Response of Little-leaf Linden and Honey Locust to Rates of Organic and Mineral Nitrogen

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Additional index words. nursery crops, nutrition, organic by-products, feather meal, Gleditsia triacanthos, Tilia cordata

Natural organic fertilizers have benefited agriculture since ancient times. These fertilizers, primarily processed wastes from the agri-food industry, are used today for producing organically grown food crops (Gagnon and Berrouard, 1994) and also as specialty fertilizers for lawns and home gardens (Tisdale and Nelson, 1975). Such uses offer alternative ways to dispose of organic waste by-products and conserve landfill space (Williams and Nelson, 1992).

While products such as bone meal, blood meal, and feather meal have been considered as sources of N for greenhouse (Choi and Nelson, 1996) and turf (Peacock and Daniel, 1992) use, a comprehensive literature search indicated no such consideration in modern ornamental nursery tree production practices. The objective of this study was to evaluate and compare how two shade tree species responded to mineral source. The results of this study demonstrated that both shade tree species responded similarly to natural, organic-based N from feather meal vs. mineral-based N over a 4-year period. Growth of honey locust, but not little-leaf linden, was stimulated by rates of N between 50 and 200 kg·ha⁻¹. The relatively modest (honey locust) or no (little-leaf linden) response to N rates may in part be attributed to the fact that the soil was fertile, deep, and well drained (Chong et al., 1991).

Data were analyzed by regression (Chong and Cline, 1994). Each response was regressed within species on level of organic or mineral N. Graphically, the model represents two lines, one for each N source radiating from a common intercept. When the two regressions did not differ at P ≤ 0.05, a common regression was fitted. The coefficient of determination for each set of responses was expressed in terms of "partial r² (pr²), which measured the strength of the response relationship after removing replication effects (Chong and Cline, 1994).

Trees of both species grew vigorously throughout the 4 years in this relatively fertile soil. After the fourth season, trunk diameters of honey locust trees were proportional to the quantity of N applied, responding similarly to the organic (O) and mineral (M) sources (combined regression, Y = 61 + 0.015X, pr² = 0.79, Fig. 1). Height (3.8 ± 0.3 m) was unaffected. Growth of little-leaf linden was not affected by any N treatment (trunk diameter, 72 ± 0.6 mm; height, 3.7 ± 0.3 m).

Data for earlier years (not shown) indicated that the effect of N rates on trunk diameter of honey locust began to be statistically significant after the second season. After the third season, most trees of both species were of marketable size (50-mm trunk diameter). Annual analysis indicated adequate quantities of all foliar nutrients in both species from all treatments (Ontario Ministry of Agriculture, Food and Rural Affairs, 1994). Foliar nutrient concentrations were not affected by N rate or source except in the first year (1992), when foliar N increased linearly in both species (honey locust, Y = 2.59 + 0.0033X, pr² = 0.42; little-leaf linden, Y = 3.22 + 0.019X, pr² = 0.32) and K increased in honey locust only (Y = 1.22 + 0.0016X, pr² = 0.44).

According to Williams and Nelson (1992), feather meal has not been used effectively as a plant fertilizer, since N mineralization by microbial activity is considered to be too slow to meet plant requirements. Tisdale and Nelson (1975) emphasized that one source of N can be as effective as another, depending on factors such as soil type, method and time of application, and type of carrier.

NOTE
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Fig. 1. Response of honey locust to level and source of N after the fourth growing season. Organic (O) = circles; mineral (M) = squares; common curve, Y = 61 + 0.015X, pr² = 0.79.