Effects of Boron Deficiency on Geranium Grown under Different Nonphotoinhibitory Light Levels

Apart from a role in cell wall structure, specific functions for boron (B) in plants are unclear; hence, responses and adaptations to B stress are incompletely understood. It is thought that with B deficiency, alterations in carbohydrate metabolism may be a key adaptation. The objective of this study was to investigate the early effects of B deficiency on photosynthesis and how carbohydrate status might affect plant responses to B deficiency.

Geranium (Pelargonium x hortorum L.H. Bailey cv. Nittany Lion Red) were grown hydroponically and then exposed to normal (45 µM) or deficient (0 µM) B at two light levels [100 or 300 µmol·m⁻²·s⁻¹ photosynthetically active radiation (PAR)]. Photosynthesis [net CO₂ uptake, carboxylation, and photosystem II (PSII) efficiency] was monitored for 5 days, as were concentrations of B, chlorophyll, soluble sugars, total protein, and several photosynthetic and stress proteins.

As expected, B deficiency generally decreased the concentration of B in most tissues at both light levels. Steady state photosynthesis (Pₙ) and carboxylation efficiency (CE), which is proportional to rubisco activity (rubisco concentration and activation state), decreased significantly by acute B deficiency, but effects were delayed under higher light conditions (Figure 1). PSII was not damaged by B deficiency.

Growth of plants in high light increased the concentration of soluble sugars in leaves over those in low light; however, the reverse was true in roots (Figure 2). Acute B deficiency had no effect on the sugar concentration of tissues. Chlorophyll concentration decreased, and Mn-SOD increased transiently with B deficiency at both light levels, but no other effects of acute B deficiency were observed. Thus, in geranium, photosynthesis is affected by B deficiency before effects on leaf growth, and higher light can temporarily ameliorate B deficiency, perhaps partly due to enhanced carbohydrate status.

![Figure 1](image1.png)

![Figure 2](image2.png)


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