PINE SEEDLING PRODUCTION AND PEST MANAGEMENT IN METHYL BROMIDE FUMIGATED AND NONFUMIGATED NURSERY SOIL[1]

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A study is being undertaken to determine the effect of soil fumigation on pine seedling production, and to evaluate the development and severity of pest problems in fumigated and nonfumigated soil. Research plots were established in two compartments of the Flint River Nursery (Byromville, GA) operated by the Georgia Forestry Commission. One compartment, which will be referred to as 'problematic', was removed from operational seedling production in the early 1990's because pests apparently reduced pine seedling production and quality. In March of 1995, 8 plots were established: 4 plots were fumigated with methyl bromide; the other 4 were not fumigated. Three plots of each treatment were sown with loblolly pine (*Pinus taeda* L.) seeds; one plot of each treatment with slash pine (*Pinus elliottii* Engel. *elliottii*) seeds. The study was repeated in 1996 and the number of plots was increased to 12: 6 plots were fumigated with methyl bromide in March of 1996; the other 6 were not fumigated. Three plots of each treatment were sown with loblolly pine seeds and 3 of each treatment with slash pine.

Study plots were also established in a 4-ha operational compartment. Six plots were established: 3 were fumigated with methyl bromide in March of 1995 and 3 were not fumigated. The entire field was sown with loblolly pine seeds in 1995 and again in 1996. The fumigated plots were not fumigated again prior to sowing seeds in 1996.

Three permanent subplots were established on the center seedbed of all plots in both compartments to periodically evaluate seedling densities and mortality. Seedlings were counted and evaluated weekly during the first two months after sowing and thereafter monthly. Samples of dead and dying seedlings were collected, examined and plated on various agar media to determine fungal associations. Soil samples were collected monthly for nematode evaluations. Nematodes were extracted using the centrifugal-flotation technique. Fungal associations with roots were assessed at mid-season and evaluated again at the time of lifting.

Seedling densities for loblolly pine did not differ between fumigated and nonfumigated plots in the operational compartment in 1995 or 1996. Differences in seedling quality were not observed between treatments in this compartment in 1995, and no differences were observed during mid-season assessments in 1996.

In the problematic compartment, seedling densities for slash and loblolly pine seedlings have been consistently lower in the nonfumigated plots compared to the fumigated plots during 1996, but no differences were observed between treatments for loblolly pine in 1995. However, the quality of loblolly pine seedlings was significantly less in nonfumigated soil compared to fumigated in 1995. Seedlings produced in fumigated soil in this compartment had greater root collar diameters, heights, and root and top weights as compared to those produced in nonfumigated soil.

Ring nematodes (*Mesocriconema* spp.) have been the predominant nematodes extracted from soil. Monthly population levels of ring nematodes were consistently greater in nonfumigated soil than in fumigated soil in 1995. Average counts in nonfumigated soil were approximately 25 ring nematodes per 100cc of soil; in fumigated plots the average was 1.5 nematodes. In 1996, ring nematodes have not been recovered from fumigated soil, but monthly population levels have ranged from 16-70 nematodes per 100cc of soil in nonfumigated soil.

In both compartments, *Fusarium* spp. and *Pythium* spp. have been consistently isolated with greater frequency from the roots of seedlings produced in nonfumigated soil compared to those produced in fumigated soil. In contrast, *Trichoderma* species have been consistently isolated with greater frequency from the roots of seedlings grown in fumigated soil compared to those produced in nonfumigated soil.

Nutsedge (*Cyperus* spp.) has emerged as a major pest problem in nonfumigated plots, particularly in the problematic compartment. Reflex® was applied to all plots in both years, but in the present study this herbicide has not been effective for nutsedge control.

Low-level seedling mortality was observed in nonfumigated plots during the summer of 1995. Although *Fusarium* spp. and a Rhizoctonia-like fungus were isolated from roots of dead and dying seedlings, it is not clear whether they caused the disease. This phenomenon did not reoccur during the summer of 1996.

Based on these results, we believe that fumigation may not have been necessary in the operational field in 1995 for production of quality seedlings and control of pests. In contrast, nutsedge, and perhaps nematodes and pathogenic fungi, have been major obstacles to seedling production in nonfumigated plots in the problematic compartment. Currently, fumigation appears to be the most efficient pest management practice available for sections of a nursery where pests will have an adverse effect on seedling production. A better understanding of soilborne nursery problems and their impact on seedling production is needed to develop predictive indicators that will enable nursery managers to determine when fumigation is necessary for seedling production.

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