Seed Germination of *Leucothoe fontanesiana* as Influenced by Light and Temperature[1]

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Abstract

Seeds of *Leucothoe fontanesiana* (Steud.) Sleum. were germinated at 25°C (77°F) and 25°/15°C (77°/59°F) with daily photoperiods of 0, 1/2, 1/2 twice daily, 1, 2, 4, 8, 12, or 24 hr. For both temperatures, no germination occurred during a 30-day period for seeds not subjected to light. At 25°C (77°F) increasing photoperiods increased germination with germination of 60 and 68% occurring by day 24 for the 12 and 24 hr photoperiods, respectively. The alternating temperature of 25°/15°C (77°/59°F) enhanced germination when light was limiting. At this temperature germination ≥85% was reached by day 27 for photoperiods ≥2 hr.

Index words: seeds, sexual propagation, native plants, doghobble, switch ivy, drooping leucothoe, fetterbush

Significance to the Nursery Industry

Quantitative data are presented concerning the influence of light and temperatures of 25°C (77°F) and 25°/15°C (77°/59°F) on seed germination of *L. fontanesiana*. Regardless of temperature, seeds rquired light for germination. When germinated at 25°C (77°F) for 30 days, germination was a function of photoperiod with continuous light resulting in the greatest germination (70%). In contrast, the alternating temperature partially substituted for the light requirement with germination ≥85% attained by 27 days for photoperiods ≥ 2 hr. Seeds should not be covered during propagation because of their small size and light requirement.

Introduction

Leucothoe fontanesiana (doghobble, switch ivy, drooping leucothoe, or fetterbush) is a native, ericaceous, evergreen shrub occurring from Virginia south to Georgia and east to Tennessee (6). Plants can reach up to 1.8 m (6 ft) in height having an arching, spreading growth habit. Flowering is in May, resulting in perfect, white, fragrant, pitcher-shaped flowers, 0.6 cm (0.25 in) long, which are borne in 5.0 to 7.5 cm (2 to 3 in) long, pendulous racemes originating from the left axiles (3). *Leucothoe fontanesiana* has many desirable landscape qualities. These attributes, coupled with it being a native species, have created a demand for this plant.

Nurserymen may propagate the species by sexual or asexual means. Although stem cuttings reportedly root in high percentages (4), some nurserymen prefer sexual propagation. Mature seeds are collected in the fall and later sown to produce seedlings. Despite common use of sexual propagation, nurserymen have often observed poor germination and have inquired about optimum germination conditions. Such inquiries prompted a literature search by the authors. Few references were found on seed propagation and these simply noted that seeds could be germinated (3, 4, 5). The search provided no information on the influence of various environmental factors on germination of the species. In addition, a preliminary study by the authors indicated seeds of *L. fontanesiana* have a light requirement for germination suggesting that light may interact with other environmental factors such as temperature in promoting germination. Therefore, the objective of this investigation was to study the influence of light and temperature on seed germination of *L. fontanesiana*.

Materials and Methods

On October 25, 1987 mature seed capsules were collected from a native population of open-pollinated plants of *L. fontanesiana* growing in Henderson County, North Carolina at an elevation of 640 m (2100 ft). Capsules were stored in a paper bag at 20°C (68°F) for 30 days. Seeds were then removed from the capsules and stored at a moisture content of 3% in a sealed glass bottle at 4°C (39°F). Moisture content of the seeds was determined by calculating the mean moisture content of six, 200-seed samples following drying at 105°C (221°F) for 24 hr.

In January 1990, seeds were removed from storage and graded by manual removal of abnormal, damaged and undersized seeds. Graded seeds were sown in covered 9 cm (3.5 in) glass petri dishes containing 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 water overnight at 21°C (70°F). The next day, bags were randomized within two growth chambers [C-chambers (5)] 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, 1/2, two 1/2 hr photoperiods separated by 7 1/2 hr of darkness, 1, 2, 4, 8, 12 or 24 hr. Regardless of temperature, photoperiod treatments were administered the same time each day and for the alternating temperature of 25°/15°C (77°/59°F),

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all photoperiod treatments with the exception of total darkness and 24 hr began with the transition to the high temperature portion of the cycle. Growth chambers were equipped with cool-white fluorescent lamps which provided a photosynthetic photon flux (400–700 nm) of 35 μmol $m^{-2}s^{-1}$ (2.8 klx) as measured at dish level with a cosine corrected LI-COR LI-185 quantum/radiometer/photometer. All photoperiod treatments except total darkness and the 24 hr irradiation 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 open chamber conditions. Regardless of the photoperiod, temperatures within the petri dishes never exceeded ambient by more than 1°C (2°F). Petri dishes representing the total darkness treatment were kept in 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 within each temperature regime 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). The experiment was conducted two times.

