AMELIORATION OF SALT DAMAGE TO *COTONEASTER* BY GYPSUM

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Abstract. Cotoneasters were grown in a gypsum-treated medium and salinized with 0.15*N* NaCl. Gypsum was applied in 3 forms with 2 application methods and at 2 rates. Controls received no gypsum additions. Control plants were severely injured, while gypsum treated plants showed reduced damage. The incorporated gypsum was more effective in alleviating damage than surface applications. Rate was not a factor as 20 lb/100 sq. ft. proved as effective as 40 lb/100 sq. ft. All 3 gypsum formulations were effective but the granular materials were easier to work with when compared to the fine-ground. Electrical conductivity of the media leachates were significantly lower in incorporated gypsum treatments compared to the control. The pH of the leachates was not affected by gypsum treatments.

Salt damage to vegetation along highways, sidewalks and in containers has been well documented (3,5,9,10). Injury (2,5,10) results from aerial and soil-deposited salts. Plants in tree lawns, parkways, planters or close to roadways are more apt to be injured by soil salts (3,9). Damage to containerized plant materials is often accentuated because salt-laden snow is piled around the containers and tree lawn areas. Gypsum has been shown to reduce Na uptake by plants (1) and, possibly Cl (6), and is recommended as an ameliorative treatment for reducing salt injury to *Acer saccharum,* sugar maple, in New England (9). The possible beneficial effects of gypsum on the alleviation of the soil salt damage to containerized plants have not been critically examined. This study determined the ameliorative effects of 3 gypsum sources, 2 application methods, and 2 rates on the appearance of Skogsholm cotoneaster, and the media electrical conductivity and pH.

Materials and Methods

Healthy, vigorous rooted cotoneaster cuttings were transplanted into 15cm plastic pots containing a soil:peat:perlite (1:1:1) medium or a gypsum-amended medium of the same composition. Three gypsum sources were used: United States Gypsum Granular; Sof'n-Soil Lawn and Garden (granular); and Sof'n-Soil Lawn and Garden (fine). These sources were incorporated or surface applied at rates of 20 and 40 lb/100 sq. ft. (17.6 g/pot=20 lb rate or 35.3 g/pot=40 lb rate). The surface treatment was applied after transplanting, while the incorporated gypsum was mixed with the media and the plants potted thereafter. Control consisted of the medium without gypsum.

Plants were pruned to a uniform height and placed in the greenhouse under 15-hour photoperiods at 24° day/20°C night temperatures. Plants were fertilized for 8 weeks with Hoagland's No. 1 solution (4) at a rate of 200 ml/container on alternate days. Leachates were collected weekly from each container and pH and electrical conductivity were determined. When no significant pH or conductivity changes were evident, the leachates were collected at 2 week intervals thereafter. Only initial and final values are presented.

Salt treatments were initiated in the ninth week. Each container was supplied with 200 ml of 0.15*N* NaCl on alternate days and with a Hoagland's or deionized water treatment the other days. The experiment was terminated after 4 weeks when the majority of the control plants showed 70 to 80 percent or greater necrosis. Plants were evaluated using a rating index (See Table 1 for criteria). Plants were arranged in a completely randomized design with 5 single plant replicates per treatment.

Results and Discussion

Gypsum ameliorated the salt damage on cotoneaster in all treatments except the Sof'n-Soil (fine) surface applications (Table 1). Control plants were approximately 70 to 80 percent necrotic while plants grown with the 3 incorporated gypsum sources at the 2 rates were less

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than 40 percent necrotic. A high rate of soil salt application was used in this study to produce toxicity symptoms. Under normal conditions container-grown plants would not be exposed to these quantities and the ameliorative effect of gypsum would possibly be greater.

The incorporated gypsum proved more effective than surface applications. The use of gypsum on established plants in tree lawns and containers, however, would probably necessitate surface applications. Three gypsum applications methods used in Maine experiments were most effective in the following order: surface, subsurface, and subsurface combined with mechanical soil aeration (9). Drill hole application would work but the cost might preclude this method. In new plantings the gypsum could be easily mixed with the backfill.

Both rates appeared to be effective. The 20 and 40 lb./100 sq. ft. translate into 4.36 and 8.72 tons/acre, respectively. Rates of gypsum application required to achieve soil salts reduction varies from 4 to 15 tons/acre (9). Plice (7) reported that 4 to 6 tons/acre reclaimed strongly saline soils, and that 12 tons/acre offered the advantage of reducing salts more quickly. Gypsum treatments

are effective over a long time period and annual or biennial treatments are not necessary.

