BARE FALLOW AND MULCH TREATMENTS FOR PRODUCTION OF CONIFER SEEDLINGS WITHOUT CHEMICAL FUMIGATION IN CALIFORNIA, IDAHO, OREGON, AND WASHINGTON

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Studies are in progress at 8 bareroot forest tree nurseries to evaluate cultural alternatives to chemical fumigation for production of conifer seedlings. For these studies, nurseries are growing Shasta red fir (Abies magnifica var. shastensis Lemm.), Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco.), ponderosa pine (Pinus ponderosa Laws.), or lodgepole pine (Pinus contorta var. latifolia Engelm.). Pre-plant soil treatments were applied beginning in spring 1993, in randomized blocks with 4 or 5 replicates at each nursery. Each nursery applied bare fallow with or without a variety of amendments and mulches. Sowing of conifer seed began in November 1993 in California and finished in June 1994 in Washington. Treatments are being compared for effects on population levels of soil-borne pathogens, weed infestation, and seedling emergence, density, mortality, and quality.

As of midseason (July or August 1994), chemical fumigation with dazomet (350 lb/acre) or methyl bromide/chloropicrin (67/33 at 350 lb/acre) did not result in higher seedling densities than many bare fallow treatments. Bare fallow treatment consisted of maintaining the soil without vegetation for several months by periodic tilling or by use of herbicide or hand weeding. When weeds were allowed to grow instead of maintaining bare fallow, the effect was similar to that of a cover crop.

Results of laboratory assay for population levels of soil-borne pathogens (Fusarium spp. and Pythium spp) tended to be the lowest with chemical fumigation and the highest with cover crop alone. The highest levels of seedling mortality and lowest densities occurred in plots with the highest pathogen populations. Low and moderate pathogen levels did not consistently correspond to levels of seedling mortality.

Weeds tended to be fewer after chemical fumigation, and some bare fallow treatments had weed levels comparable to fumigated treatments. High levels of weeds were associated with cover crops, fallow treatments where uncontrolled weeds acted as a cover crop, and some mulches apparently contaminated with weed seed.

At Humboldt Nursery, McKinleyville, California, no apparent differences in seedling density of Shasta red fir resulted from five treatments, including dazomet and methyl bromide. See Table 1.

At Placerville Nursery, Placerville, California, 6 treatments resulted in similar seedling densities of Shasta red fir. The seventh treatment, conventional mid-April sowing with soil covering the seed, resulted in apparently lower seedling density. See Table 2.

At Magalia Nursery, Magalia, California, many differences were apparent between the six treatments. Highest seedling densities of Shasta red fir apparently resulted from solar heating (covering moist soil with clear polyethylene sheeting for several weeks in summer) followed by shallow fall sowing and sawdust mulch. See Table 3.

At Coeur d'Alene Nursery, Coeur d'Alene, Idaho, no significant differences in seedling density of Douglas-fir resulted from five treatments, including dazomet. See Table 4.

At Lucky Peak Nursery, Boise, Idaho, no significant differences in seedling density of ponderosa and lodgepole pines resulted from five treatments, including methyl bromide. See Table 5.

At J. Herbert Stone nursery, Medford, Oregon, no significant difference in seedling density of Douglas-fir and ponderosa pine resulted from five treatments, including dazomet. See Table 6.

At Bend Pine Nursery, Bend, Oregon, density of ponderosa pine was significantly lower in one of five treatments: pea cover crop alone. This treatment also suffered significant mortality due to disease. Other treatments, including methyl bromide, resulted in no significant difference. See Table 7.

At Wind River Nursery, Carson, Washington, no significant differences in seedling density of Douglas-fir seedlings resulted from five treatments, including methyl bromide. See Table 8.

These preliminary results suggest that cultural alternatives, including bare fallowing, are viable alternatives to chemical fumigation. These studies continue, and seedling survival and growth data will be reported at the end of the 1995 growing season.

Tables: Average midseason seedling density (seedlings per square foot) by treatment and species for each nursery. Significance at P = 0.05 indicated by *.
SRF = Shasta red fir; DF = Douglas-fir; PP = ponderosa pine; LPP = lodgepole pine.

Table 1. Humboldt Nursery. (Significance not yet determined.)	SRF
Bare fallow with tilling, methyl bromide/chloropicrin	15.8
Bare fallow with tilling, dazomet	19.2
Bare fallow with tilling, hydromulch after sowing	18.6
Bare fallow with tilling, composted redwood chips mulch after sowing	15.1
Bare fallow, no tilling	16.6

Table 2. Placerville Nursery. All treatments followed bare fallow with tilling. (Significance not yet determined)	SRF
Rice straw winter mulch, March sow, hydromulch	29.5
Rice straw winter mulch, mid-April sow, no mulch	18.5
Sawdust winter mulch, March sow, sawdust mulch	27.7
Sawdust winter mulch, March sow, hydromulch	27.9
Pine needle winter mulch, March sow, hydromulch	26.4
Dry hydromulch for winter, March sow, hydromulch	26
No winter mulch, March sow, hydromulch	24.1

Table 3. Magalia Nursery. (Significance not yet determined.)	SRF
Bare fallow, no tilling, shallow April sow, sawdust mulch	5.1
Bare fallow, no tilling, shallow November sow, sawdust mulch	21
Bare fallow, no tilling, April sow, no mulch	3.3
Solar heating, shallow April sow, sawdust mulch	16.1
Solar heating, shallow November sow, sawdust mulch	34.3
Solar heating, April sow, no mulch	9.6

Table 4. Coeur d'Alene Nursery. No significance. (Continued on next page).	DF
Bare fallow with tilling, dazomet	18.2
Bare fallow with tilling	17
Bare fallow with tilling, pine needle mulch after sowing	16.8

Tables (continued). Average mid-season seedling density.

Table 4. Coeur d'Alene Nursery (continued). No significance.	DF
Composted bark chips amendment, bare fallow with tilling	17
Sewage sludge amendment, bare fallow with tilling	17.2

Table 5. Lucky Peak Nursery. No significance.	LPP	PP
Bare fallow, no tilling, methyl bromide/chloropicrin	22	20.1
Bare fallow with tilling	19.3	22
Bare fallow, no tilling	22.5	17.7
Composted mushroom medium amendment, bare fallow, no tilling	17.4	17.2
Sawdust + N amendment, bare fallow, no tilling	19.7	21.9

Table 6. J. Herbert Stone Nursery. No significance.	DF	PP
Sawdust + nitrogen amendment, bare fallow with tilling, dazomet	14.6	10.6
Sawdust + nitrogen amendment, bare fallow with tilling	14.3	11.
Sawdust + nitrogen amendment, bare fallow, no tilling	13.5	8.5
Sawdust amendment, no nitrogen, bare fallow with tilling	16.5	12.2
No sawdust, bare fallow with tilling	13.9	10.8

Table 7. Bend Pine Nursery.	PP	
Pea cover crop, methyl bromide/chloropicrin	23.3	
Bare fallow with tilling	23.6	
Bare fallow, no tilling	24.2	
Bare fallow, no tilling, pine needle mulch after sowing	20.9	
Pea cover crop alone	8.2	*

Table 8. Wind River Nursery. No significance.	DF
Rye cover crop, methyl bromide/chloropicrin	43.5
Bare fallow with tilling	36
Bare fallow, no tilling	40.2
Bare fallow with tilling, sawdust mulch after sowing	41.2
Rye cover crop alone	37.8