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The Effect of 6-Benzylaminopurine (BAP) on Bud-Forcing of Twelve *Quercus* L. Species

Andrea Brennan[1], Valerie Pence[2], Matthew Taylor[3], Brian Trader[3], and Murphy Westwood[4]

[1]Longwood Graduate Program, University of Delaware, Newark, DE, USA, abrennan@udel.edu

[2]Cincinnati Zoo & Botanical Garden, Cincinnati, OH, USA

[3]Longwood Gardens, Kennett Square, PA, USA

[4]The Morton Arboretum, Lisle, IL, USA

Andrea Brennan

Abstract

One method of propagating oaks (*Quercus* L.) is micropropagation using young, newly flushed shoots collected in the spring. This is a narrow and somewhat unpredictable time window for obtaining explants. However, forcing bud break of cuttings can increase the time range to collect young shoot explants and allow for shoot development in a controlled, clean environment. The objective of this experiment was to determine the effectiveness of 6-benzylaminopurine (BAP), a cytokinin, on bud break in twelve *Quercus* species.

Dormant cuttings of *Quercus* were collected in February in Pennsylvania. The experiment was a factorial design with 12 species, 3 BAP treatments (0, 100, and 500 ppm) and 3 replications, giving a total of 108 cuttings. Each of the 3 repetitions were placed into Erlenmeyer flasks with distilled water and placed in a greenhouse. Cuttings were evaluated weekly and rated on a scale of 0-4 with 0 = no development and 4 = target stage for shoot tip micropropagation.

Results indicate that overall, the BAP treatment had significant effects, but responses varied by species. BAP treatment at 100 or 500 ppm significantly increased the rate of bud break and shoot elongation for four of the *Quercus* species, but had little to no significant effect on the remaining eight species. All but 3 *Quercus* species reached stage 4 with all treatments, indicating that forcing bud break without BAP application is a viable option, but the rate may be enhanced with some species by the application of BAP.

Figure 1: Bud-forced *Quercus variabilis* with developing shoot

Introduction

- Oaks (*Quercus* L.) are valued globally for their strong economic, ornamental, and ecological contributions, but despite their importance, many species of *Quercus* are under threat from a wide range of global issues (Oldfield and Eastwood 2007).
- One method of saving threatened species is micropropagation using newly-flushed shoot tips (Figure 2) (Kramer and Pence 2012).
- Natural shoot emergence in the spring is a narrow and somewhat unpredictable time window, but forcing bud break of cuttings can increase this window in a controlled environment (Vieitez et al. 1994).

Figure 2: Young shoot tips of *Quercus rubra* in spring

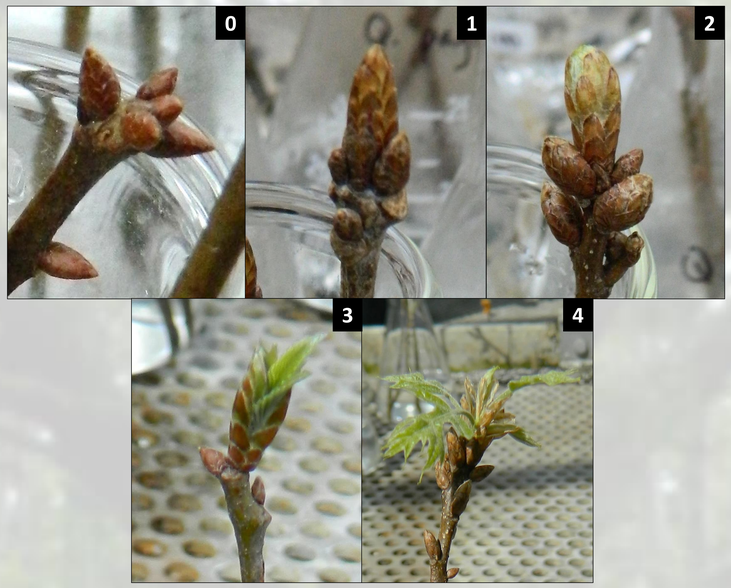
Experimental Objective

To determine the effectiveness of 6-benzylaminopurine (BAP), a cytokinin (hormone that promotes cell division), on bud break in twelve *Quercus* species

