salt | 0.15 a | 0.69 a | 0.42 a | 1.34 a | 3.59 a | 1.36 a |
| Foliar salt | 0.19 a | 0.43 b | 0.17 b | 0.83 b | 2.17 b | 0.66 b |

[z]Means not followed by the same letter or letters within a column are significantly different by Duncan's Multiple Range Test, 0.05 level.