CORRECTION OF HUMUS DEFICIENCY IN NURSERY SOILS BY DIRECT APPLICATION OF ALDER SAWDUST [1]

The growth-depressing effect of the high C/N ratio of red alder sawdust was eliminated by simultaneous addition of urea and **Coprinus ephemerus** inoculum.

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A critically important problem frequently encountered in the production of tree planting stock is the maintenance of organic matter in nursery soils. Outside sources of organic matter are seldom readily available or effective without preliminary nutrient additions and subsequent fermentation. In consequence, the present search aims to discover a material which, in combination with a simple treatment, would rapidly reduce its harmful C/N ratio and permit its direct application to nursery soils. The authors surmised that sawdust of alder, a nitrogen-fixing species, may possess properties answering the requirements of nursery soils. They conducted trials under greenhouse conditions using finely ground sawdust of red alder, Alnus rubra Bong.

The growing medium consisted of Plainfield sand, a dominantly quartzitic soil with a small admixture of silicate minerals. Quad ruplicate treatments in ½-gallon glazed jars were established in early December of 1977. The design of the trial was as follows:

1. Control; untreated Plainfield sand;
2. Untreated Plainfield sand plus 100 cubic yards per acre of sawdust;
3. Untreated Plainfield sand plus 100 cubic yards per acre of sawdust; plus 250 lbs per acre of urea;
4. Untreated Plainfield sand plus 100 cubic yards per acre of sawdust; plus 250 lbs per acre of urea; plus 2 cubic yards per acre of non-calcareous paper mill sludge containing Coprinus ephemerus;
5. Untreated Plainfield sand plus 100 cubic yards per acre of sawdust; plus 250 lbs per acre of urea; plus 2 cubic yards per acre of manure-enriched soil containing Coprinus ephemerus.

The paper mill inoculum was obtained by treatment of air-dry sludge with anhydrous ammonia and phosphoric acid and subsequent inoculation of the mash

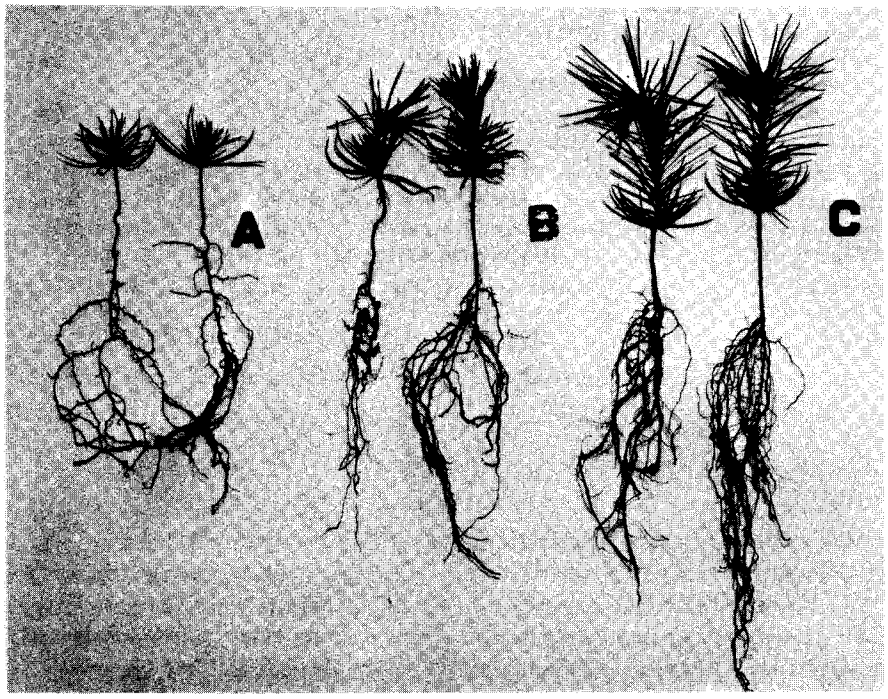

Figure 1.—*Average 6-month-old ponderosa pine seedlings raised in Plainfield sand treated with red alder sawdust: A, sand plus 100 cu. yds/acre of sawdust; B, sand plus 100 cu. yds/acre of sawdust plus 250 lbs/acre of urea; C, same as B plus 2 cu. yds/acre of* Coprinus ephemerus inoculum.

