PART III

MADRONE CULTURE

&

MANAGEMENT

10

The Propagation of *Arbutus menziesii* from Seed

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Abstract: Pacific madrone (*Arbutus menziesii*) seed from a high elevation seed source (Cayuse, Washington) and a sea-level source (Blyn, Washington) were tested for germination requirements. Preliminary studies show that madrone seed need a chill period for adequate germination and that gibberellic acid (GA-3) has little effect on enhancing germination. Cleaned seed of 2 maternal trees were given cold stratification treatments of 4°C for 0, 20, 40, 60 and 80 days. Mean days to germination, percent germination and a comparison of the 2 seed sources were determined. Germination percent increased with increasing exposure to cold with maximum percent germination at 60 days for ‘Cayuse’ and 40 and 60 days for ‘Blyn’. Mean days to germination decreased with increasing exposure to cold.

Plants are propagated by seeds for many reasons (Hartmann and Kester 1983). Seed from many temperate zone plants from the northern hemisphere often exhibit one or more types of dormancy which in nature may require an after-ripening period, or in the greenhouse an artificial chemical/physical manipulation, for germination. Such physiological dormancy is commonly encountered. It is usually broken in nature by a chill period (Hartmann and Kester 1983 and Dirr and Heuser 1987). The plant propagator may be able to accomplish this with the application of an artificial chill period or the application of gibberellic acid (Bretzloff and Pellett 1979). Artificial removal of these various dormancies usually leads to increased and more uniform germination and ultimately results in more uniform propagules. This research was designed to more accurately determine the germination requirements of a native Pacific Northwest plant, the Pacific madrone (*Arbutus menziesii*).

Arbutus menziesii is a small to medium tree with a geographical distribution from southeastern British Columbia and southern Vancouver Island to southern California on the western side of the Cascade, Coast and Sierra Nevada Mountains. Growing season precipitation (April – September) varies from 2.5 to >100 cm.

The landscape attributes of this evergreen tree include white ericoid, urceolate flowers arranged in panicles in May, showy fruit colored from light orange to crimson, striking exfoliating bark and an excellent tolerance of aridity. Throughout its range there is much variation in flower size, fruit color, size and bark characteristics. The madrone does not seem to tolerate wet conditions nor transplant easily. There are isolated stands in the Cascade Mountains, well removed from the normal range, the clones of which may prove to be hardiest. Little is found in the literature on madrone propagation and cultural practices for nursery production. The only reported dormancy of madrone seed is physiological dormancy requiring a chill period (Schopmeyer 1974 and Macdonald 1990). This research was designed first to determine how best to propagate the madrone from seed and then to use the seedlings for research on container production methods, transplant methods, cutting propagation and hardiness testing at the Washington State University (WSU) Research and Extension Center in Puyallup. Our results of preliminary trials at WSU-Puyallup suggest that madrone seed need a cold stratification period and that gibberellic acid (GA-3) has little effect on hastening germination.

MATERIALS AND METHODS

We started an experiment in 1988 to compare the germination of half-sibling seed collected from native trees growing at 2 different geographic locations. Fruit were collected from individual trees located on Highway (HWY) 101 at the southern end of Discovery Bay (Blyn) and about 27 km south of the intersection of State HWY 410 and 123 (Cayuse) in the Cascade Mountains.

Seeds were separated from the pulp by maceration, flotation and decantation and were stored dry at 4°C until used in the experiment. The seeds were sown on a sterile, moistened peat-vermiculite mix in 8.5 x 13 x 6 cm plastic containers and given cold (4°C), moist stratification periods of 0, 20, 40, 60 and 80 days. The experiment was a 2 x 5 factorial in a completely random design. There were 20 seeds per replication (container) and 5 replications. The experiment was planned so that all the seeds (containers) were placed under the mist at the same time. The mist was on 30 seconds every 30 minutes from 9:00 AM to 3:00 PM. Percent germination and mean days to germination were measured. We performed analysis of variance (ANOVA) on arcsine transformed percent germination data and used the orthogonal polynomial trend comparison procedure (Gomez and Gomez 1984) to evaluate the effect of stratification period on seed germination

RESULTS AND DISCUSSION

Results of this experiment, in agreement with earlier reports (Schopmeyer 1974 and Macdonald 1990), indicate madrone seed requires a period of cold stratification (Figure 10-1). ANOVA of percent germination data indicates the interaction between maternal tree and cold stratification period is significant (alpha = 0.01). Analysis of percent germination data for each tree indicates there is significant linear and quadratic effects (alpha = 0.01) for cold stratification treatment in both Blyn and Cayuse. Germination percent increases with increasing time in cold stratification up to 60 days (Figure 10-1). After 60 days there is a decline in percent germination with both seed sources. While the seeds of trees of both provenance sources exhibit increased germination percent with increasing time in cold stratification up to 60 days, the seeds from sea level (Blyn), reach maximum germination after both 40 and 60 days. The seeds from the tree from the higher elevation in the Cascades (Cayuse) reach their highest germination percent after 60 days of cold. Percent germination of Blyn and Cayuse is not significantly different at 0 and 60 days of cold stratification. The differences, however, are significant (alpha = 0.01) at 20, 40 and 80 days with Cayuse having lower germination than Blyn.

