BIOCIDES, FERTILIZERS, AND SURVIVAL POTENTIAL OF TREE PLANTING STOCK

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During the last decade forest nursery practice has accepted wide use of organic eradicants, such as Trizone, Vapam, Mylone, Vorlex, and Dacthal. Some of these chemicals induce highly undesirable changes in morpho-anatomical and physiological properties of nursery stock. The most important of these are as follows: Abnormal stimulation of top growth; high increase in succulence of plants with subsequent reduction of specific gravity of lignified parts of seedlings; reduction of root systems, their lengths, and absorbing surface. Largely these unfavorable modifications result from a discrepancy in the nitrogen-phosphorus nutrition of plants. Organic biocides unduly increase the supply of available nitrogen by elimination of microbiotic consumers of nitrates and ammonia, and by enrichment of the root zone in proteinaceous tissues of controlled organisms (Iyer 1964). On the other hand, eradication of mycorrhiza-forming fungi greatly retards uptake of phosphorus by seedlings even when this element is abundant in the soil in so-called "available form" (Henderson and Stone 1967; Lipas 1968).

As fas as a tree planter is concerned, biocideinflicted changes are summed up in abnormally high top-root and stem-diameter ratios, well-known characteristics which predispose planted trees to damage by drought, frost, and snow press (Wilde 1958; Iyer and Wilde 1965). Restoration of the external and internal makeup of planting stock produced on biocide-treated soils is one of the most urgent problems of contemporary nursery practice.

In recent time certain improvements in the morphological balance of nursery stock have been achieved by use of generally undesirable soil amendments Aluminum sulfate, raw sawdust, and acid moss peat (Iyer et al. 1969). Paradoxically the objectionable property of these materials, their tendency to immobilize available nitrogen, proved to be among the most practical means of reducing foliar growth and of obtaining stock of acceptable top-root ratio. This study revealed an even more paradoxical relationship improvement of biocide-stimulated plants by use of growth-promoting fertilizers.

Results obtained with Mylone DMTT herbicide are reported in this paper.

Pot culture trials were conducted in a greenhouse. Subhumus horizon (Bir) of Plainfield sand was used as the growing medium and Monterey pine, *Pinus radiata,* as test plant. The quadruplicate series included untreated soils, soils treated with Mylone at a rate of 800 lbs. 50-D and 600 lbs. 85-W per acre, and similarly Mylone-treated soils with addition of 1,000 lbs./a. of 2-6-15 fertilizer, composed of 11-48 monoammonium phosphate, 20-percent superphosphate,

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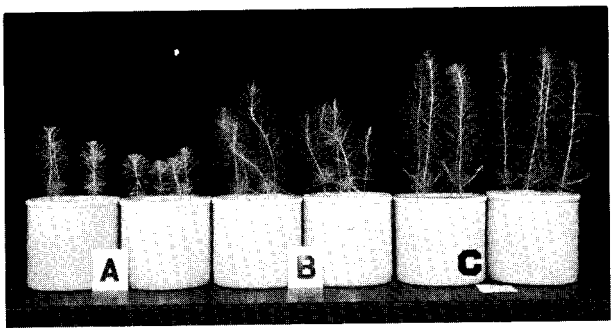

Figure 1.—Effect of fertilizers on crown structure of 1-year-old Monterey pine, *Pinus radiata,* raised on bicocide-treated soil: (A) Seedlings raised on untreated Plainfield sand; (B) highly succulent seedlings with weak, partly deformed stems raised on similar soil treated with Mylone herbicide at a rate of 800 lbs. 50-D and 600 lbs. 85-W per acre; (C) seedlings of nearly normal specific gravity of stems raised on eradicant-treated soil with addition of 1,000 lbs/a of 2-6-15 fertilizer.

and 50-percent potassium sulfate.

One gallon jars were planted to 12 seeds. Two months later, the growing stock was reduced to 4 plants. The content of moisture was maintained at field capacity of 12 percent by weight. At the age of 11 months, the cultures conspiculously demonstrated the succulence-producing effect of the eradicant and reinforcement of tissues by fertilizers (fig. 1). Seedlings were harvested and subjected to analysis following the methods described by Wilde et al. (1964).

The results (table 1) clearly show the beneficial effect of fertilizers. In spite of the high rate of fertilizer application and additional growth stimulation, seedlings attained remarkable improvement in toproot and height-diameter ratios, specific gravity, and root adsorbing surface as inferred from titration values. Beyond doubt this improvement was the result of a greater uptake of phosphorus and potassium and subsequent reestablishment of a normal nutrient ratio disrupted by an excess of nitrogen.

Regardless of its apparent paradoxicalness, use of fertilizers in forest nurseries, and probably elsewhere, must form an integral part of biocidic treatments.

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TABLE 1.—*Effect of 1,000 lbs./a. of 2-6-15 fertilizer, on morphoanatomical properties of 1-year-old Monterey pine seedlings raised on Plainfield sand treated with Mylone herbicide at a rate of 800 lbs. of 50-D and 600 lbs 85-W per acre (results per average seedling)*

Soil treatments	Height	Diameter	H:D ratio	Weight of plants	Top: root ratio	Specific gravity	Root titration
	Cm.	*Mm.*		*G.*			*ml.NaOH*
Control	14.8	1.2	12.3	0.62	1.6	0.354	0.268
Mylone	25.5	1.4	18.2	0.96	3.4	0.310	0.112
Mylone plus fertilizer	27.8	2.5	11.1	1.38	2.0	0.332	0.345