Benzyladenine in the Priming Solution Reduces Thermodormancy of Lettuce Seeds

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Summary. When lettuce seeds are imbibed and subjected to high temperature for periods of 72 h or more, dormancy known as thermodormancy is induced. Priming of three cultivars of lettuce (Lactuca sativa L.) seeds in 1% (w/v) K$_3$PO$_4$ for 20 h in the dark reduced thermodormancy. Addition of 100 mg 6-benzyladenine (BA)/liter to the priming solution increased germination in petri dishes at 35°C in 'Green Lakes' from 65% in seeds that were primed without BA, to 92% when BA was added to the priming solution. In 'South Bay' these percentages were 24% and 86%, respectively. Seedling emergence was improved in other lots of 'Green Lakes' and 'Montello' using soilless mix.

Thermodormancy is an important problem in establishing stands of lettuce when seeds are sown under high soil temperatures. It can be circumvented by seed-priming (Cantliffe et al., 1981; Guedes and Cantliffe, 1977, 1980; Guedes et al., 1979). For the procedure to be successful commercially, the components of priming must be standardized as much as possible. These components include the type of soak solution (osmoticum) and its osmotic potential, aeration, temperature, light, soak duration, seed redrying procedures, seed storage, and seed quality (Cantliffe, 1983). For lettuce, many of these factors have been standardized, including soaking the seeds in aerated solutions of 1% (w/v) K$_3$PO$_4$ for 20 h in the dark (Cantliffe, 1981), followed by redrying the seeds at low temperature and relative humidity to retard radicle growth.
where: \( A = \) number of seeds germinating per day, \( T = \) time corresponding to \( A \) in days, and \( n = \) number of days to final count.

In the first experiment, 'Green Lakes' and 'South Bay' lettuce seeds were primed without BA, dried, then germinated at 10, 15, 25, 30, or 35°C. In the second experiment with the same cultivars, BA was added to the priming solution in concentrations ranging from 0 to 500 mg. In the third experiment, 'Green Lakes' (a different seed lot from the above) and 'Montello' lettuce seeds were primed with or without 100 mg BA/liter, dried, then germinated in incubators at 15, 25, or 35°C or in a 1:1 peat:vermiculite mix in growth chambers maintained at constant 15 or 35°C.

Germination of 'Green Lakes' and 'South Bay' was high (98%), regardless of treatment, at 10, 15, 25, and 30°C (data not shown). At 35°C, only primed seeds germinated, however, values were low-52% for 'Green Lakes' and 36% for 'South Bay'. ADG at 10 or 15°C was improved for both cultivars by priming (Table 1). At 25 and 30°C, ADG was similar for control and primed seeds.

With 25 mg BA/liter priming solution, germination of 'Green Lakes' at 35°C increased from 65% to 85%, but higher BA concentrations did not increase germination further (Fig. 1). Germination of 'South Bay' seeds at 35°C was not increased by BA addition until ≥100 mg BA/liter was added to the priming solution. Subsequent additions of 150, 250, and 500 mg BA/liter further increased germination of this cultivar. Abnormal germination, manifested as thickened hypocotyls, was observed in seedlings primed at 250 or 500 mg BA/liter. Morphological abnormalities were not observed in seedlings primed in 100 mg BA/liter; thus, this concentration was selected for the third experiment.

In a third experiment with different seed lots, percentage germination at 15 and 25°C was unaffected by seed priming, with or without BA in the osmoticum (Table 2). At 35°C, only primed 'Green Lakes' seed germinated, and the addition of BA to the priming solution increased germination significantly. Results with 'Montello' were similar. At 15°C, seed priming decreased ADG, but at 25 or 35°C, ADG was the same whether or not the seeds were primed.

When primed or nontreated seeds were sown in soilless mix in the growth chamber, emergence at 15°C was unaffected by priming (Table 3). At 35°C, percentage emergence of primed seed was low in both cultivars unless BA was used. ADG; at 15°C was not affected by seed priming.

Seed priming effectively overcomes thermom dormancy in lettuce both in the laboratory and the field (Cantliffe, 1981). In the past, the actual germination percentage of primed seeds achieved at 35°C has varied, ranging from 50% to 80%. With the addition of BA to the priming solution, germination at 35°C was generally >90%, a germination percentage similar to that achieved at an ideal germination temperature (25°C). Previous reports using cytokinin to improve germination of lettuce at high temperatures relied on either leaving the growth regulator in contact with the seed during germination (Sharbles, 1973) or pregerminating the seed directly in cytokinin solutions at low temperature and then transferring the seed to the high temperature (Smith et al., 1968). The results from the former procedure were generally more favorable, while those from the latter usually led to <50% germination.

Germination at 35°C in a soilless
mix was improved 2-fold for ‘Montello’ and 4-fold for ‘Green Lakes’ when BA was added to the priming solution. Heydecker and Joshua (1977) observed reduced germination at 29°C when kinetin-soaked lettuce seeds were germinated in a potting mix instead of petri dishes. Under the conditions of the laboratory experiments, 100 mg BA/liter was sufficient for most lettuce seed lots to reach >90% germination at 35°C, without any adverse effects on the seedling.

Lettuce seed priming appears to be most effective when high-quality seeds are soaked at 15°C in aerated osmotic solutions (salt or polyethylene glycol) at concentrations that prohibit radicle growth. The addition of cytokinin improves the overall effectiveness of the priming treatment and tends to reduce treatment variances due to seed source or cultivar.

**Literature Cited**