For each experiment, percent germination was calculated as a mean of four replications per treatment. Data were subjected to analysis of variance procedures and regression analysis (9).

Results and Discussion

There were no significant differences between the two experiments. Therefore, data of both were combined.

Seeds of *L. fontanesiana* required light for germination whether germinated at 25°C (77°F) or 25°/15°C (77°/59°F) (Fig. 1). With the exception of the split photoperiod (1/2 + 1/2 hr), germination at 25°C (77°F) was a function of photoperiod with 30-day germination being greater with each increase in photoperiod (Fig. 1A). The highest germination (70%) at the constant temperature was realized for seeds subjected to continuous light.

At 25°/15°C (77°/59°F) the germination response was different than at 25°C (77°F) as the alternating temperature partially compensated for the light requirement (Fig. 1B).

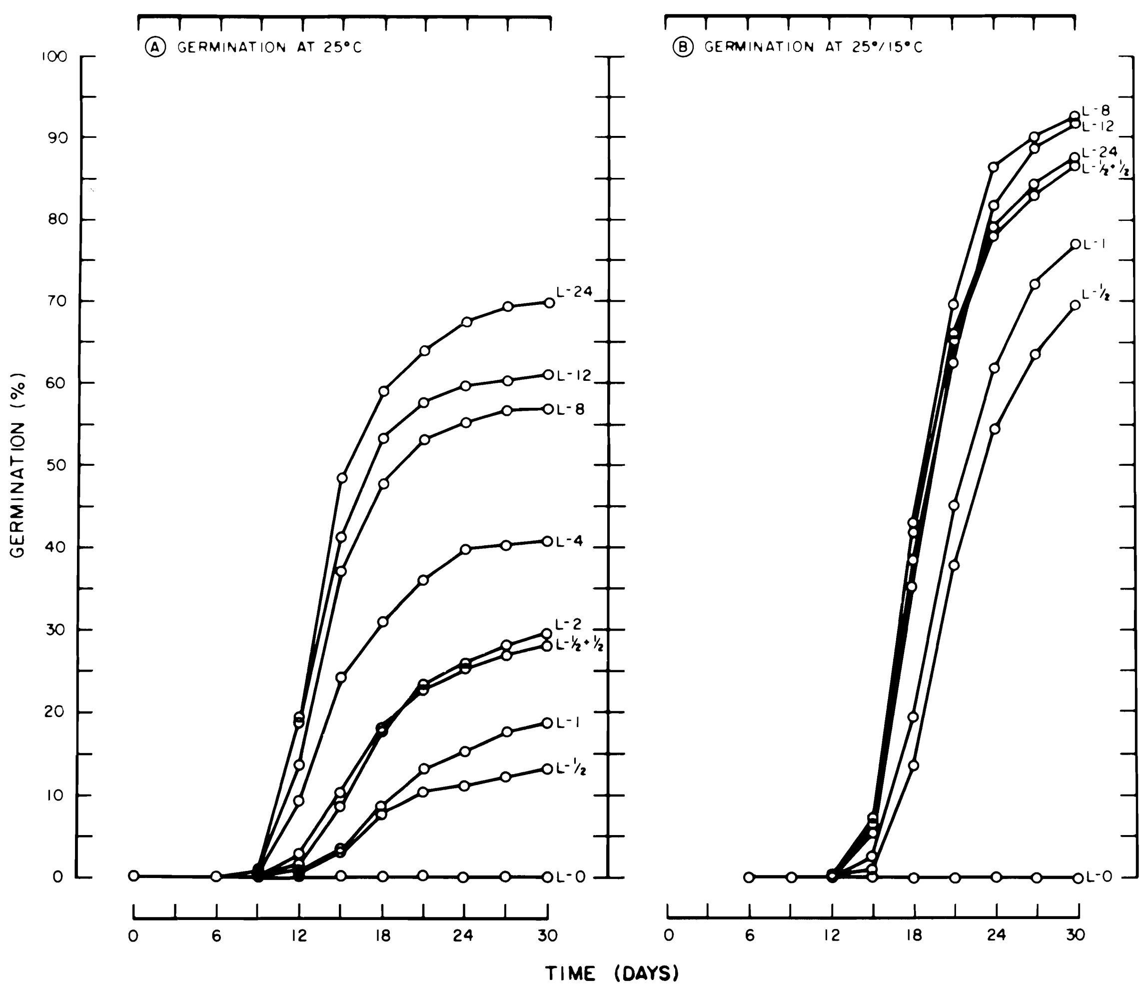

Fig. 1. Influence of light and temperature on seed germination of *L. fontanesiana*. (A) germinated at 25°C (77°F) with daily photoperiods (L) ranging from total darkness (L–O) to 24 hr (L-24). (B) germinated at 25°/15°C (77°/59°F) utilizing the same photoperiods as in A. Data for the 2- and 4-hr photoperiods were omitted since germination for the 2-hr photoperiod was similar to the split photoperiod (1/2 + 1/2 hr) and the 4-hr was similar to the 12-hr light treatment.

