A POT CULTURE EXPERIMENT WITH UNDISTURBED FOREST SOIL

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Abstract

In order to determine the effect of certain treatments upon the soil and upon survival and growth of spruce seedlings under better conditions of control than are possible in the forest, blocks of the upper 6 inches of soil, together with the overlying A₀ layer were excavated and transferred to 2-gallon pots and to wooden squares (12 X 12 X 16 inches) and brought to the greenhouse. Treatments were applied and, in the following spring, Norway spruce was seeded. At intervals the soil in the pots was flooded with water which, after standing about 3 hours, was removed by suction and analyzed.

Two experiments were carried out. In the first, the soils were kept in the greenhouse in winter, and treatments consisted of applying different fertilizer and lime combinations. In the second, the soils were kept out of doors the year around, and treatments included burning, raking, and mixing of the A₀. In both experiments the pots were protected from rain. Water was applied when needed and any excess appearing as drainage water was caught and eventually returned to the soil. The squares were exposed to natural precipitation and leaching. After 2 years the seedlings were measured and the soil was examined and tested.

The principal effects of treatment upon the composition of the flooding water were (a) lime raised the pH, increased the conductivity and the calcium and nitrate content, and reduced the ammonia; (b) removal of the A₀ by raking definitely decreased the nitrate, ammonia, calcium, and potassium content of the water; (c) removal of the A₀ by burning raised the pH and lowered the conductivity and the ammonia content.

Soil tests and analyses showed that, in general, fertilizers and lime, separately or together, tended to increase the amount of available nutrients, total nitrogen, and organic matter, and to lower the soluble iron content. Removal of the A₀ by burning or by raking, or mixing the A₀ into the mineral soil, had a similar effect. Mixing, alone or with added nitrogen and phosphorus, caused a marked increase in nitrogen and organic matter and a narrowing of the OM:N ratio of the A₂ horizon.

Survival of the seedlings was, on the whole, poor because of losses from damping-off. There was little consistency among the several fertilizers and lime treatments in their effects upon survival. Where the A₀ was burned, mixed, or raked, the mortality was considerably lessened. Growth was favored somewhat by phosphorus but was definitely handicapped by raking, mixing, or burning of the A₀.

The principal points of interest brought out in this work are (a) the high mortality of seedlings where the normal duff cover is present, and the relatively low mortality where the duff is removed or burned or turned under; (b) the generally favorable effect of phosphorus, alone or with nitrogen, upon growth; (c) the increase in available plant nutrients and in total nitrogen in the soil resulting from the various treatments; (d) the tendency toward a narrowing of the OM:N ratio of the A₂ as the result of burning, raking, or mixing of the A₀.

It is believed that this method of studying the effect of certain treatments upon forest soil has considerable merit. Better results are obtained where the cultures are kept out-of-doors or in a well-ventilated, unheated greenhouse the year around than where they are put in a heated greenhouse in winter. Inasmuch as natural soil variability is not eliminated in this type of experiment, it is advisable to use at least three replications for every treatment.