Using Micronutrient Fertilizers in Forest Nurseries

For Invigorating Stunted Stock

by

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The influence of trace or minor elements on tree seedlings often is not obvious. Until the supply of these micronutrients-including iron, manganese, boron, copper, zinc, and molybdenum—reaches an extreme deficiency level, nursery stock does not exhibit any readily detectable changes in its appearance. Nevertheless, low concentrations of these minute but essential constituents of soil fertility cause serious abnormalities to the internal, anatomical and physiological makeup of young trees. Under unbalanced nutritional Conditions, partially stared nursery stock shows a sluggish response to applications of the major nutrient fertilizers, and may succumb to the attack of parasitic organisms. The latter outcome may *not be* preceded by stunted growth of trees or other symptoms of the so called "deficiency diseases."

The recent increase ill the taxonomic members of the fungal populations parasitizing nursery stock-fur example. *Lophodernium, Phytopthora, Scleroderis,* . and *Cylindrocladium* spp.--may be directly related to the general depletion of nursery soil in micro elements. This assumption is not only plausible, but very probable in view of the past history of nurseries producing reforestation material. During the past 40 tear.. soil of a very large proportion of Federal, Stale, and private nurseries have failed to receiye even small amounts of micronutrient fertilizers. This failure has been largely due to the concealed effects of trace elements and limitations of the present methods of soil analysis. Laboratory determinations of available trace elements, whether chemical or biological, are too laborious and costly to he incorporated into the routine analyses of nursery soils.

Treatment Procedures

Fortunately. in many cases a deficiency of trace elements can he either prevented or corrected with relatively small effort and expense. One way to accomplish it is by applying solutions containing micro-nutrients, alone or ill combination with fertilizers with the major nutrient elements (1). Recently, liquid treatments have greatly increased their scope and effectiveness due to the production of soluble, chelated fertilizers of nearly all micronutrients. The pincerlike structure of these chemical reduces the toxicity of trace elements and their tendency to form insoluble compounds in the soil.

The solution that provided a safe amelioration in our trials on non calcareous soils had the following composition, given on a pounds-per-acre basis applied in 1400 gallons of water: Sequestrenes of chelated 330 iron (10 percent Fe); manganese (12 % Mn) and copper (13 % Cu), each 8 pounds; Sequestrene chelated zinc (14%Zn), 12 pounds; boric acid (10% B) 8 pounds,and, for leguminous stock or green manure crops, sodium molybdate (40 percent Mo). 1 pound. The treatment can be repeated after an interval of about 10 days. Depending on soil conditions, any of the components, except those of presumably

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Figure 1.—A rapid growth response of greenhouse-raised 1-year-old white spruce, induced by a foliar spray of N-P-K and micronutrient fertilizers applied at rates of 100 *(left)* and 200 *(right)* pounds per acre. The additional growth materialized in 18 days after the spray.

critical importance, can be reduced or deleted. If desirable, the solution can be supplemented by 100 pounds of 11-48-0 mono-ammonium phosphate and 200 pounds of 13-0-44 potassium nitrate, thus obtaining a nearly complete, and usually highly effective mixture to invigorate stunted stock. However, solutions carrying major nutrient elements tend to increase succulence and foliar growth, and their excessive use will yield stock lacking in morphological and physiological balance (2).

Discussion

In general, it is advisable to leave some nursery beds without fertilizer application to serve as controls. If circumstances permit, results of the treatments can he appraised at the end of the growing season on the basis of foliar analyses of the fertilized and untreated stock. Rapid foliar analyses by an emission spectrometer now provide, at a relatively small expense, an accurate picture of the actual uptake of nutrients by plants. An appreciable increase in the concentration of certain nutrient elements in the tissue of fertilized seedlings usually testifies to their deficiency in the soil or else their presence in a form unavailable to trees.

A deficiency of micronutrients can also be corrected, at least temporarily, by foliar sprays. These treatments, using mobile tanks with the spraying equipment, are the least expensive; they are rapidly accomplished and require very small amounts of both fertilizers and water. In conservative treatments, the following amounts of chemicals should be dissolved in 100 gallons of water and sprayed over 1 acre of nursery beds: Chelated 330 iron (10 per cent Fe) and zinc (14 per cent Zn), each 1 pound; chelated manganese (12 per cent Mn) and copper (13 per cent Cu), each .5 pound, and, for leguminous plants, sodium molybdate (40 per cent Mo). 4 ounces.

Sprays, including a mixture of trace and major nutrient elements quickly produce a spectacular recovery of the color and the growth of inferior nursery stock (fig. 1). However, this effect is of very short duration. The foliar sprays do *not* augment the nutrient supply of the soil and this form of fertilization, particularly where embracing major nutrient elements, is better suited to the production of ornamentals or Christmas trees, rather than reforestation material.

Literature Cited

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