# TREE BARK AS A SOURCE OF ORGANIC MATTER IN NURSERY SOILS[1]

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Results of greenhouse trials have indicated that ground bark of ponderosa pine and Douglas-fir, applied together with urea and inoculum of *Coprinus ephemerus,* increases organic matter of nursery soils.

Greenhouse trials were conducted in the hope that bark of old coniferous trees could serve as a source of organic matter for amelioration of nursery soils. Previous studies have indicated that the bark of southern pines is a suitable medium for tests of fusiform rust resistance (*2*) and for the production of pine seedlings with abundant ectomycorrhizae (*3*). The latter study also suggests that ground bark can be utilized in the production of containerized planting stock. Recent experiences in the use of sawdust have suggested that a reduction of the high C/N ratio of raw wood materials can be achieved without complicated anhydrous ammonia and phosphoric acid treatments (*1*).

The bark of ponderosa pine and Douglas-fir was obtained from timber-si4e logs. About 2-foot-long pieces of the bark were broken by hand into 6- to 8-inch fragments and ground in a hammermill, a Prater Pulverizer, size G6C with a ¾-inch screen. If desired, ground material of almost any size can be produced by the use of a screen of different mesh.

The trial was initiated in October 1978. It was conducted in triplicate. The test plant, ponderosa pine, was raised from seed in 1-gallon glazed pots containing the A-1 horizon of Plainfield sand developed on largely quartzitic outwash. All cultures were planted with 15 seeds, and 6 weeks after seeding the growing stock was reduced to 10 trees. The trial included the following cultures:

1-3: Sand with 60 cubic yards per acre of ponderosa pine bark; 4-6: As 1-3 plus 180 pounds per acre of urea; 7-9: As 4-6 plus 2 cubic yards per acre of *Coprinus ephemerus* inoculum in manure-enriched soil (*1*). All ingredients were thoroughly mixed with the soil.

Similar cultures (10-18) were established simultaneously using the Douglas-fir bark. Control cultures (19-21) included untreated sand and (22-24) the sand treated with 180 pounds per acre of urea.

Germination of the seed exceeded 70 percent, and no loss of seedlings took place after thinning the growing stock to 10 trees per jar. The soils were kept at an approximate moisture content of 8 percent by weight. During the period of early December until late February, natural light was supplemented by incandescent illumination for 4 hours per day. The trees were harvested on June 15, 1979. The air-dry weights of roots and tops of 8-month-old seedlings and catalytic potentials (Cp) of feeding rootlets, determined according to Wilde et al. (*4*), are given in table 1. Figure 1 illustrates the morphology of seedlings produced with addition of ponderosa pine bark.

### Conclusions

The results of this trial indicate that the supply of organic matter in nursery soils can be augmented beneficially by application of the bark of ponderosa pine in combination with urea and inoculum of *Coprinus ephemerus,* the inky caps. The ratio of ingredients that proved satisfactory in this trial was: 1 cubic yard of the bark, 3 pounds of urea, and about 1 cubic foot of inoculum. In application of the bark at a rate of 60 cubic yards per acre, the expected enrichment of the 6-inch surface soil layer in organic matter approaches 0.5 percent.

The growth of test plants as well as the values of the catalytic potential of feeding rootlets suggest that the bark of Douglas-fir possesses less favorable soil-ameliorating properties in comparison with the bark of ponderosa pine. This may be associated with the high content of tannin and alkaloids present in the Douglas-fir bark.

Seedlings raised in untreated soils exhibited roots more than

[1] Research was supported by the College of Agricultural and Life Sciences, University of Wisconsin, Madison, and the Wisconsin Department of Natural Resources.

**Table 1.—***Effect of ponderosa pine and Douglas-fir ground bark on the growth of 8-month-old ponderosa pine seedlings and the catalytic potential of feeding roots*

| Treatments | Total plants | Roots | Tops | R/T ratio | Cp |
|---|---|---|---|---|---|
| | *. . . . . . . . . . .* | *grams* | *. . . . . . . . . . .* | | *mm Hg/g* |
| Ponderosa pine bark alone | 0.65 | 0.33 | 0.32 | 1.0 | 16 |
| Pine bark plus urea | 1.24 | 0.62 | 0.62 | 1.0 | 23 |
| Pine bark plus urea plus inoculum | 1.98 | 0.86 | 1.12 | 0.8 | 28 |
| Douglas-fir bark alone | 0.70 | 0.38 | 0.32 | 1.2 | 10 |
| Fir bark plus urea | 0.90 | 0.48 | 0.42 | 1.1 | 16 |
| Fir bark plus urea plus inoculum | 1.52 | 0.80 | 0.72 | 1.1 | 16 |
| Control, untreated soil | 0.82 | 0.41 | 0.41 | 1.0 | 24 |
| Control plus urea | 2.30 | 0.73 | 1.57 | 0.5 | 57 |

