LIQUID FERTILIZER TREATMENTS OF NURSERY SOILS-THEIR ADVANTAGES AND SHORTCOMINGS [1]

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The use of liquid fertilizers in forest nurseries was introduced in the summer of 1932 when several blocks in two Wisconsin nurseries were treated with a solution of ammonium sulfate, diammonium phosphate, and potassium nitrate. Because of the spectacular response of seedlings to liquid treatments, the method attracted the immediate attention of nursery specialists. Within a few years, the application of fertilizer solutions through sprinkling cans, pressure sprayers, and overhead systems became a common practice in many nurseries (Wilde, 1935). At present, the practice is widely used, with or without justification, in this country and abroad.

No other method of nursery soil management has rendered such helpful services or brought such harmful consequences as has the use of liquid fertilizers. A review of the beneficial and the harmful aspects of this practice follows.

Applications of fertilizers ahead of seeding require plowing and discing, or rototilling. Liquid treatments are much less laborious. As recently shown by Krause (1960), application of fertilizer solutions on densely-stocked nursery beds nearly eliminates the losses of nutrients by leaching and fixation because the entire content of applied salts is intercepted by foliage and root systems. The use of fertilizer solutions permits the correction of nutrient deficiencies in soils which have not received enough fertilizers prior to seeding, or in which the supply of available nutrients has been reduced by heavy rains, unexpectedly high germination of seed, activity of micro-organisms, or inter-action with biocidic compounds.

An important advantage of fertilizer solutions, not fully utilized until recent times, is their use as foliar sprays. The ability of plants to absorb nutrients by their foliage permits the use of very minute amounts of fertilizer salts. Thus, in the treatment of vineyard soils with zinc sulfate, a foliar spray of a mere 6 grams per acre produces the same beneficial result as does an application of 30 pounds per acre to the soil (Dobroliubsky, 1956).

Aside from financial savings, this reduction in the amount of applied chemicals is of particular importance in the production of nursery stock. It permits correction of the constantly increasing deficiencies of minor elements (boron, manganese, copper, zinc, and molybdenum). The salts of these elements are applied in minute quantities because they are toxic to tree seedlings.

To summarize, using fertilizer solutions is a valuable auxiliary method of maintaining nursery soil fertility. Yet such solutions cannot entirely replace the application of fertilizers to the soil. One reason is that it is impossible to maintain the fertility of a permanent nursery soil without using peat, catch crops, lime, and the slowly soluble fertilizers of major elements, particularly the phosphates. More important is the fact that unless nursery soil has a supply of buffered nutrients which is well distributed in the root-bearing zone, the stock will fail to develop an adequate root system. In a large measure, the harmful effect of fertilizer solutions is due to their nitrogen content, which is responsible for an increased concentration of indol-acetic acid in the plant sap. At a certain concentration of this acid, the growth of the root system is arrested, whereas the growth of the crowns proceeds at an increased rate (Bosemark, 1954).

Therefore, maintenance of soil fertility by means of fertilizer solutions alone, or even indiscriminate application of liquid fertilizers, will in time lead to the production of

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inferior planting stock with unsatisfactory top-root ratio, succulent crowns, and unbalanced physiological makeup (Wilde, 1958).

During the past few years, fertilizer solutions have been replaced in some nurseries by the top dressings of solid fertilizers, spread between rows of seedlings by a seeding machine. This practice, the outcome of a general tendency to simplify the operation and reduce the cost of labor, has several serious disadvantages. Because of the fixed formulas of commercial fertilizers, a single top dressing can seldom provide the desirable ratio of nutrients. The surface application of fertilizers occasionally gives rise to a very high concentration of the infiltrating solution which causes severe burning of the surface roots of trees, especially in 1-year-old seedlings. In addition, much of the applied fertilizers may become unavailable to plants upon contact with the soil because of the chemical or biological fixation. All in all, this modification of fertilizer treatments has highly questionable merits; in unskilled hands, it is likely to deteriorate the quality of planting stock and bring considerable financial losses.

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