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Carbon and nitrogen allocation strategy in *Posidonia oceanica* is altered by seawater acidification

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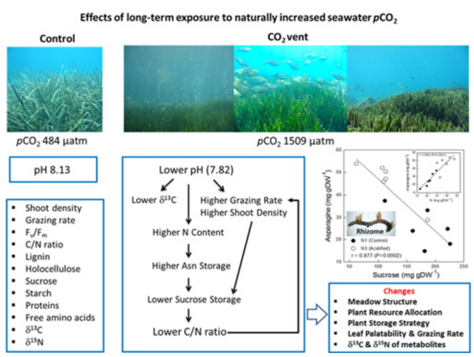
HIGHLIGHTS

- Under ocean acidification *P. oceanica* is able to modulate C and N allocation strategy.
- Acidification lowers C:N ratio and promote grazing rate.
- Sucrose reserves are mobilized for shoot recruitment and Asn synthesis in rhizomes.
- Starch is not affected ensuring a buffering capacity to environmental perturbation.
- Acidification alters $\delta^{13}C$ and $\delta^{15}N$ in metabolites and organs.

GRAPHICAL ABSTRACT



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ABSTRACT

Rising atmospheric CO_2 causes ocean acidification that represents one of the major ecological threats for marine biota. We tested the hypothesis that long-term exposure to increased CO_2 level and acidification in a natural CO_2 vent system alters carbon (C) and nitrogen (N) metabolism in *Posidonia oceanica* L. (Delile), affecting its resilience, or capability to restore the physiological homeostasis, and the nutritional quality of organic matter available for grazers. Seawater acidification decreased the C to N ratio in *P. oceanica* tissues and increased grazing rate, shoot density, leaf proteins and asparagine accumulation in rhizomes, while the maximum photochemical efficiency of photosystem II was unaffected. The ^{13}C-dilution in both structural and non-structural C metabolites in the acidified site indicated quali-quantitative changes of C source and/or increased isotopic fractionation during C uptake and carboxylation associated with the higher CO_2 level. The decreased C:N ratio in the acidified site suggests an increased N availability, leading to a greater storage of ^{15}N–enriched compounds in rhizomes. The amount of the more dynamic C storage form, sucrose, decreased in rhizomes of the acidified site in response to the enhanced energy demand due to higher shoot recruitment and N compound synthesis, without affecting starch reserves. The ability to modulate the balance between stable and dynamic C reserves could represent a key ecophysiological mechanism for *P. oceanica* resilience under environmental perturbation. Finally, alteration in C and N dynamics promoted a positive contribution of this seagrass to the local food web.

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