Zinc fertilization is one of the prime nutrient management considerations in commercial pecan production. Deficiency in pecans results in rosetting; interveinal chlorosis; small, chlorotic (and necrotic) leaves (Fig. 1); less cytoplasm; and failure of chloroplast formation (limiting photosynthesis) (Kim and Wetzstein, 2003).

Pecans growing in calcareous, alkaline soils are particularly susceptible to Zn deficiency because soluble zinc reacts with carbonates and hydroxides, reducing its availability to plants (Lindsay, 1972). In areas with acidic soils, both soil fertilization and foliar sprays are used to supply Zn to pecan trees, whereas only foliar sprays are used in alkaline soils. It has been suggested that foliar sprays are less effective in increasing vegetative and root growth because the zinc is only minimally translocated from the sprayed leaves (Neilsen and Neilsen, 1994). Christensen and Jackson (1981) showed that root growth depends on zinc supply. When ZnSO₄ was foliar-applied to mature pecan tree leaves, only 0.37% of the applied zinc translocated from the treated leaf; this increased to 1.0% when applied to immature leaves (Wadsworth, 1970). In contrast, when pecan seedlings were grown in a solution with ZnSO₄, zinc was translocated into the petioles and the lateral and midrib veins of the youngest, most active leaves.

Zinc application to pecans growing in calcareous soils has met with limited success. Storey et al. (1971) determined that 140 lb of ZnSO₄ per tree was required to alleviate zinc deficiency in calcareous Texas soils. In Arizona, neither band application of 75 lb/ac of Zn as ZnSO₄ nor 20 lb/ac as Zn-EDTA consistently increased Zn uptake in mature ‘Wichita’ pecans growing in a calcareous soil (Nuñez-Moreno et al., 2009).

We conducted several studies evaluating soil application of chelated zinc. In a 2008–2009 shade-house study, one-year-old Wichita pecan trees were potted in calcareous (pH 7.6) Pima clay loam soil. Treatments included: soil-applied ZnSO₄ (36% zinc), Zn-EDTA (9% zinc), zinc Avail (8% zinc with a dicarboxylic acid polymer resin), cow manure (0.84 N, 0.18 P₂O₅, 1.19 K₂O), or cow manure plus ZnSO₄. Also included were foliar-applied ZnSO₄ and an untreated control. The manure application rate was equivalent to 8 tons/ac, and the zinc application rate of all soil applications was equivalent to 80 lb Zn/ac. Soil treatments were applied only one time, at the beginning of the study. The foliar spray was applied at approximately two-week intervals from April to August. Leaves harvested at the end of the two growing seasons were acid-washed and analyzed for zinc content.

Of the soil zinc applications, only Zn-EDTA significantly increased foliar zinc levels (Fig. 2), and this treatment was effective only during the first growing season. By the second season, the Zn-EDTA was ineffective, either due to EDTA decomposition or leaching, or because chelated Zn was displaced by another cation.

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**Fig. 1.** Zinc deficiency symptoms in pecan leaves.


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