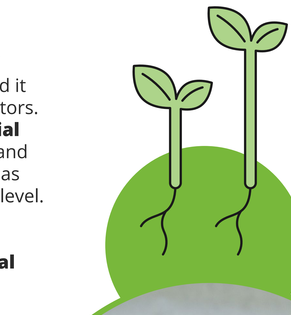
The combined effects of light intensity, temperature, and water potential on wall deposition in regulating hypocotyl elongation of *Brassica rapa*

BACKGROUND

Hypocotyl elongation is a critical sign of seed germination and seedling growth, and it is regulated by multiple environmental factors. **Light, temperature, and water potential are the major environmental stimuli**, and their regulatory role in hypocotyl growth has been extensively studied at the molecular level.

However, **where signaling process of light, temperature, and water potential converges to modulate hypocotyl elongation** is still unclear.



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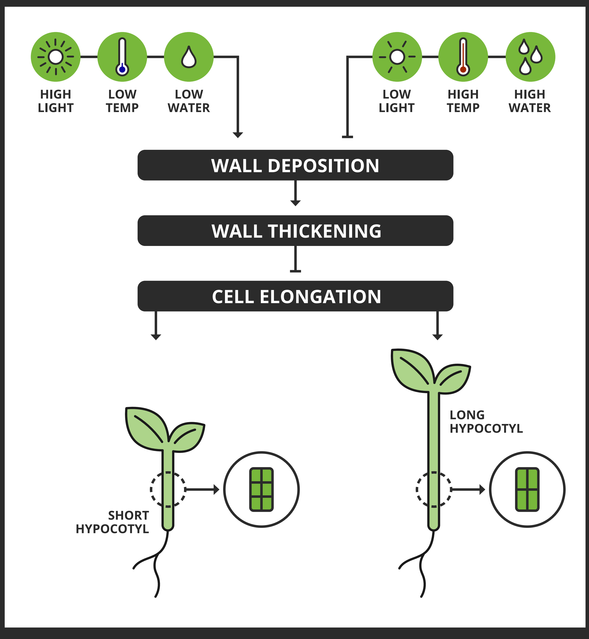
RESULTS

In the present study, we found that the **cell wall was the shared target of three environmental factors regulating hypocotyl elongation**. This was discovered by analyzing the extension kinetics of hypocotyl and the changes in the hypocotyl cell wall of *Brassica rapa* under the combined effects of light intensity, temperature, and water potential. These three environmental factors regulated hypocotyl cell elongation both in isolation and in combination. Cell walls thickened, maintained, or thinned depending on growth conditions and developmental stages during hypocotyl elongation.



Further analysis revealed that the imbalance in wall deposition and hypocotyl elongation led to dynamic changes in wall thickness. Low light repressed wall deposition by influencing the accumulation of cellulose, hemicellulose, and pectin; high temperature and high water potential had significant effects on pectin accumulation overall.

CONCLUSIONS

It was concluded that wall deposition was tightly controlled during hypocotyl elongation, and that low light, high temperature, and high water potential promoted hypocotyl elongation by repressing wall deposition, especially the deposition of pectin.

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