Table 1. Influence of photoperiod on cumulative seed germination of *Leucothoe fontanesiana* for days 9 to 30.

Temp.		Time (days)							
(°C)	Photoperiod[z]	9	12	15	18	21	24	27	30
25°	L	**	**	**	**	**	**	**	**
	Q	*	**	**	**	**	**	**	**
25°/15°	L	—[y]	NS	**	**	**	**	**	**
	Q	—	NS	*	**	**	**	**	**

[z]NS, *, **, indicates nonsignificant, significant (p = 0.05) and highly significant (p = 0.01) linear (L) or quadratic (Q) response, respectively.
[y]No germination occurred by day 9.

This is best illustrated by comparing 30 day germination at 25°C (77°F) and 25°/15°C (77°/59°F) for photoperiods of 1/2 and 1 hr. At 25°C (77°F) 30-day germination for photoperiods of 1/2 and 1 hr was 13 and 19%, respectively, in comparison to 69 and 77%, respectively, for identical photoperiods at 25°/15°C (77°/59°F). So great was the stimulatory influence of the alternating temperature that germination >87% was achieved with photoperiods as short as 2 hr. Partial substitution of a light requirement by an alternating temperature has also been demonstrated with other ericaceous species such as mountain laurel [*Kalmia latifolia* L. (8)], flame azalea [*Rhododendron calendulaceum* Michx. Torr. (7)], catawba rhododendron [*Rhododendron catawbiense* Michx. (1)] and rosebay rhododendron [*Rhododendron maximum* L. (1)].

Analysis of variance showed that for each temperature, photoperiods, time (days) and their interactions were highly significant. Thus, regression analysis was conducted on cumulative germination within each temperature for each 3-day interval (Table 1). The analysis did not include data for total darkness or the split photoperiod.

At 25°C (77°F) a highly significant linear germination response to photoperiod was noted beginning at day 9 and continuing to day 30 (Table 1, Fig. 2A). A significant quadratic response was also observed at day 9, becoming highly significant at day 12 and remaining unchanged to day 30.

