Auburn University
Southern Forest
Nursery Management
Cooperative

RESEARCH REPORT 01-3

THE AFFECTS OF ALTERNATIVE FUMIGANTS, AND EPTC ON THE PRODUCTION OF LIVE OAK AND SHUMARD OAK AT THE INDIAN MOUND NURSERY

by
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INTRODUCTION

In the South, most trials evaluating replacements for Methyl Bromide (MBr) since 1993 have assessed their affects on the production of pine seedlings. Although no fumigant has been as effective as MBr for all its uses, various combinations of fumigants have effectively increased the production of pine seedlings and improved weed control across a range of soil types, at least in the short term. Similar research is needed for the species of hardwoods produced in the South. This trial was carried out on two species of oak at the Indian Mound Nursery near Alto, TX to evaluate fumigants and application techniques that have been most effective for pine seedlings.

These treatment combinations were tested concurrently at the Westvaco Nursery near Summerville, SC for sweetgum seedlings (See Research Report 01- 2).

METHODOLOGY

Live Oak (*Quercus virginiana* Mill*)* and Shumard Oak (*Q. shumardii* Buckley) seedling growth were compared among plots that were not fumigated and plots that received one of four fumigation treatments at the Indian Mound Nursery near Alto, TX during the 2000/2001 season. Treatments were applied to not bedded ground through a complete riser-line section (58 ft wide) in which nine 400 foot long beds would be sown. Before application, the area was divided into three, 3-bed-wide blocks which were each subdivided into five 3-bed-wide main plots to which fumigation treatments were randomly assigned. This produced a randomized complete block with five treatments. Just before fumigants were applied on November 12, 1999, EPTC was applied to one complete bed in block one and to one bed in block two by spraying 6 lb ai/ac on the soil surface and rotovating to a depth of six inches. No EPTC was applied in block 3 (due to mis-communication) so the design was

not balanced with respect to this treatment.

The four fumigation treatments (lbs/ac) and the application methods are as follows: 1) a standard practice control of 343 lbs of MBr plus 7 lbs of chloropicrin (350 lbs MC2) shank injected and tarped, 2) 500 lbs of Metham Sodium sprayed on the surface and rotovated in plus 200 lbs of shank injected chloropicrin (CMS) not tarped, 3) 250 lbs of chloropicrin alone shank injected and not tarped, and 4) a coded compound (MBR-300) plus 200 lbs of chloropicrin shank injected and tarped.

Live oak acorns were a wild collection from Louisiana and shumard acorns were a wild collection from Arkansas. Both species were sown across the study area within a few days beginning on November 23, 1999. Two drills of shumard and two drills of live oak were sown per bed so that each 4ft^2 sample plot contained a 2 ft^2 plot for each oak species. All post fumigation seedling culture was carried out by Texas Forest Service management using the schedule for the rest of their oak crop. Treatment affects were assessed on October 30, 2000 by harvesting all above ground biomass within a 4 ft^2 area in each fumigation plot of a not EPTC treated bed in each block and in each plot of an EPTC treated bed in blocks 1 and 2. In Auburn, stems were counted, leaves removed, rcd's measured and stems oven dried and weighed.

Although the weed control aspects of fumigation are presently even more important for hardwood than for pine production the current study did not evaluate treatment affects on weeds. The study area was managed for seedling production and therefore regularly hand weeded, but these efforts were not assessed with respect to our treatments.

RESULTS AND DISCUSSION

Seedling numbers, and stem mass per seedling and per 2ft^2 plot are presented by fumigation and by EPTC in Table 1. Among measured variables, the mass of live oak mass per plot was greater among chloropicrin than MBR-300 treatments. This was the only difference among fumigation treatments; no fumigation treatment differed from control. There were more live oak seedlings in plots not treated with EPTC but these were smaller so that mass per plot did not differ. Since seedbed densities of oaks were more variable than would be expected for pine (due in part to variability associated with wild collections and in part to sowing difficulties) and since live oak mass /ft^2, was inversely related to seedbed density (gms/ft^2 = 3/4 - 0.18 stems/ft, r^2 = 0.48) the larger seedlings among EPTC treated plots seems to be due to their being fewer seedlings per plot as a function of random variability associated with sowing. Figure 1 presents mass per plot for all treatment plots for both oak species. The correlation between seedbed density and seedling mass was significant across all plots and for both species combined (gms/stem = 5.9 - 0.4 stems/plot, r^2 0.36).

Similar studies with pines have indicated that effective fumigation enhances seedling development. That is, fumigated plots usually produce more pine biomass than not fumigated plots. However, oak biomass was not increased in Texas and sweetgum mass was not increased in South Carolina for any treatment compared to not fumigated plots. The lack of difference in Table 1, appear valid (not unusually likely to be type II error) despite large variability in seedbed densities among plots. The probable source of variability both among and within treatments is due to the variability associated with wild collections of acorns. The significant correlations between seedbed density and mean seedling mass across fumigation treatments (Figure 1) indicates those treatments had little affect on the relationship between density and seedling mass.

