Germination of Madrona Seed

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INTRODUCTION

Nursery plants are propagated by seeds for many reasons (Hartmann and Kester, 1983). One important objective of seedling production is to have uniform germination, emergence, and growth of the seedlings. Seed from many commonly grown north and south temperate zone plants often exhibit one or more types of dormancy which may require an after-ripening period in nature, or an artificial chemical/physical manipulation for germination. Physiological dormancy is a common dormancy encountered. It is usually broken in nature by a chill period (Dirr and Heuser, 1987; Hartmann and Kester, 1983). Artificially this may sometimes be done with 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 plants at sales time. This research was designed to more accurately determine the germination requirements of a native Pacific Northwest plant, the Pacific madrona (*Arbutus menziesii* Pursh).

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 mountains. Growing season precipitation (Apr.-Sept.) varies from 2.5 cm to 100+ cm (1 in. to 40+ in.).

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 to drought. Throughout its range there is much variation in flower size, fruit color and size, and bark characteristics. The madrona does not tolerate wet conditions nor does it seem to transplant easily. There are isolated stands in the Cascade mountains, well removed from the normal range, the clones of which may prove to be hardier.

Little is found in the literature on madrona propagation and cultural practices for nursery production. The only reported dormancy of madrona seed is physiological dormancy requiring a chill period (Macdonald, 1990; Schopmeyer, 1974).

The present research was designed first to determine how best to propagate the madrona from seed and then to use the seedlings for research on container production methods, transplant methods, cutting propagation, and hardiness testing.

MATERIALS AND METHODS

Results of preliminary trials at WSU-Puyallup had indicated that madrona seed did need a cold stratification period and that gibberellic acid (GA_3) had little effect on hastening germination (Maleike and Hummel, unpublished data).

An experiment was started in 1988 to compare the germination of half-sibling seed collected from native trees growing at two different geographic locations. Fruits were collected from individual trees located on HWY 101 at the southern end of Discovery Bay, Washington (Blyn) and about 16 mi. south of the intersection of HWY 410 and 123 (Cayuse) in the Cascade mountains.

The 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-lite mix in 8.5×13×6 cm plastic containers and given cold-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 sec every 30 min from 0900 to 1500. Percent germination and mean days to germination were measured. Germination percentages were arc-sine transformed for statistical analysis. Analysis of variance (ANOVA) was performed on the data and the orthogonal polynomial trend comparison procedure (Gomez and Gomez, 1984) was used to evaluate the effect of stratification period on seed germination.

RESULTS AND DISCUSSION

Results of this experiment, in agreement with earlier reports (Macdonald, 1990; Schopmeyer, 1974), indicated madrona seed requires a period of cold stratification (Figure 1). ANOVA of percent germination data indicated the interaction between maternal tree and cold stratification period was significant at the 1% level Analysis of percent germination data for each tree indicated there were significant linear and quadratic effects (1% level) for cold stratification treatment in both Blyn and Cayuse. Germination percentage increased with increasing time in cold stratification up to 60 days (Figure 1). After 60 days there was a decline in percentage germination with both seed sources. While the seeds of trees of both provenance sources exhibited increased germination percentage with increasing time in cold stratification up to 60 days, the seeds from Blyn (the tree from sea level elevation) reached maximum germination at both 40 and 60 days. The seeds from the tree from the higher elevation in the Cascades, Cayuse, reached their highest germination percentage at 60 days of cold. Percent germination of Blyn and Cayuse seed was not significantly different at 0 and 60 days of cold stratification.

