

# Above and belowground traits vary in response to soil moisture availability and plant competition

September 14 2022, by Zhang Nannan

---



Credit: CC0 Public Domain

Functional traits have been used to explain plant responses to alterations in water availability. Our understanding of plant responses to biotic and

abiotic drivers are largely based on aboveground plant traits. Due to the limited consideration of belowground plant traits, a general view of plant water use strategies remains elusive.

In a study published in *Annals of Botany*, researchers from the Xishuangbanna Tropical Botanical Garden (XTBG) of the Chinese Academy of Sciences tried to examine and compare the response of above and belowground traits, and patterns of biomass allocation to soil moisture and plant [competition](#) treatments.

The researchers chose seedlings of five tropical tree species and grew them in a greenhouse for 16 weeks under a soil moisture gradient (low (drought), medium, and high (well-watered) moisture levels) with and without intraspecific competition. At harvest, they measured nine above and five belowground traits of all seedlings based on standard protocols.

They found that above and belowground traits have heterogeneous responses and inconsistent correlations to soil moisture availability and plant competition. In response to the soil moisture gradient, aboveground traits are found to be consistent with the leaf economics spectrum whereas belowground traits are inconsistent with the root economics spectrum. Specific leaf area was positively correlated with specific root length, while it was negatively correlated with root average diameter across moisture levels. However, leaf dry matter content was unexpectedly positively correlated with both specific root length and [root](#) branching index.

Intraspecific competition has influenced both above and belowground traits, but interacted with soil moisture to affect only belowground traits. Biomass allocation to above and belowground plant organs across the soil moisture gradient, however, does support functional equilibrium theory where relatively larger proportions of biomass were allocated in organs capturing limited water resource for growth.

"Our results indicate that the response of belowground traits to plant intraspecific competition and [soil moisture](#) conditions may not be inferred using aboveground traits. The plants may use a range of ecological strategies in response to varying [environmental changes](#)," said Yang Jie of XTBG.

**More information:** Mengesha Asefa et al, Above and belowground plant traits are not consistent in response to drought and competition treatments, *Annals of Botany* (2022). [DOI: 10.1093/aob/mcac108](https://doi.org/10.1093/aob/mcac108)

Provided by Chinese Academy of Sciences

Citation: Above and belowground traits vary in response to soil moisture availability and plant competition (2022, September 14) retrieved 9 April 2024 from <https://phys.org/news/2022-09-belowground-traits-vary-response-soil.html>

<p>This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.</p>
--