Materials and Methods

- **12 species of *Quercus***: *alba, bicolor, cerris, falcata, imbricaria, macrocarpa, macrocarpa* var. *macrocarpa, pagoda, palustris, rubra, texana,* and *variabilis*
- **Cuttings**: Terminal, measuring 10-33 cm in length with 5-25 buds each (varied by species)
- **Location & Timing:** Kennett Square, Pennsylvania, in mid-February during temperatures of -16 to -5°C
- **Experiment:** Factorial design with 12 species, 3 BAP treatments, and 3 replications (108 cuttings in total)
- **Treatments:** 3 BAP treatments at 0 ppm, 100 ppm, and 500 ppm applied weekly by paint brush until runoff
- **Conditions & Environment**: The 3 repetitions for each species and treatment were each placed into Erlenmeyer flasks with distilled water (changed weekly) and placed in a greenhouse (heat set point of 20°C; cooling set point of 26.5°C)
- **Evaluation:** Weekly; bud development was rated on an activity level scale of 0-4 with 0 = no development and 4 = target for shoot tip micropropagation (Figure 3)

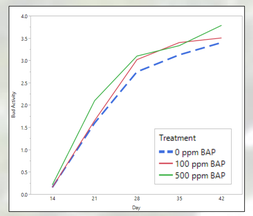
Figure 3: Bud activity evaluation scale



Results and Discussion

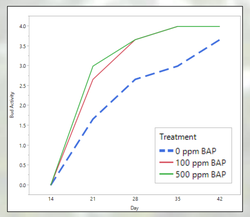
- Results indicate that overall, the BAP treatment had significant effects on the *Quercus*, but responses varied by species (Figures 4 & 5).

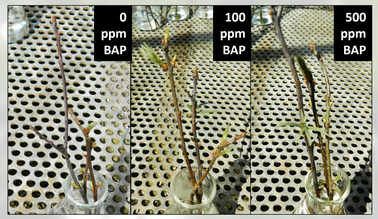
Figures 4 & 5: All *Quercus* species – mean bud activity (left) and cuttings, day 35 (right)



- The BAP treatment at 100 or 500 ppm significantly increased the rate of bud break and shoot elongation for four of the *Quercus* species: *imbricaria* (Figures 6 & 7)*, macrocarpa, pagoda,* and *variabilis*.

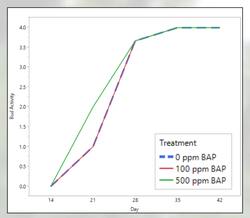
Figures 6 & 7: *Q. imbricaria* (as an example species significantly affected by BAP treatment) – mean bud activity (left) and cuttings, day 35 (right)

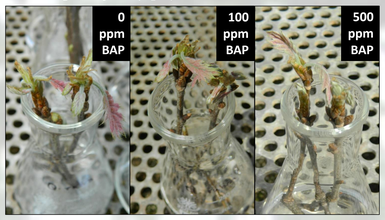




- There was little to no significant effect from BAP application on the remaining eight species: *alba, bicolor, cerris, falcata, macrocarpa* var. *macrocarpa, palustris, rubra* (Figures 8 & 9)*,* and *texana.*

Figures 8 & 9: *Q. rubra* (as an example species not significantly affected by BAP treatment) – mean bud activity (left) and cuttings, day 35 (right)





Conclusion

The effect of BAP on *Quercus* bud-forcing varied by species and all species except *alba, bicolor*, and *pagoda* reached stage 4 with all treatments. This indicates that forcing bud break without BAP application is a viable option, but the rate may be enhanced with some *Quercus* species by the application of BAP.

Literature Cited

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