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Influence of Light and Temperature on Seed Germination of Mountain Laurel¹

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Abstract

Seeds of mountain laurel (*Kalmia latifolia* L.) were germinated at 25°C (77°F) and 25°/15°C (77°/59°F) with daily photoperiods of 0, ½, ½ twice daily, 1, 2, 4, 8, 12, and 24 hr. Seeds exhibited an obligate light requirement. At 25°C (77°F), increasing photoperiods increased germination with maximum germination (90%) occurring by day 18 under continuous illumination. The alternating temperature of 25°/15°C (77°/59°F) enhanced germination when light was limiting. At this temperature, maximum germination of 86 to 87% was reached by day 24 for photoperiods ≥ 8 hr.

Index words: seeds, sexual propagation, *Kalmia latifolia*, native plants

Introduction

Mountain laurel (*Kalmia latifolia* L.) is a broad-leaved evergreen shrub considered by many to be one of the most beautiful native flowering species. It has a wide range, extending from New England to Florida, primarily along the Appalachian mountains, westward to Louisiana and northward into southern Ohio and Indiana (2). It blooms from March to July, depending on location (6) and flower color typically ranges from white to pink and occasionally, crimson or purple (2).

Mountain laurel is in great demand for landscape use but supplies are often limited due to problems associated with propagation. The species is generally considered difficult to propagate vegetatively by stem cuttings although successful micropropagation (tissue culture) techniques have been reported and are currently being used commercially (4, 5). Mountain laurel can also be propagated sexually. Nurserymen in western North Carolina propagate the species by seed with the resulting seedlings sold to other growers or grown by the propagator to a larger size prior to sale. Despite successful propagation by seed, information regarding various aspects of this technique is lacking. For example, no data have been reported regarding seeding rates or the influence of light and temperature on growth following germination. One aspect of sexual propagation for which some data are available is the effect of temperature on germination. Jaynes (3) subjected seeds of mountain laurel to constant temperatures ranging from 18°C (64°F) to 30°C (86°F) with a 16-hr photoperiod and found little or no germination at 30°C (86°F) with 22°C (72°F) about optimal. He also reported the seeds require light for germination. There are, however, no reports on the effects of different

photoperiods or alternating temperatures on germination of mountain laurel. The objective of this investigation, therefore, was to examine the influence of varying photoperiods and a constant versus an alternating temperature on germination of mountain laurel.

Materials and Methods

Mature seed capsules were collected from open-pollinated plants growing in Avery County, North Carolina, at an elevation of 923 m (3030 ft) on November 13, 1986. Capsules were stored in a paper bag at 20°C (68°F) for 21 days. Seeds were then removed from the capsules and stored at a moisture content of 5% in a sealed bottle at 4°C (39°F). Moisture content of the seeds was determined by calculating the mean moisture content of six 100-seed samples following drying at 105°C (221°F) for 24 hr.

In October 1987, seeds were removed from storage and graded by manual removal of abnormal, damaged and undersized seeds. Graded seeds were sown in covered, 9-cm glass Petri dishes on 1 piece of Whatman 3 filter paper overlying two pre-washed germination blotters moistened with tap water. Following placement of seeds in the dishes, half were designated for germination at 25°C (77°F) and the other half for germination at an 8/16 hr thermoperiod of 25°/15°C (77°/59°F). All dishes were placed in black sateen cloth bags and the seeds allowed to imbibe overnight prior to initiation of the photoperiod treatments. Dishes were randomized within two growth chambers [C-chambers (1)], set at the appropriate temperatures. Chamber temperatures varied within ± 0.5°C (0.9°F) of the set point.

Within each temperature regime, seeds were subjected daily to the following nine photoperiods: total darkness, ½, two ½ hr photoperiods separated by 7½ hr of darkness, 1, 2, 4, 8, 12 and 24 hr. Growth chambers were equipped with cool-white fluorescent lamps which provided a photosynthetic photon flux density (400–700 nm) of 42 µmol m⁻²s⁻¹ (3.2 klx) as measured at dish level with a cosine corrected LI-COR LI-185 quantum-radiometer/photometer. All photoperiod treatments, except the 24-hr illumination, were regulated by removal and placement of the Petri dishes in black sateen cloth bags. For the 24-hr photoperiod treatment, the Petri dishes remained continuously unbagged in

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open chamber conditions. Regardless of the photoperiod, temperatures within the Petri dishes as measured with a thermocouple never exceeded ambient by more than 1°C (1.8°F). Petri dishes representing the total darkness treatment were kept in the black cloth bags throughout the experiment and all watering and germination counts were performed under a green safelight. Germination blotters were kept moist with tap water throughout the experiment. Seeds showing signs of decay were immediately removed from the dishes. Each photoperiod treatment was replicated four times with a replication consisting of a Petri dish containing 100 seeds. Germination counts were recorded every 3 days for 30 days. A seed was considered germinated when the emerging radicle was ≥ 1 mm (0.04 in.).

