Dolomitic Lime Particle Size and Container Medium pH[1]

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Abstract

Boxwood liners, *Buxus sempervirens* 'Suffruticosa', were container-grown for two years in a pine bark/peat moss medium amended with various particle sizes of dolomitic limestone. Adjustment of pH was more effectively accomplished with the finer particles. All treatments resulted in greater plant growth than the untreated control. A surface application of a commercially available pulverized dolomitic limestone was also effective in increasing the pH above the control treatment, and plants grown with the surface applied treatment were as large as any of the incorporated treatments.

Index words: pine bark, boxwood, *Buxus sempervirens*

Significance to the Nursery Industry

The idea that fine grades of dolomitic limestone are leached from porous container media and thus not effective in adjusting pH or influencing plant growth is unfounded. This study indicates that finely ground pulverized limestone can be used with porous container media to meet the dolomitic limestone needs of the plant. The idea is unfounded that finely ground dolomitic limestone products will leach from porous container media to the extent that the limestone needs of the plant are not met. This study also shows that surface applications of dolomitic limestone are effective in adjusting the pH of container medium, although not to the extent that incorporated limestone does, and that surface applications can accommodate the plant's dolomitic limestone needs.

Introduction

Particle size of liming material influences the rate of dissolution in soils (1, 2, 3). Finer particles react more readily than coarser particles, but persist for a shorter time in soils. Most limestone sold contains a specific percentage of fine and coarse particles to provide maximum effectiveness over time.

Container media are very porous and may allow the more reactive fine particles of lime to move through the media and leach from the container. Therefore, some growers prefer to use a coarser grade limetone compared to the pulverized grade normally sold to the horticultural industry (personal communications). The objective of the study was to compare the effectiveness of 1) pulverized dolomitic limestone, 2) a coarser grade of agricultural dolomitic limestone, and 3) three particle size fractions which were obtained from agricultural dolomitic limestone to adjust and maintain medium pH.

Materials and Methods

A two-year study was conducted on container-grown boxwoods, the growth of which benefits from limestone additions (4). Boxwood liners (2-years-old) were transplanted into 2 gallon plastic containers on June 30, 1988 and grown outdoors in a peat moss and coarse pine bark medium (1:3 by vol) for 2 years. Forty grams of Osmocote 18-6-12 (18N-2.6P-7.6K) were applied at the beginning of each growing season. Plants were irrigated with an overhead irrigation system as needed and overwintered in an unheated structure covered with white polyethylene. There were 8 replications of seven lime treatments which are listed in Table 1. The particle analyses for pulverized and agricultural dolomitic limestone are similar except that pulverized limestone contains 25% more particles less than 0.25mm in diameter. The particle analysis of pulverized dolomitic limestone is 100% U.S. standard sieve #20, 85% sieve #60, and 75% sieve #100. Particle analysis of agricultural limestone is 100% sieve #20, 60% sieve #60, and 50% sieve #100. The three fractions obtained from the agricultural limestone were as follows: >1mm (sieve #18), <1mm >0.25mm (sieve #60), and <0.25mm. A randomized complete block design was used. Limestone was surface applied or incorporated at the rate of 6 kg/m^3 (10 lb/yd^3). Container medium solution pH's (5) were taken in May, July and September of each growing season. At the conclusion of the study, November 2, 1989, shoot dry weights were determined. Data were analyzed via Duncan's multiple range test.

Results and Discussion

The incorporated pulverized limestone effectively increased pH over the two-year period (Table 1). This was also true for the two finer particles sieved from the agricultural limestone. Surface applied limestone increased solution pH, although not effectively as incorporated limestone.

Table 1. Average medium solution pH in 1988, 1989 and final shoot dry weight of boxwoods grown in pine bark amended with various limestone particle sizes.

