CULTURAL & BIOLOGICAL ALTERNATIVES TO METHYL BROMIDE IN SOUTHERN PINE SEEDLING PRODUCTION

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It is unlikely that the annual production of billions of pine seedlings would have been possible without methyl bromide (m.b.). Initially, the product appeared to be a panacea since it was, and still is, probably the most effective single pre-emergent herbicide and soil fumigant available. Realistically, however, the primary initial use for methyl bromide was for its pre-emergent herbicidical effects more than for its ability to control potentially destructive soil-borne organisms. Many herbicides are now available for use with pines but still, it is considered an essential tool for maintaining pine seedling production even in the absence of known soil-borne pathogens. What is the underlying reason for continued reliance upon methyl bromide? We believe its effectiveness has been masking a soils related problem resulting from successive crops of pine and this led to a quasi-dependency upon it to maintain nursery productivity.

Regardless of the nursery management protocol, the initial seedling crop following methyl bromide fumigation will be the best. Generally, there is a significant but acceptable, reduction in seedling quality in the second crop. This reduction does not appear to be affected by geographic location, soil type or nursery fertility protocol. After the second seedling crop quality becomes unacceptable with a significant increase in culls and substandard seedling sizes. A cover crop of sorghum or sudex followed by fumigation before the pine crop restores seedling productivity.

It appears that some biological or chemical process is occurring in the nursery soil under successive non fumigated loblolly seedling crops that produces adverse effects. The underlying biological or chemical processes are unknown and we don't know why traditional agronomic cover crops do not eliminate it without methyl bromide fumigation. For several years, however, we have observed that loblolly pine seedlings develop better after a hardwood cover crop than after a sudex cover crop. We have been cropping the same nursery beds for five years or more without soil fumigation or depression of seedling development by alternating pine and hardwood crops.

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In 1993, in a cooperative effort with the Georgia Forestry Commission (GFC), nineteen different hardwood species were grown as a cover crop sequence, comparing them to the traditional sudex cover crop used at the Flint Nursery. By August 1994, those loblolly pine seedling that followed the hardwood cover crops were greener and had larger needles. When the seedlings were lifted in early November, even though seedling sizes were comparable in both fields, those from the hardwood cover crops were heavier than those from the sudex crop. (Table 1)

Currently, we are testing five different cropping sequences at the GFC's Flint Nursery complex. Twenty-five different hardwood species all appear to be very good crops, and in the absence of known potential destructive soil-borne organisms, may reduce the need for soil fumigation. Effective herbicides are readily available for use in pine seedling production. These results should provide an impetus for further research into the cause of growth depression in successive loblolly pine crops while the use of methyl bromide is still permitted.

Table 1. Loblolly pine 1-0 seedling morphological and growth data following different cover crops. Control cover crop is sudex. Seedlings from all treatments were lifted on November 7, 1994.

Cover crop	FOLR#	Ht cm	RCD mm	Top FW g	Root FW g	T/R Ratio
Sawtooth oak	5	30.3	4.1	11.2	1.5	8:1
White oak	4	26.7	4.0	10.0	1.4	7:1
Water oak	5	26.6	4.0	8.3	1.1	8:1
Chestnut oak	4	26.7	3.8	8.3	1.1	8:1
Live oak	5	28.8	4.0	10.7	1.4	8:1
Swamp chestnut oak	3	24.3	3.4	5.6	0.9	6:1
Northern red oak	4	25.8	3.6	7.7	1.2	7:1
Crabapple	5	26.1	4.0	8.3	1.2	7:1
Persimmon	5	28.9	4.0	9.4	1.1	8:1
Yellow poplar	3	28.8	3.7	8.7	1.2	8:1
Crepe myrtle	4	27.5	3.7	8.6	1.1	8:1
Sweetgum	4	25.9	3.6	8.0	1.3	6:1
Sycamore	4	25.1	3.7	7.5	1.2	6:1
Catalpa	4	25.6	3.7	7.6	1.1	7:1
Redbud	4	26.4	3.8	8.3	1.2	7:1
Swamp tupelo	5	28.3	4.2	10.3	1.8	6:1
Water tupelo	6	26.8	4.2	8.6	1.7	5:1
Green ash	4	22.8	3.4	6.3	1.1	6:1
Water hickory	5	26.2	3.8	8.9	1.7	5:1
Control 11/7/94	4	25.4	3.7	7.0	1.1	6:1