Percent germination was calculated as a mean of 4 replications per treatment. Comparison of means was by LSD, at the 5% level.

Results and Discussion

Data confirm a previous report (3) that seeds of mountain laurel have an obligate light requirement (Fig. 1). This report, however, lacked such critical information as the number of hours required daily and the interaction of light and temperature.

Germination commenced earlier at 25°C (77°F) than at 25/15°C (77/59°F). Under the constant temperature of 25°C (77°F), germination increased as the photoperiod increased (Fig. 1A). There was a rapid increase in germination after day 9 with the greatest increase occurring between day 9 and 12 for seeds receiving photoperiods ≥ 8 hr. For the 12 and 24-hr light treatments, germination was essentially complete by day 18 since there was no significant increase in germination thereafter. The highest total germination (90%) was attained under constant illumination at 25°C (77°F). This was significantly greater than the 82% germination under the 12-hr photoperiod (Fig. 1A). Germination of $< 30\%$ was noted for seeds receiving daily light treatments ≤ 4 hr.

The alternating temperature of 25°/15°C (77°/59°F) de-

layed initial germination by 3 days when compared to constant temperature. For photoperiods ≥ 8 hr, a majority of the seeds germinated between days 12 to 18. Germination continued to increase and maximum germination was attained by day 24 (Fig. 1B). The highest germination (87%) under alternating temperature was achieved at photoperiods ≥ 8 hr, and this was equivalent to the highest total germination obtained under continuous illumination at the constant temperature.

The alternating temperature did not stimulate germination in the dark (Fig. 1B). However, it did enhance the germination response for seeds receiving light. This is indicated by the fact that total germination at 25°/15°C (77°/59°F) for photoperiods of $\frac{1}{2}$, $\frac{1}{2} + \frac{1}{2}$, 1, 2, 4, 8 and 12 hr was always significantly greater than germination at 25°C (77°F) for the same photoperiods. Such responses to alternating temperature have also been observed in other light-sensitive species (7).

Under both temperature regimes, the twice-daily illumination (two $\frac{1}{2}$ hr exposures separated by $7\frac{1}{2}$ hr of darkness) induced significantly higher germination compared to a single, continuous light treatment of an equivalent photoperiod (Fig. 1). This split photoperiod treatment was included as an indirect means of providing evidence for the involvement of phytochrome in seed germination of mountain laurel. Results suggest that the light response is phytochrome mediated.

In the present study, the highest germination (90%) at 25°C (77°F) was attained under continuous illumination. However, photoperiods between 18 to 24 hr would probably have yielded equivalent germination (Fig. 1A).

Significance to the Nursery Industry

Quantitative data are presented regarding the influence of varying photoperiods and a constant [25°C (77°F)] versus an alternating [25°/15°C (77°/59°F)] temperature on seed germination of mountain laurel. Results indicate that excellent germination can be achieved relatively quickly at either temperature regime provided the proper photoperiod is utilized. Nurserymen are cautioned that the seeds should not be covered during sowing, since they require light for germination and are extremely small [1.4 million seeds/28 g (1 oz)] (4).

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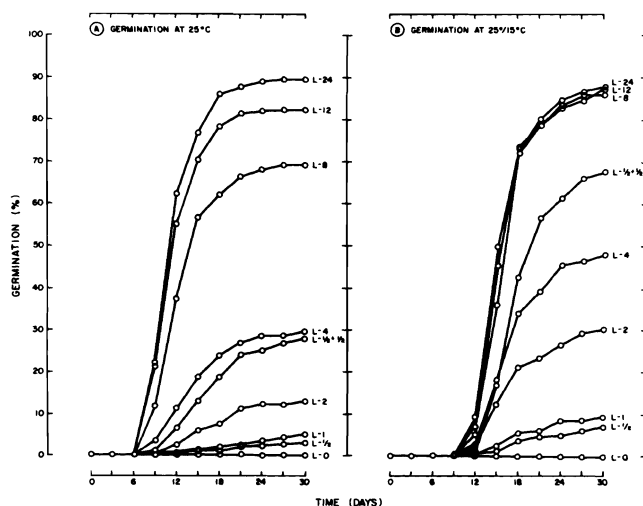


Fig. 1. Influence of light and temperature on seed germination of mountain laurel. LSD_{0.05} = 3.8 for comparing means within a temperature and between temperatures. (A) germinated at 25°C (77°F) with photoperiods (L) ranging from total darkness (L-0) to 24 hr (L-24). (B) germinated at 25°/15°C (77°/59°F) utilizing the same photoperiods as in A.