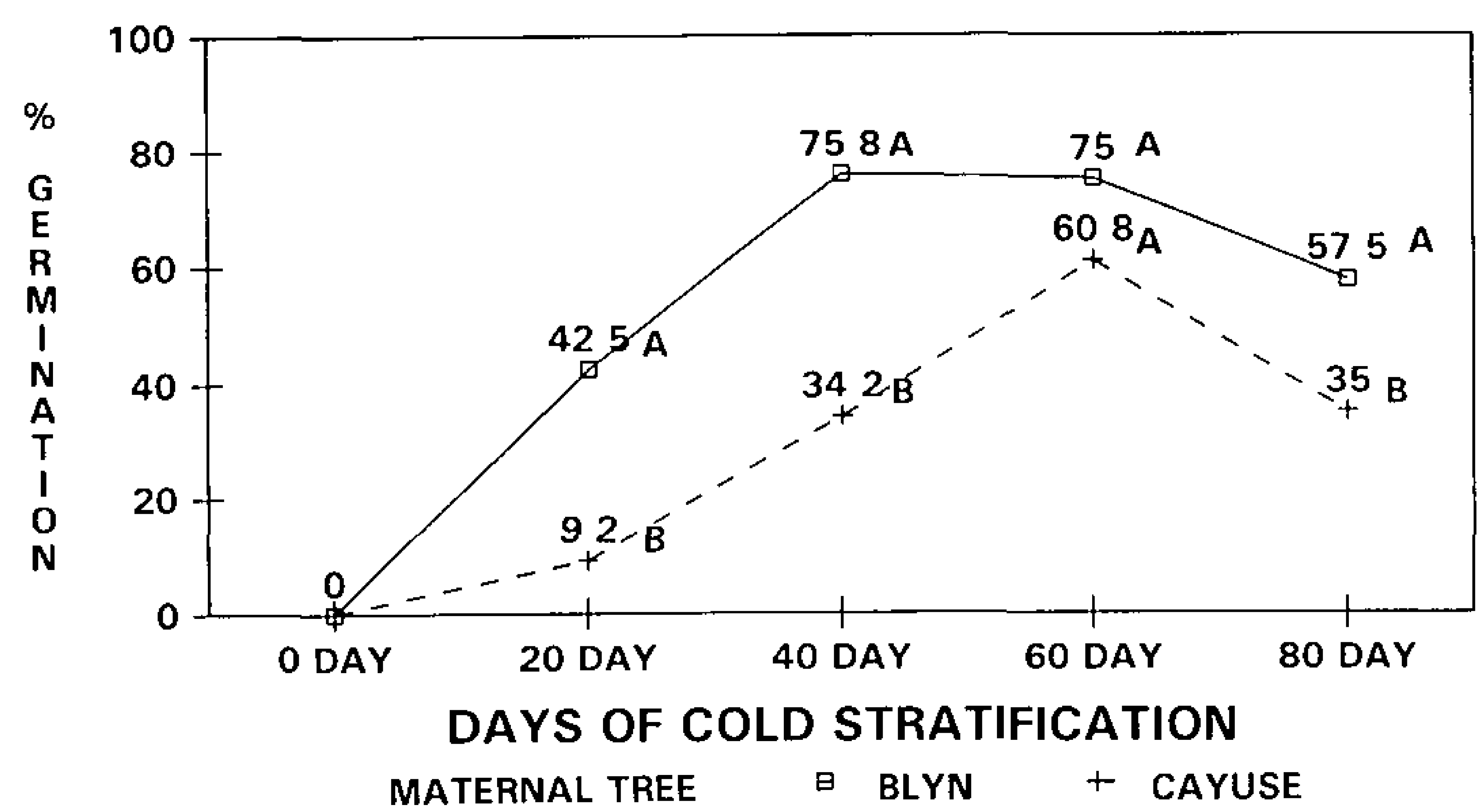

Figure 1. Effect of cold stratification on germination percentage of madrona seed collected from trees growing at two different geographic locations Means within cold stratification day followed by the same letter are not significantly different at the 1% level.

However, the differences were significant (1% level) at 20, 40 and 80 days with Cayuse having a lower germination percentage than Blyn.

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 indicated the interaction between maternal tree and cold stratification and the main effect of maternal tree were not significant. Linear and quadratic effects of cold stratification on mean days to germination were significant at the 1% level (Figure 2). The mean days to germination of the madrona seedlings from both trees was similar with the fastest germination occurring after 60 and 80 days of cold treatment (Figure 2).

