High Dolomitic Lime Rates Induce Mouse-ear Symptoms in Container-grown Pecan Trees

Gary J. Keever and William D. Goff
Department of Horticulture and Alabama Agricultural Experiment Station, Auburn University, AL 36849

Mark S. West
Department of Research Data Analysis and Alabama Agricultural Experiment Station, Auburn University, AL 36849

Additional index words. Carya illinoensis, little-leaf, manganese, fertilization, soil amendments, pH

Abstract. Pecan [Carya illinoensis (Wangenh.) C. Koch] trees were grown in containers in a pine bark and sand medium amended with 0, 3.0, 5.9, 8.9, or 11.9 kg dolomitic limestone/m³. Mouse-ear symptom expression, characterized by small, rounded, cupped, and slightly wrinkled leaflets, increased linearly as dolomitic lime rate increased. Plant growth was best at 3.0 kg dolomitic lime/m³, which resulted in a growth medium pH of 4.3.

“Mouse-ear” has been used to describe abnormal growth in pecan trees characterized by small, rounded, cupped, and slightly wrinkled leaves (Gammon and Sharpe, 1956). In orchards, it has been associated with soil pH of 6.5 to 8.0 and was thought to be caused by Mn deficiency (Gammon and Sharpe, 1956). Later research (Gallaher and Jones, 1976; Grauke et al., 1983; Worley, 1979) reported similar symptoms in non-Mn-deficient trees, or a low correlation between Mn and symptom expression (Goff and Keever, 1991), suggesting a more complex or different problem. Gallaher and Jones (1976) suggested Ca deficiency as a cause, but their research showed higher Ca, Mn, Fe, Cu, Zn, and Mo and less Mg in leaf and stem tissue from affected trees. Worley (1979) reported elemental concentrations of normal and mouse-ear leaflets differed among cultivars, with inconsistencies in element concentrations of affected leaflets occurring for particular cultivars and locations. Grauke et al. (1983) observed higher N, P, Ca, S, and Mn and lower Fe in mouse-ear than normal leaves from container-grown trees. The results of this work suggested that high N levels were lowering the N : S ratio and that correspondingly high levels of S may be needed for normal growth.

Pink bark-based media are standard in the container industry in the southeastern United States for ornamental and fruit trees. Published research indicates excellent growth of containerized pecans in a pine bark : sand medium (Acock and Overcash, 1983). Working with trees grown in a pine bark-based medium, Goff and Keever (1991) demonstrated that repotting pecan trees with severe mouse-ear symptoms into media amended with little or no dolomitic lime (lime) alleviated the symptoms. This “curative effect” of little or no lime suggested that a study of lime rates should be conducted to determine if symptom expression could be induced on previously healthy plants by high applications of lime. The purpose of this experiment was to evaluate effect of rate of lime application on inducing mouse-ear symptoms in previously healthy pecan trees grown in a pine bark-based medium.

Pecan seedlings grown from open-pollinated ‘Elliott’ nuts were used in the experiment. Ten nuts per 11.4-liter container were planted in July 1989, in a milled 5 pine bark : 1 sand medium (v/v) amended with (kg·m⁻³) 8.3 Osmocote 18N-2.6P-10K (Grace-Sierra, Milpitas, Calif.), 1.2 gypsum, 0.9 Micromax (Grace-Sierra), and 3.6 dolomitic limestone.

In Jan. 1990, 84 of the seedlings described above were selected for uniform caliper and height to be used in the experiment. Trunk caliper 5 cm above the soil line and plant height were recorded on 16 Jan. 1990. Plants of similar caliper were assigned to a given block. Treatments were O, 3.0, 5.9, 8.9, or 11.9 kg of 100 mesh or finer dolomitic limestone/m³ (0N-0P-0K-20Ca-8.0Mg).
limestone was incorporated into a 6 milled pine bark : 1 sand (v/v) medium that contained, in addition, (kg·m⁻³) 8.3 Osmocote 18N-2.6P-10K, 1.2 superphosphate (ON-20P-0K), 1.2 gypsum, and 0.9 Micromax. A sixth treatment included the same medium as above with no limestone, but with supplemental Ca (14 g CaSO₄) and Mg (4.7 g MgSO₄) per container topdressed at repotting and then monthly from April-July. This treatment was included to determine if Ca and Mg influenced mouse-ear expression when no lime was incorporated into the growth medium. Trees were transplanted bareroot, one per 11.4-liter container; there were no mouse-ear symptoms on the selected plants at any time before replanting into the treatment mixes. There were seven two-plant replications per treatment in a randomized complete-block design.

Plants were rated for mouse-ear severity (1 = healthy, 5 = severely mouse-eared) on 23 July 1990. Leaflet and leaf lengths, which are objective indicators of mouse-ear severity, were measured on the same date. Two compound leaves from the middle of current season’s shoots and the middle pair of leaflets from the compound leaves were measured on each plant. Plant caliper and plant height also were recorded on the same date. Growth medium pH was determined in July 1990, 6 months after repotting, on seven single-plant replicates using the saturated paste extraction method (Warnke and Krauskopf, 1983).

Mouse-ear symptom expression, whether measured by a severity rating or leaf and leaflet lengths, was greater at the higher rates of incorporated dolomitic lime (Table 1). Severity rating increased quadratically, while leaflet and leaf lengths decreased linearly as dolomitic lime rate increased from 3.0 to 11.9 kg lime/m³. Plant caliper increased from 0 to 3 kg·m⁻¹, but did not increase with increasing lime above 3 kg·m⁻¹. Medium pH, as expected, increased with increasing dolomitic lime application. Lime at 3.0 kg·m⁻¹, which produced maximum plant growth and few mouse-ear symptoms, resulted in a medium pH of 4.3. This pH is well below the optimum of 6.5 to 7.0 proposed for pecans (Sparks, 1977) grown in soil. As pointed out by Ogden et al. (1987), in a pine bark medium, pH itself is not critical, and proper plant growth can be achieved, regardless of pH, by providing sufficient essential elements in an available form with correct balance. This balance would appear to have been achieved with the ingredients we used and lime at 3.0 kg·m⁻¹. Lime at 0 kg·m⁻¹ minimized mouse-ear symptoms but also resulted in less growth in diameter than 3.0 kg lime/m³. Adding supplemental Ca and Mg to 0 kg lime/m³ produced similar responses as 0 kg lime/m³. Since release of Ca and Mg from lime depends on moisture, temperature, fineness of material, and uniformity of mixing, it was not possible to directly compare the supplemental Mg and Ca we added to the amount available from any of the lime applications. The irrigation water we used, which contained 2.0 and 5.6 mg·liter⁻¹, respectively, of Mg and Ca, may have provided enough of these elements to increase plant growth when no lime was used.

These and other results (Goff and Keever, 1991) suggest that mouse-ear symptoms exhibited by pecan trees grown in a pine bark-based medium can be almost totally eliminated if ≤3.0 kg lime/m³ is added to the medium, resulting in a medium pH of ~ 4.3. Very low rates, or no dolomitic lime at all, may reduce plant growth. These results suggest that lime at 3.0 kg·m⁻¹ maintains good tree growth and minimizes mouse-ear occurrence.

**Literature Cited**


