

**Table 9 — Theoretical amount of supplemental nitrogen required when 1 ton of organic amendment is incorporated into the soil**

Amendment	Supplemental nitrogen required <i>Pounds per acre</i>
Bark	<sup>1,2</sup> 10-20
Sawdust	<sup>1,2</sup> 10-20
Chips	10-20
Flyash	0
Sludge:	
Paper mill	0
Mint	0
Sewage	0
Leaves	10
Alfalfa or other legumes	0
Straw	<sup>3</sup> 25
Peat	0
Hop waste	0
Manure	0

<sup>1</sup> For more precise calculations, use the information in table 11 and appendix A.

<sup>2</sup> Bollen (1969).

<sup>3</sup> Allison (1973). Extra N promotes more rapid decomposition in spite of a lower carbon-to-nitrogen ratio.

<sup>4</sup> Most clean manures not mixed with sawdust or other material.

Organic material can be incorporated using many types of equipment, such as rototiller, disk, or plow. Disking is preferred because it ensures optimal mixing while leaving some organic matter on the surface of the soil.

Incorporated organic materials may need additions of supplemental nitrogen; some general recommendations are given in Table 9. If a nursery manager is considering whether to incorporate material other than sawdust or bark, he or she should get a chemical analysis of the material. Along with cumulative properties, the manager should look at the concentrations of certain elements and give particular attention to pH and electrical conductivity. Standards have not been developed to guide the nursery manager, but some suggestions can be made. Generally, analyses should include determining the concentrations of lead, zinc, copper, nickel, and cadmium if evaluating the use of sewage sludge. Organic byproducts should be tested for pH and the usual elements (phosphorus, potassium, calcium, magnesium, and total nitrogen) and be analyzed for sodium, electrical conductivity, and cation exchange capacity. If, for some reason, the pH of the material being evaluated is less than 4.0 or greater than 8.0 or the electrical conductivity is greater than 4 millimhos per centimeter, the manager should seek assistance from a technical pool such as the soil science department at a nearby university.

Hausenbuiller (1978) has provided a generality relative to the amount of metal accumulation allowable; his generality provides a small degree of guidance. For each milliequivalent of cation exchange capacity, no more than the following amounts should be allowed to accumulate: lead 89.2 pounds per acre, zinc 44.6, copper 22.3, nickel 8.92, and cadmium 0.89.

Any material to be applied should be incorporated into the upper 10 inches of soil at least 4 months before conifer seedlings are planted. Preferably, the material should be applied before the cover crop. If analysis of the incorporated material indicates the presence of undesirable properties, a cover crop should be selected on the basis of its ability to absorb or reduce those undesirable properties. Leaching through the use of irrigation systems is also a management tool that can be used to ameliorate undesirable properties.