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Table 1.—*Effect of red alder sawdust supplemented with urea and inoculum of Coprinus ephemerus on the growth of 6-month-old ponderosa pine seedlings*

Soil treatments per acre	Average Weight			Root-top ratio
	Seedling	Roots	Tops	
	----------	----------	grams ----------	----------
1. Control; untreated Plainfield sand	0.26	0.09	0.17	0.53
2. Treatment 1 plus 100 cu. yds of sawdust	0.14	0.06	0.08	0.73
3. Treatment 2 plus 250 lbs. urea	0.32	0.10	0.22	0.45
4. Treatment 3 plus 2 cu. yds of Coprinus sludge	0.57	0.19	0.38	0.50
5. Treatment 3 plus 2 cu. yds of Coprinus in manured soil	0.53	0.17	0.36	0.47

with *Coprinus ephemerus*; (*4*); the manured soil inoculum was autochthonously inoculated with Coprinus ephemerus. Coprinus, ephemerus, or, inky caps, is a widely distributed mushroom, found usually in farmyard manure and near decaying stumps of hardwood trees. It possesses a very high capacity for decomposition of cellulose and was successfully used in preparation of a highly effective fertilizer from fresh sawdust treated with anhydrous ammonia and phosphoric acid (*2, 4*).

The cultures were sown to ponderosa pine, using 14 seeds per container. With a few exceptions, the germination and survival of seedlings exceeded 80 percent. Ten weeks after seeding, the growing stock was reduced to 10 plants per jar. The trial was discontinued in the middle of July 1978. The average weights of 6-month-old seedlings are given in table 1 and illustrated by figure 1. The near identity of results obtained with two kinds of inocula indicates the possibility of a very desirable simplification of the procedure.

The study was supplemented by determination of the catalytic potential of roots of seedlings not exceeding 2 mm in diameter (*3*). The roots of trees raised in urea-treated and inoculated soils effected the highest potential of 31 mm Hg/g, disclosing a high supply of enzymatic substances produced in part by mycorrhiza-forming fungi (fig. 2); the roots of trees raised in soils with untreated sawdust produced an extremely low potential of only 4 mm Hg/g, indicating suppression of mycotrophic symbionts.

The trial performed suggested that the supply of organic matter in nursery soils may be safely increased by direct application of finely ground alder sawdust in combination with urea and inoculum of *Coprinus ephemerus* cultivated in either paper mill sludge or manure-enriched soil. The treatment promises to overcome the growth-depressing effect inflicted by under composed sawdust of a high C/N ratio (*2*), as well as damage by rotted, sour sawdust containing an excess of acetic acid (*1*).

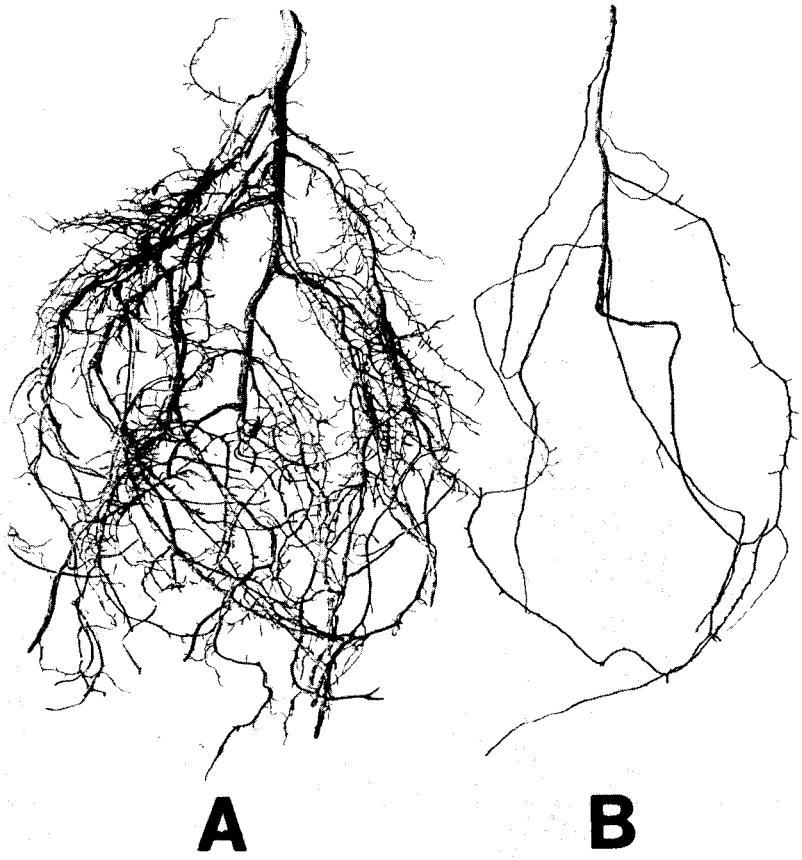

Figure 2.—*Reproduction of roots of 8-month-old ponderosa pine seedings: A, Average root of seedlings raised in soils treated with red alder sawdust supplemented with urea and* Coprinus inoculum; *B, average root of seedlings raised in soils treated with sawdust alone.*

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