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Supplemental Nickel Corrects Mouse Ear Disorder of Bitternut Hickory

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Summary

Mouse ear disorder manifests as leaf curling, necrotic margins, rosetting of the stem, suspended leaf expansion, and stem dieback in certain woody taxa including river birch and pecan. This is the first report of mouse ear disorder on bitternut hickory (*Carya cordiformis*) and its correction in plants treated with supplementing nickel either as a substrate drench or foliar application.

INTRODUCTION

In the early 2000s, it was discovered that mouse ear disorder, an issue limiting the production of river birch (*Betula nigra*) and pecan (*Carya illinoinensis*), was the result of nickel deficiency. A commercial product was developed for supplementing nickel and the element has since been recognized as essential for plant growth. Aside from these two taxa, mouse ear disorder has not been documented on other species cultivated in the nursery. As species diversification of managed landscapes becomes a

principal issue in the green industry, growers are looking for new crops to produce.

Bitternut hickory (*Carya cordiformis*) is a species gaining the attention of growers, horticulturists, and urban foresters for its horticultural merit. While desirable, one issue encountered by growers is the occurrence of symptoms akin to mouse ear disorder when cultivated in containers with soilless potting substrates. This phenomenon poses a challenge to the development of this species as a nursery crop because hickories are considered difficult to transplant and container production is likely well suited to the adoption of the taxon in landscape horticulture. We questioned whether bitternut hickory is particularly susceptible to mouse ear disorder as a function of nickel deficiency.

Our objectives were to provide evidence that bitternut hickory is susceptible to mouse ear disorder, and to characterize growth responses of symptomatic plants after treatment with the commercial product Nickel Plus® to assess if supplemental nickel ameliorated symptoms.

METHODS

Three-year-old bitternut hickory seedlings grown in a peat-based substrate (#1 containers) were treated two weeks after budbreak with either water (untreated), a substrate drench (37.85ml Nickel Plus®/ 3.79L H_2O), or foliar spray (9.46ml Nickel Plus®/ 3.79L H_2O). A total of 36 plants were used (12 single-plant replicates per treatment).

Plants were grown on a greenhouse bench in Ithaca, NY using a completely randomized design. Data were collected 30 days post-treatment by destructive harvest. Data was analyzed using a one-way ANOVA via JMP Pro version 15.

RESULTS

All untreated controls displayed symptoms of mouse ear disorder, including leaf curling, necrotic margins, rosetting of the stem, suspended leaf expansion, and stem dieback (Figure 1).

Figure 1. Close-up image of symptoms of mouse ear disorder on bitternut hickory.

Symptoms did not manifest on plants treated with either a substrate drench or foliar application of Nickel Plus® and all treated plants resumed normal growth (Figure 2).

Figure 2. Left to right: seedling hickory left untreated (control), treated with a substrate drench, or supplemented via a foliar spray of Nickel Plus®.

ICP-AES test results indicated all untreated controls had undetectable amounts of nickel whereas mean nickel content of plants treated with either a drench or foliar spray comprised ≈2.5 or 83.6 mg•kg^{-1}, respectively. These results indicate symptoms are the result of nickel deficiency, bitternut hickory is susceptible to mouse ear disorder, and that the problem can be corrected by supplementing nickel.

DISCUSSION

Each of the taxa documented as susceptible to mouse ear disorder are ureide transporters. Additional research will screen other woody plants with similar ureide-transporting nitrogen metabolism for susceptibility to mouse ear disorder including other species belonging to the genus *Carya* as well as unrelated taxa.

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