



FOREST RESEARCH LABORATORY

RESEARCH NOTE 78

Natural and Artificial Regeneration of Whiteleaf Manzanita in Competition Studies

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Abstract

At three sites in southwest Oregon, uniform stands of whiteleaf manzanita were created for future studies on the effects of manzanita competition on Douglas-fir and ponderosa pine plantations. The sites were marked according to grids and nearby 2-year-old seedlings were lifted and transplanted to fill in gaps in the natural stands. Some plots were treated with a mixture of simazine, glyphosate, and 2,4-D to control weeds, and some were left untreated. After one

year, survival of natural seedlings that were not transplanted was 98.0 and 95.3 percent on treated and untreated plots. Survival of transplanted seedlings was 66 and 92 percent on treated and untreated plots. Residual herbicides in the soil may have decreased the survival of transplanted seedlings. A uniform stocking of manzanita can be achieved by transplanting natural seedlings and controlling weeds with a minimum amount of herbicides.

Introduction

The heterogeneity of plant populations complicates the study of competition among species. Plant spacing is uneven, hence there are different levels of competition among individual plants in a small area. This report describes an experiment in which uniform stands of whiteleaf manzanita (*Arctostaphylos viscida* Parry) were created for future studies on the effects of manzanita competition on Douglas-fir [*Pseudotsuga menziesii* (Mirb.) Franco] and ponderosa pine (*Pinus ponderosa* Dougl. ex Laws.) plantations.

Whiteleaf manzanita is widespread on hot, dry sites in California and southwest Oregon. It often prevents growth of conifers on slopes with fine-textured soil and is therefore considered undesirable in forest plantations. Roy (1981) and

Conard and Radosevich (1981) reported that with related species, competitive effects persist for decades, perhaps even after the shrubs have become subordinate to the conifers.

The effects of shrub competition on conifer growth have been reported by Zavitkovski *et al.* (1969), Youngberg *et al.* (1979), Horowitz (1982), and Petersen and Newton (1983) with different conclusions. We attribute many of the differences to the interaction of microsite with growth of shrubs and trees. Although trees are often planted in areas where shrubs do not grow, favorable sites for trees are likely to be favorable for shrubs and may be the only places where shrubs will grow. It is therefore easy to infer that shrubs are "good" for trees, but in fact, the shrubs are competing with the trees for survival.

For studies of shrub competition to be valid, both the patterned and the uniform distribution of conifers and shrubs on a full range of micro-sites should be surveyed. Creating a uniform stand requires that a natural stand be dense enough to be thinned to regular spacing or, if

the stand is sparse, that it be supplemented with transplanted seedlings. This study describes successful planting procedures for creating a uniform stand of manzanita and reports the effects of herbicides on transplanted and natural manzanita seedlings.

Methods

The three study sites were near Ruch, Oregon, about 35 km west of Medford. The sites, on south slopes of about 20 percent gradient, had clay soils 60 to 90 cm deep on a siltstone bedrock. Many fires had occurred on the sites, the most recent between 40 and 50 years ago. From the presence of scattered conifers and of general vegetation cover types, we estimated timber growth capacity to be Site V for Douglas-fir (McArdle *et al.* 1949) and ponderosa pine.

Before our experiment began in 1980, a mixture of whiteleaf manzanita, Pacific madrone (*Arbutus menziesii* Pursh) and wedge-leaf ceanothus [*Ceanothus cuneatus* (Hook.) Nutt] occupied the sites. They were cleared by crawler tractors equipped with brushrakes and the windrows were then burned clean. The sites were later ripped along the contour at 2-m intervals to a depth of about 45 cm and planted with a mixture of 2-0 bareroot Douglas-fir and ponderosa pine seedlings.

As a result of scarification, the manzanita seed germinated in large numbers and produced from 3,000 to 500,000 seedlings per ha. We achieved our goal of a uniformly dense manzanita plantation by thinning natural seedlings according to a grid. Heavy competition from ceanothus, madrone, and grass killed almost all of the manzanita seedlings in some areas. We therefore had to plant seedlings in these areas and to control their competitors.

Grids with different sizes of spacing were established to study various levels of competition. Grid spaces were 60 x 60 cm, 85 x 85 cm, 120 x 120 cm, 165 x 165 cm, and 250 x 250 cm within 22-m-square plots. Nine plots with 77 to 1,343 manzanita seedlings each were established in each of three replications. The plots were first laid out with wire stakes at the intersections of grid lines to mark the shrub sites. The site for a shrub

was considered stocked if a manzanita was already growing within 30 cm of the stake. In the absence of a natural seedling, a shrub was planted.

The manzanita seedlings were lifted from dense patches of 2-year-old seedlings near the study site. One of the patches had been treated with 1.7 kg/ha hexazinone during the year of seedling germination and the 2-year-old bushes were vigorous and abundant. The other patches had not developed herb cover in their first year and these seedlings were also vigorous. Seedlings in heavy herb cover were yellowish, with small leaves, so we did not lift them.