This research shows that uniform seedlings of madrona can be obtained quickly

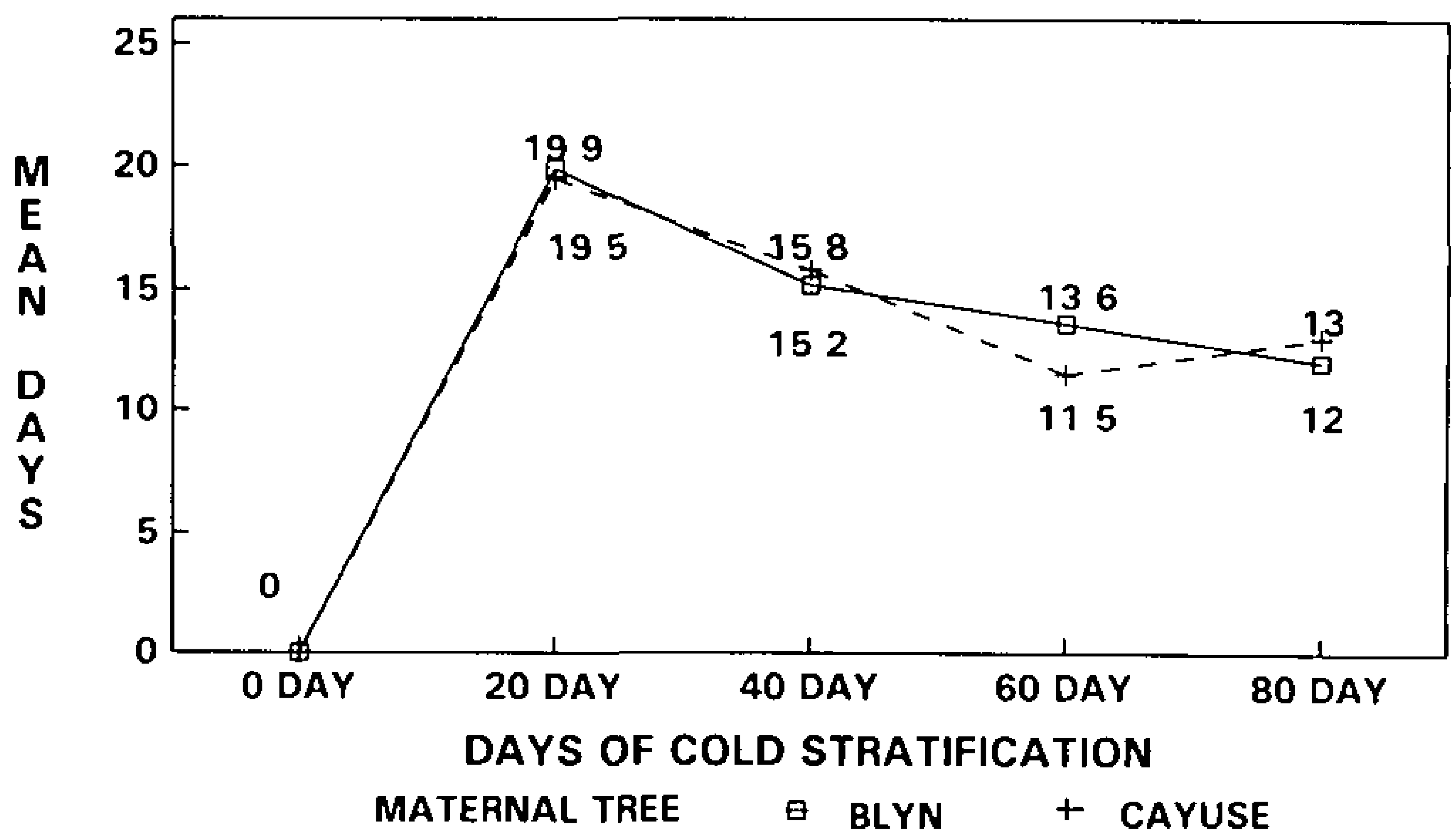

Figure 2. Effect of cold stratification on mean days to germination of madrona seed collected from trees growing at two different geographic locations

if the seeds are given a 60 day cold period before germination. Madrona seedlings are similar to seedlings of rhododendron, azalea, *Kalmia, Pieris* and other ericaceous plants in size at germination; however they develop more rapidly than those of some of the other family members. If the seed are germinated in mid-to late-winter inside, a sizable # 1 (1 gal) plant may be obtained by the second growing season.

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