The electrical conductivities (measure of total ions in solution) were significantly lower in all incorporated gypsum treatments than in the controls. Surface applications of Sof'n-Soil (granular) at 40 lb and Sof'n-Soil (fine) at both rates also resulted in lower conductivities. The plants grew better in the soils with lower salt content. This is to be expected in view of the reported effects of high soil salts on plant growth (8). Although tissue analysis was not completed, it is logical to assume that levels of Na and Cl were lower in plants grown with gypsum. Ayoub (1) reported a 30 to 85 percent reduction in leaf Na from plants grown in saline soils treated with gypsum. Jacobs (6) showed that gypsum applications resulted in greater soil Cl reductions than those of controls (non-gypsum). Both Na and Cl ions have been implicated in plant salt damage (2,5,10) and if they are effectively reduced in plant tissue then increased vigor should result.

The pH changes due to gypsum treatments were negligible although there was 0.5 to 0.8 unit change from the initial values to the final. This was

Table 1. Effect of gypsum sources, application methods, and rates on the appearance of Cotoneaster dammeri 'Skogsholmen' and on the initial and final leachate electrical conductivities and pH values.

Gypsum source	Application method	Rate lbs/ 100 sq.ft.	Appearance index[z]	Conductivity		pH	
				initial	final	initial	final
Control			3.7 a[y]	3.7 a	9.1 a	4.9	5.8
Granular	Surface	20	2.6 cde	2.6 cde	8.6 ab	5.2	5.6
		40	2.1 defgh	2.1 defgh	7.5 abcd	5.2	5.9
	Incorporated	20	1.6 h	1.6 h	5.7 fgh	5.3	6.0
		40	2.1 defg	2.1 defg	5.7 fgh	5.2	5.8
Sof'n Soil (granular)	Surface	20	2.3 cdef	2.3 cdef	7.7 abc	5.2	5.7
		40	2.8 cd	2.8 cd	7.2 bcde	5.2	5.8
	Incorporated	20	2.0 efgh	2.0 efgh	4.6 h	5.5	6.1
		40	1.5 h	1.5 h	5.3 gh	5.8	6.0
Sof-n Soil (fine)	Surface	20	3.0 abc	3.0 abc	6.3 cdefg	5.1	5.8
		40	3.6 ab	3.6 ab	6.8 cdef	5.2	6.0
	Incorporated	20	1.7 gh	1.7 gh	4.7 h	5.3	6.0
		40	1.8 gh	1.8 gh	5.4 fgh	5.4	6.1

[z]Appearance incides: 0=no damage; 1-20%, 2-40%, 3-60%, and 4-80% browning; 5-dead.

[y]Mean separate, within columns, by Duncan's multiple range test, 0.05 level.

due largely to the Hoagland's solution which is 100% nitrate nitrogen and pH rises with NO_3 fertility.

Summary and Conclusions

Gypsum appears to have potential for alleviating soil-salt damage to landscape plants. A broader spectrum of plants must be screened and a more definitive range of gypsum concentrations should be examined. Soil and plant tissue analyses are needed to corroborate the observed beneficial effects. All sources of gypsum, when incorporated, were effective. The Sof'n-Soil (fine) is difficult to work with. The granular forms are recommended.

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ABSTRACT

ANAGNOSTAKIS, S.L. 1978. **The American chestnut: new hope for a fallen giant.** Conn. Agr. Expt. Sta. Bul. 777. 9 p.

The American chestnut (*Castanea dentata*) was once the most important hardwood species in the Eastern United States. The blight fungus (*Endothia parasitica*), was responsible for its loss. The canker disease was first reported on American chestnut trees in the Bronx Zoological Park in 1906. When the seriousness of the disease became evident, much money and effort went into a campaign to save the chestnut. Within 40 years the blight fungus had decimated every major stand of American chestnut in the eastern United States. In Connecticut, a chestnut breeding program was begun in 1931. Progress has been made, but we are still a long way from producing true breeding forest trees. Europeans have isolated forms of the blight fungus that have reduced virulence. We know that: 1) hypovirulence is a disease or group of diseases of the fungus *E. parasitica* that reduces its pathogenicity but not its vigor as a saprophyte, 2) it is controlled by genetic determinants in the cytoplasm of the fungus, 3) the determinants are probably on, or associated with, dsRNA, 4) all hypovirulent strains examined contained dsRNA, and 5) the dsRNA is associated with club-shaped virus-like particles in at least one strain.