Treatments	Medium solution pH 1988	Medium solution pH 1989	Shoot dry wt (g) 1989
Pulverized surface applied	5.09 d	4.79 c	71.8 a[z]
Pulverized incorporated	6.85 a	6.60 a	65.0 ab
Agricultural incorporated	6.37 b	6.37 a	66.0 ab
Particle size >1mm (Sieve #18)	5.62 c	5.45 b	67.6 a
Particle size <1mm >0.25mm (Sieve #60)	6.60 ab	6.23 a	73.0 a
Particle size <0.25mm (final pan)	6.67 ab	6.48 a	65.5 ab
Control without lime	4.80 d	3.89 d	56.6 b

[z]Mean separations within columns by Duncan's multiple range test, P=0.05.

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All lime treatments were similar, even the surface applied, and resulted in greater shoot dry weight compared to the unlimed treatment.

It appears that fine grades of limestone are effective in adjusting the container media pH throughout a normal production period thus satisfying the liming needs of plants such as boxwood. The idea is unfounded that fine grades of limestone are leached from the container and are not effective in adjusting container media pH over time. In fact, the finer limestone grades in this study were more effective in raising pH than the coarser grades, even after two years. The faster rate of dissolution by the finer particles grades (1, 2, 3) is more important in terms of pH adjustment than the leaching potential of the finer grades.

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Soil Moisture Uptake by Green Ash Trees After Transplanting[1]

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Abstract

Forty-five Summit green ash trees (*Fraxinus pennsylvanica* Marsh. 'Summit') were planted on a compacted clay soil site. Unamended soil, amended soil, and friable topsoil were used as backfill, in combination with holes slightly larger than the root ball, twice, and 3 times the diameter of the root ball. Soil moisture tension (SMT) was monitored in the root ball, in the backfill, and outside of the planting hole. Soil moisture tension reached at least −50 KPa within the root ball in as little as two days. Improved backfill soil and large planting holes resulted in earlier significant uptake of soil moisture outside of the root ball compared to nearby soil where roots were excluded. SMT inside the root ball were significantly more negative than the surrounding soil for all treatments until twenty weeks after transplanting. At 68 weeks after transplanting, differences in SMT between the root ball, the backfill, and the soil outside the planting hole became insignificant for all treatments. Soil moisture tensions levels reported to inhibit root growth were frequently measured in the root zone throughout the first two growing seasons after transplanting.

Index words: Soil moisture tension, backfill amendments, *Fraxinus pennsylvanica*

Significance to the Nursery Industry

Little information is available on the soil moisture supply of transplanted trees, or how moisture supply is affected by planting hole design, backfill type, and root regeneration. This information is important in determining optimum planting specifications. The results of this study indicate that watering newly planted trees is required more frequently, and for a longer period of time than is commonly practiced.

Introduction

Plant growth is reduced more often by water deficits than by any other factor (5). When available soil water is adequate, water movement through the plant is controlled by transpiration. When soil water is limited, water movement through the plant is regulated primarily by soil water supply and conductivity of the roots (9). When soil moisture tension (SMT) reaches −50 KPa, root growth is checked and capacity to absorb water is reduced because of suberization (2).

Water outside of the root zone is largely unavailable to the plant (6). Water uptake within the root ball exceeds water diffusion into the root ball (1), even if movement is not inhibited by a soil textural difference. Thus, the root ball soil is the only source of moisture available to newly planted trees until the roots grow out into the surrounding soil.

Root growth results in exploitation of an ever-increasing soil volume and the greater volume of water associated with it. Barnett (1) reported that soil water available to transplanted privet increased from a 2 to 23 day supply, over a 17 week period after transplanting. As water supply increases, incidence of stress is likely to decrease.

Planting hole preparation is an extremely important factor in the transplanting success (7). Root incursion decreases in compacted and hard to penetrate soils (8). Well aerated soils around the root ball assist in rapid root development (11). Large planting holes can result in greater development of new roots (4). The purpose of this study is to examine the role of planting hole design and backfill soil type in soil

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