

Soil Fumigation Effects on Seedling Nutrition

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Soil fumigation with Vapam or Trizone at the New York State Nurseries has given excellent control of weeds and other soil pests and has resulted in larger seedlings. As these materials became used on a routine basis, nutrient deficiencies began to appear in seedlings, especially white spruce and red pine. Nutrient deficient seedlings are stunted and often dead after the first winter. The deficiency was tentatively identified by Stone as phosphorus. The phosphorus deficiency resulted from the destruction of mycorrhizae fungi by the fumigants. The work of Henderson on sample plots established with various fumigants and tree species demonstrated that the deficiency could be overcome by heavy applications of superphosphorus.

The following statements sum up the discussions:

1. Fumigants can kill mycorrhizal fungi needed by tree seedlings to pick up phosphorus.
2. The better the fumigation and the more sandy the soil, the more likely you are to have this problem.
3. Plants show a characteristic purple color developed by mid-July, but most noticeable in August or after shade is removed from spruce. The color intensity is increased to a purple bronze color by late fall. Plants are also stunted because they fail to make the late summer growth characteristic of first year seedlings.
4. Mycorrhizal fungi are usually reestablished by late summer of the first year or spring of the second year.

5. The problem is not cumulative.
6. Soil tests for phosphorus will not reveal the cause of the deficiency. Phosphorus may be present in amounts necessary for satisfactory growth of other kinds of plants but not conifers.
7. Tissue tests will show low phosphorus after exhaustion of seed phosphorus in about 20 days after germination. Normal tissue will show an increase in phosphorus content.
8. The deficiency may be prevented by inoculation of the soil with mycorrhizal fungi after fumigation, however no large scale method to accomplish this has been developed.
9. The deficiency is easily prevented when superphosphate, 20% or 46% is banded below the seed by the seed sowing machine.
10. A machine to sow seed and fertilizer was designed and built by the Saratoga Nursery. This seeder has been successfully used for 3 years.
11. Soil fumigation has been observed to cause sandy soils to settle to a smaller volume than unfumigated. The explanation offered is that fungal hyphae which tend to hold the soil aggregated are destroyed by the fumigant.
12. The use of soluble phosphates to correct the deficiency has not been investigated. It is believed that these are often rather rapidly fixed in insoluble form in acid soils.