[1]The bark and other amendments were applied on a per acre basis at a rate of 60 cubic yards-alone, with 180 pounds of urea, and with 180 pounds of urea and 2 cubic yards of *Coprinas ephemerus* inoculum. Results obtained with air-dry tissues and reported per average seedling or per gram of rootlets.

twice as long as the seedlings raised in soils treated with the bark. With the exception of the control soil treated with urea, all trees exhibited a very well-balanced R/T ratio in the proximity of 1.0 on a weight basis.

The enrichment of the control soil in urea revealed a significant relationship: In the absence of toxic substances and wood material of a high C/N ratio, the production of enzymatic substances by feeding rootlets and corresponding catalytic potentials are directly related to the supply of available nitrogen. This, undoubtedly, is a consequence of an increased volume of the tree foliage, exposed under greenhouse conditions to direct light, and the subsequently augmented production of carbohydrates. This relationship was conspicuously reflected in an exceptionally high production of mycorrhizal short roots. On the other hand, the excess of available nitrogen, present in this trial, produced seedlings with an extremely low R/T ratio of only 0.5. In turn, this trial stresses the need for a rigorously controlled use of nitrogen fertilizers. An insufficient amount of nitrogen reduces the feeding power of trees, whereas an excessive quantity produces inferior planting stock.

## Literature Cited


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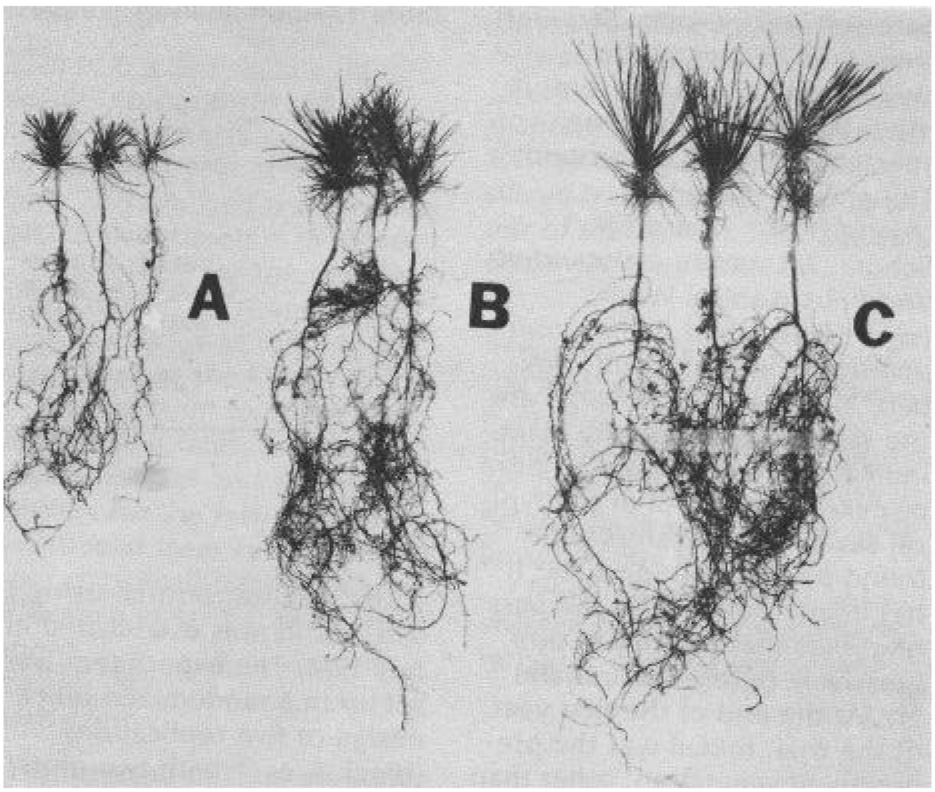


**Figure 1.—***Effect of the ground ponderosa pine bark on the growth of 8-month-old ponderosa pine seedlings. The bark was applied on a per acre basis at a rate of 60 cubic yards either alone (A), or with 180 pounds of urea (B), or with urea and 2 cubic yards of* Coprinus ephemerus inoculum *(C). Note the relative abundance of feeder rootlets and mycorrhizal short roots.*