Table 1. Oak seedling development by species, fumigant, and EPTC at the Indian Mound Nursery in 2000.

Fumigant†	Live Oak n	Live Oak Density #/2 ft²	Live Oak Above Ground Mass/2 ft²(g)	Live Oak Dry Wt. g/stem	Shumard Oak n	Shumard Oak Density #/2 ft²	Shumard Oak Above Ground Mass/2 ft²(g)	Shumard Oak Dry Wt. g/stem
MC2	5	7.1	15.9 ab	6.7	4	6.5	23.1	3.5
CMS	5	7.0	12.5 ab	7.2	4	6.6	18.0	2.8
MBR-300	5	6.5	11.4 b	7.9	4	5.8	16.8	4.3
Chloropicrin	4	8.6	18.0 a	7.2	4	7.1	27.1	4.2
None	5	6.9	15.7 ab	7.8	4	4.5	19.5	4.1
lsd		*3.9*	*5.4*	*1.9*		*4.0*	*12.5*	*3.3*
EPTC*								
Yes	15	5.1 a	13.6	3.6 a	15	6.6	26.3	4.4
No	9	8.4 b	15.2	.9 b	5	5.9	19.1	3.6
lsd		*2.5*	*3.5*	*1.7*		*2.9*	*9.1*	*2.4*

† MC2 at 350 lbs/ac tarped, MBR-300 at 400 lbs/ac tarped, CMS is 200 lbs chloropicrin plus 200 lbs metham sodium not tarped. Chloropicrin at 200 lbs/ac not tarped.

* EPTC at 6 lbs ai/ac rotovated through 6" of soil.

MANAGEMENT IMPLICATIONS

These results indicate that fumigation does not provide the positive growth response in Live and Shumard Oaks that has been documented previously for pine. Nursery Managers must be careful about assuming fumigation is not needed based on one study.

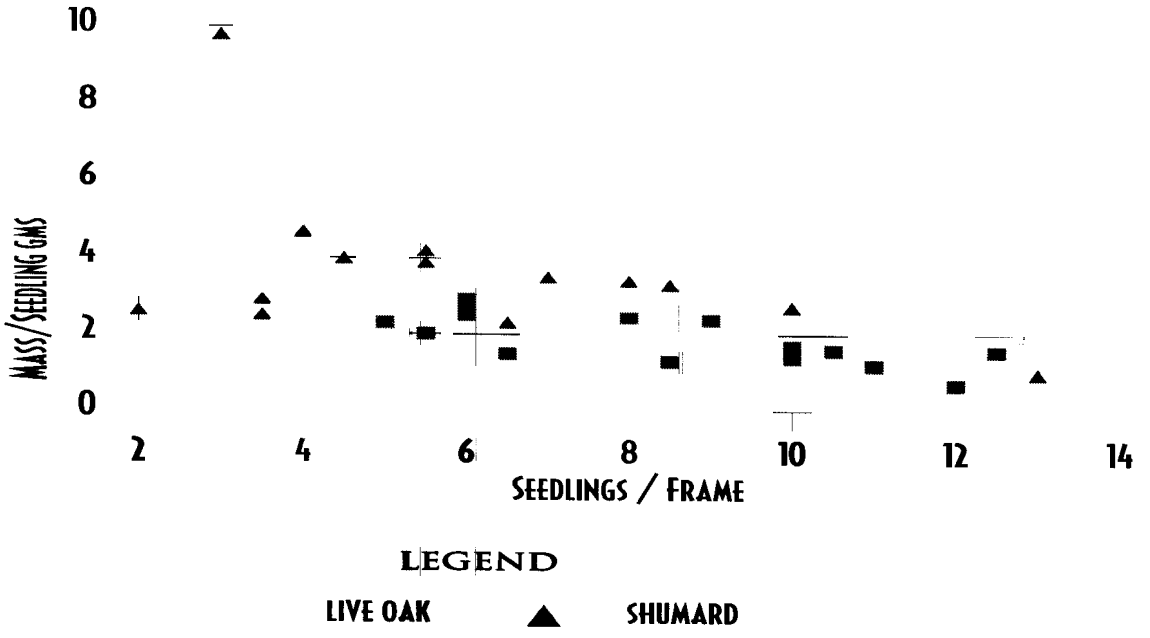

Figure 1. Seedling mass by seedbed density for live oak and shumard oak across fumigation treatments in non-EPTC treated beds at the Indian Mound Nursery for the 2000 - 2001 crop.

ACKNOWLEDGMENTS

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