The natural seedlings we lifted ranged from 15 to 30 cm in height, with roots of similar length. The roots were in good condition and resembled those of bushy, 2-0 bareroot Douglas-fir seedlings from a nursery. They appeared mycorrhizal but no cultures were taken. The seedlings were lifted either with straight-shank, number 2 shovels or with 27-cm (net) blade hoedads and were hand-planted at the designated sites.

Because heavy herb cover had killed many natural shrubs, all but one of the plots in each replication were treated with herbicides. The foliage of manzanita shrubs and conifers was protected from the herbicide spray by 1.0-1 milkshake cups placed upside down over the seedlings. The plots were broadcast-sprayed with a mixture of 3.3 kg/ha simazine, 2.8 kg/ha glyphosate, and 3.8 kg/ha 2,4-D and the cups were then removed. Total volume per ha was 121 l/ha.

About 2,500 seedlings were checked for survival and herbicide injury at the end of the first growing season. Planted seedlings were identified by boot marks in the soil at the root collar. The condition of each planted or natural manzanita was listed in one of three categories: (1) healthy, (2) discolored or otherwise unhealthy, and (3) dead.

Results and Discussion

In a mixed stand of planted and natural seedlings, we achieved 90 percent occupancy. Because of planting shock, the planted seedlings in general developed more slowly than the natural seedlings. Therefore, allowance must be made for the planted fractions when the effects of competition are extrapolated for the study of completely natural stands.

TABLE 1.

CONDITION OF NATURAL AND PLANTED MANZANITA SEEDLINGS,¹ WITH AND WITHOUT HERBICIDE TREATMENT, AT THE END OF THE FIRST GROWING SEASON (PLUS OR MINUS 95 PERCENT CONFIDENCE INTERVAL).

Treatment	Condition of seedlings (%)		
	Healthy	Unhealthy	Dead
Planted			
Treated	60.7 ± 38.2	5.0 ± 6.1	34.3 ± 14.4
Untreated	79.3 ± 38.4	12.7 ± 23.4	8.0 ± 13.0
Natural			
Treated	92.3 ± 14.7	3.0 ± 10.4	4.7 ± 5.3
Untreated	96.3 ± 9.2	1.7 ± 5.8	2.0 ± 3.5

¹ Basis: 748 planted, 1,737 natural seedlings.

The herbicide controlled almost all of the herbaceous vegetation and most of the uncovered shrubs on two of the three replications. Rain fell soon after treatment on the third replication and lessened the herbicide's effectiveness. Therefore, individual shrubs were sprayed again with 2,4-D.

Evidently, treatment with a mixture of simazine, 2,4-D, and glyphosate did not aid and, in fact,

may have reduced survival of natural and planted manzanita. We expected the planted seedlings, because of their smaller root systems, to need weed control more than the 2-year-old natural seedlings. Instead, more of the planted seedlings that were treated died than those that were untreated (Table 1). Results did not differ significantly at the 95 percent probability level.

The anomalous decrease in survival of treated shrubs suggests that a harmful level of 2,4-D remained in the soil. This suggestion is supported by the observation that there were more dead and unhealthy seedlings on the plot that was treated twice with phenoxy herbicide than on the other plots. Possibly the simazine injured the seedlings, but the safety of simazine on ornamental shrubs contradicts this suggestion.

In the first year, the seedlings survived stress well. August midday plant moisture stress reached -24 bars in seedlings on treated plots and -27 bars in those on untreated plots. The planting of the study sites, in February 1983, was followed by higher-than-average rainfall and lower-than-average summer temperatures. A normally hot, dry summer may induce more stress in untreated seedlings than we observed.

At the end of the second year, the surviving treated manzanitas are vigorous, and the mortality rate for the natural seedlings appears the same as for those outside the experimental plots. Thus, we conclude that the herbicide treatment is desirable, but that care should be taken to prevent herbicides from invading the rooting zone. The tolerance of the natural shrubs to even the double dose of phenoxy herbicide indicates that transplanting can increase seedlings' vulnerability to herbicides in the soil.

Conclusions

A uniformly spaced manzanita stand can be created by marking a natural stand according to a grid and transplanting nearby natural seedlings to fill in the gaps. Herbicide treatment can increase survival of the natural

seedlings, but must be done cautiously to prevent killing the vulnerable transplanted seedlings. Upside-down milkshake cups are an inexpensive way to protect seedling foliage from herbicide spray.

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Metric/British Conversion

1 millimeter (mm)	=	0.0393 inch (in.)
1 centimeter (cm)	=	0.3937 inch (in.)
1 meter (m)	=	3.281 feet (ft)
1 meter (m)	=	1.094 yards (yd)
1 kilometer (km)	=	0.6214 mile (mi)
1 hectare (ha)	=	2.471 acre (ac)
1 liter (l)	=	0.264 gallon (gal)
1 kilogram (kg)	=	2.205 pounds (lb)

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