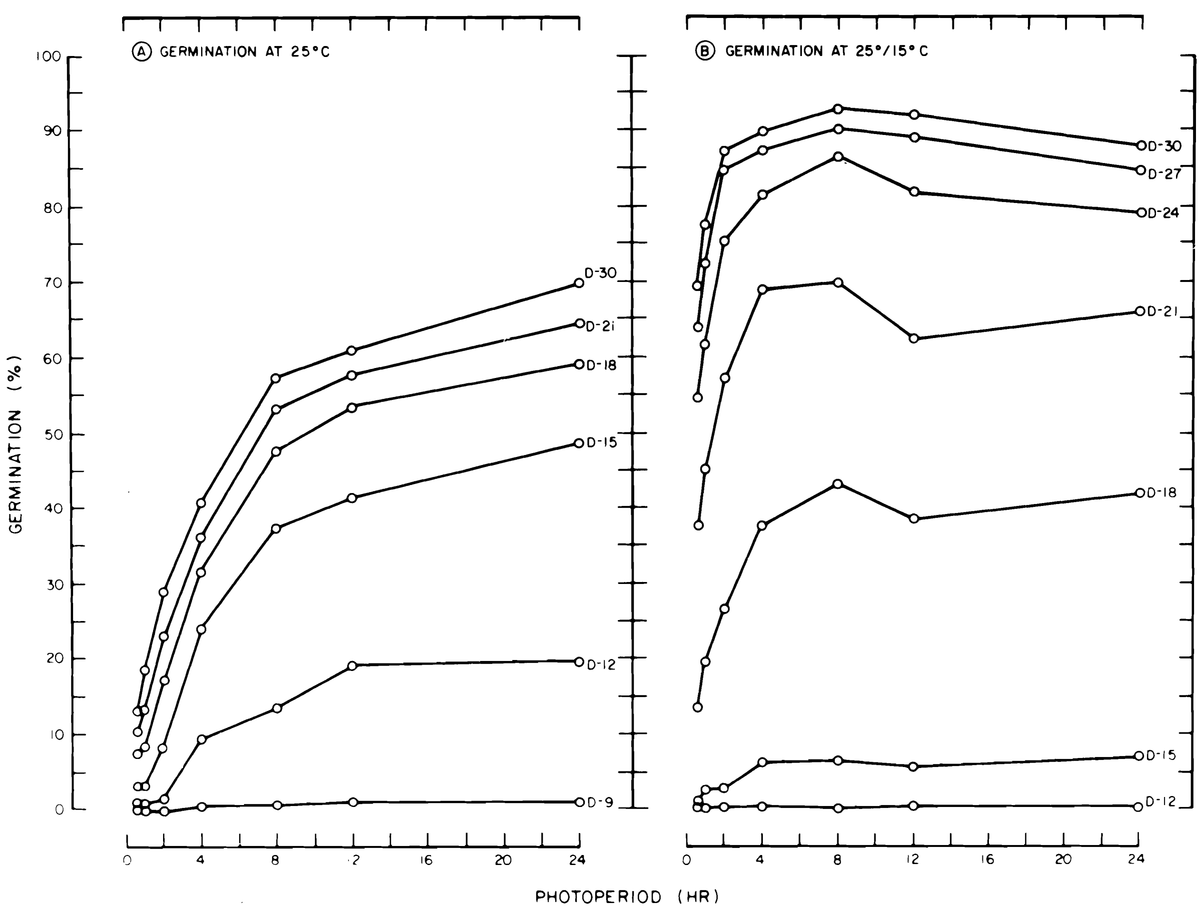

Fig. 2. Cumulative seed germination of *L. fontanesiana* as influenced by photoperiod at days (D) 9 to 30. (A) germinated at 25°C (77°F). Data for days 24 and 27 were omitted since day 21 was similar to day 24 and day 27 was similar to day 30. (B) germinated at 25°/15°C (77°/59°F). No germination occurred at day 9 for all photoperiods.

For seeds germinated at 25°/15°C (77°/59°F) there were no significant germination responses up to day 12 (Table 1, Fig. 2B). By day 15, a highly significant linear response and a significant quadratic response were observed. By day 18 both responses became highly significant and continued to day 30.

Although light was essential for germination at both temperatures, photoperiods of 12 and 24 hr appeared to inhibit germination at 25°/15°C (77°/59°F) (Fig. 2B). This was not noted at 25°C (77°F). Beginning at day 18 and continuing to day 30, germination under an 8 hr photoperiod was always greater than photoperiods of 12 and 24 hr. A similar response was reported by Blazich et al. (1) for seeds of catawba rhododendron whether germinated at 25°C (77°F) or 25°/15°C (77°/59°F). However, for seeds of catawba rhododendron, inhibition at 25°C (77°F) dissipated by the end of a 30-day germination period while the inhibition was still present after 30 days (1) at 25°/15°C (77°/59°F), which is similar to data in Fig. 2B.

Germination >87% was achieved at 25°/15°C (77°/59°F) for the split photoperiod and photoperiods of 2 to 24 hr (Fig. 1B). This is a minimum of 24% greater than the 70% germination realized under constant light at 25°C (77°F), although germination commenced earlier at 25°C (77°F) (Fig. 1A). Faster initial germination at 25°C (77°F) in comparison to germination at 25°/15°C (77°/59°F) has also been reported for other ericaceous species (1, 7, 8).

Data in Fig. 1 suggest that light stimulation of seed germination of *L. fontanesiana* is phytochrome mediated (2). This is illustrated by comparing germination of the split photoperiod (two 1/2 hr exposures separated by 7 1/2 hr of darkness) with a single continuous light treatment of 1 hr. At 25°C (77°F), 30-day germination under the split photoperiod was 39% greater than the response under a 1 hr photoperiod and at 25°/15°C (77°/59°F) the response was 13% greater.

Seeds of *L. fontanesiana* are very small. Following collection and drying to a moisture content of 3% there were approximately 640,000 seeds per 28 g (1 oz). Small seed size plus the requirement of light for germination should caution nurserymen not to cover the seeds during propagation.

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Buyer Perceptions of Foliage Trade Shows: Implications for Marketing[1]

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Abstract

A ten question survey was mailed to all registered buyers of the 1988 Foliage Expo trade show in Hallandale, Florida to seek their opinions on the performance of the show, to better understand the buyer profile, and gain insight into the effectiveness of these shows as marketing tools. Based on the results of this survey, it appears that an important target group, namely the retail trade sector, were not being drawn in sufficient numbers to this particular trade show. These findings indicate that sponsors may not have clearly identified the intended audience, determined unambiguously the preferences of this audience, nor effectively advertised and promoted the trade exhibition.

Index words: Foliage plants, market research, merchandising

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Significance to the Nursery Industry

Trade exhibitions are an important marketing tool utilized by the foliage industry, yet the benefits from these shows have become increasingly dubious. A major finding of this