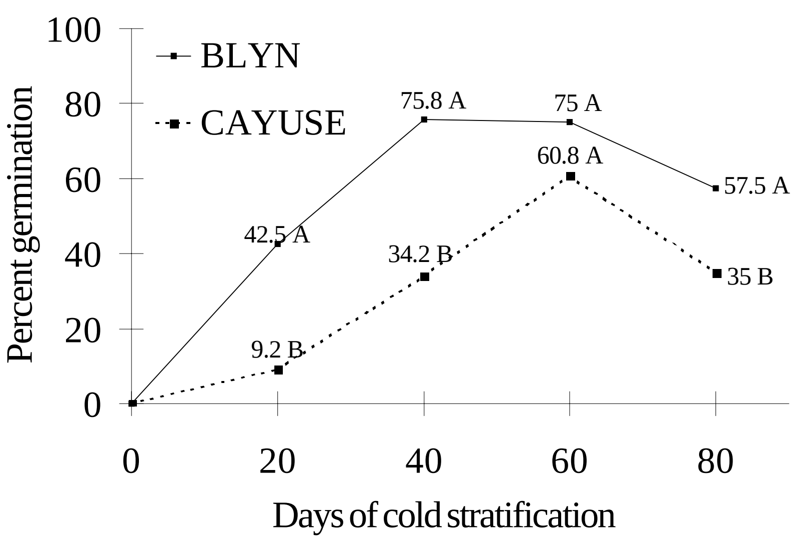

Figure 10-1. Effect of cold stratification on percent germination of madrone seed collected from trees growing at 2 different geographic locations. Means within cold stratification day followed by the same letter are not significantly different at the 1% level.

Mean days to germination (Hartmann and Kester 1983) is an indicator of the degree of uniformity of seed germination. The longer the average time to germination, the greater will be the size (age) difference between the seedlings. Results of ANOVA of mean days to germination data indicate the interaction between maternal tree and cold stratification and the main effect of maternal tree are not significant. Linear and quadratic effects of cold stratification on mean days to germination are significant (alpha = 0.01) (Figure 10-2). The mean days to germination of the madrone seedlings from both trees is similar with the fastest germination occurring after 60 and 80 days of cold treatment (Figure 10-2).

This research shows that uniform seedlings of madrone can be germinated quickly if the seed are given a 60 day continuous cold period before attempting to germinate the seed. Madrone seedlings are similar to seedlings of *Rhododendron* (including azalea), *Kalmia*, *Pieris* and other ericaceous plants in size at germination, but they develop more rapidly than some of the other Ericaceae. If the seed are germinated in mid to late winter indoors, a sizable plant in a one gallon (3.79 liter) container may be obtained by the second growing season.

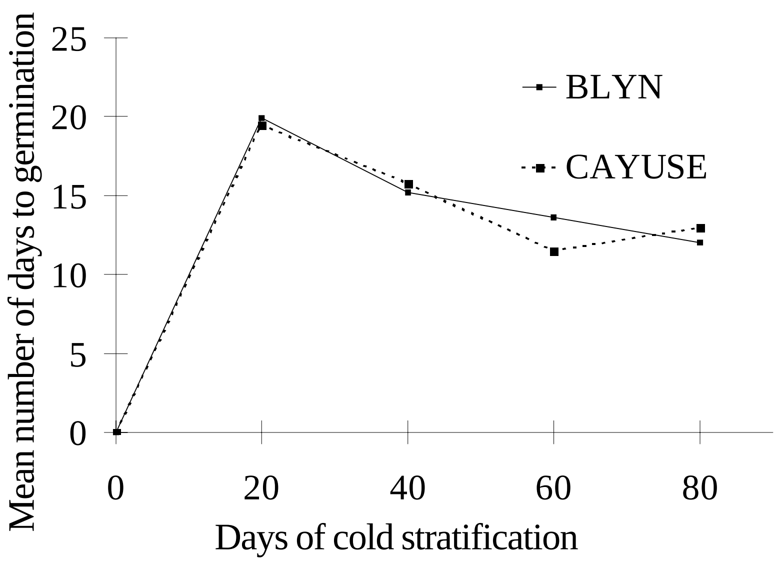

Figure 10-2. Effect of cold stratification on mean days to germination of madrone seed collected from trees growing at 2 different geographic locations.

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