EGU22-8975
https://doi.org/10.5194/egusphere-egu22-8975
EGU General Assembly 2022

Short-term responses of *Inga edulis* Mart. seedlings growing under elevated CO_2 and phosphorus addition: understanding potential phosphorus constraints on plant responses to elevated CO_2 in the understory of a central Amazon forest

Gabriela U. Neves[1], Vanessa R. Ferrer[1], Sabrina Garcia[1], Vinicius F. de Souza[2], Tomas Domingues[3], Izabela Aleixo[1], Henrique Tozzi[4], Pedro A. C. L. Pequeno[5], Nathielly P. Martins[1], Alacimar Guedes[1], Iokanam S. Pereira[1], Juliane C. G. Menezes[1], Amanda R. M. Damasceno[1], Yago R. Santos[1], Maquelle N. Garcia[1], Anna C. M. Moraes[1], Ana Caroline M. Pereira[1], Bart Kruijt[6], Carlos A. N. Quesada[1], and the AmazonFACE Team[*]

[1]National Institute of Amazonian Research
[2]Estonian University of Life Sciences, Tartu, Estonia
[3]University of São Paulo, São Paulo, Brazil
[4]São Paulo State University, São Paulo, Brazil
[5]Federal University of Roraima, Boa Vista, Brazil
[6]Wageningen University & Research, Wageningen, Netherlands
[*]A full list of authors appears at the end of the abstract

The increase in atmospheric CO_2 concentration positively affects plant carbon assimilation and carbon stock in different biomes. However, there are uncertainties regarding how plants in tropical forests, especially in the Amazon rainforest, will respond to this increase, since a large part of the soils in the region present natural low phosphorus (P) availability, which could constrain positive effects of elevated CO_2. Here, we investigated if P addition would interfere on leaf primary carbon metabolism and aboveground development responses under elevated CO_2. For that, we used 46 seedlings of *Inga edulis* Mart., a native leguminous nitrogen-fixing species, exposed for 10 months (November 2019 - September 2020) to CO_2 and P treatments. Plants grew in pots - half with natural P availability (-P) and half with P addition (+P) -, inside CO_2 enrichment chambers - half with ambient CO_2 (aCO_2) and half with elevated CO_2 (aCO_2 + 200 ppm; eCO_2), - in the understory of a primary forest in Central Amazonia, Manaus, Brazil. A factorial experimental design was used, with 11-12 plants for each treatment: aCO_2-P (control), aCO_2+P, eCO_2-P and eCO_2+P. To assess the carbon metabolism, we measured light-saturated net CO_2 assimilation (A_{sat}), leaf respiration in the light (R_{light}), leaf respiration in the dark (R_{dark}) and photorespiration (P_R). To assess aboveground development, we measured plant height and diameter, crown height and diameter, number of leaves and total leaf area. We found that eCO_2, regardless of P availability, significantly increased A_{sat} and R_{light}, while decreasing R_{dark} and A_{sat}:R_{dark} ratio, but it did not affect P_R. Those results suggest that seedlings indeed assimilated more carbon under eCO_2. However, irrespective of CO_2 treatment, +P significantly increased aboveground responses. Under P addition, plants

showed greater height and greater crown development (higher crown height and diameter and larger leaves) compared to control or eCO_2-only. Plant diameter and number of leaves did not respond to any treatment. We did not find differences between +P seedlings under different CO_2 treatments (aCO_2+P and eCO_2+P), indicating that only P had an effect on these responses. Still, there were substantial changes on some of the aboveground responses between these treatments, particularly in total leaf area which increased 60% (aCO_2+P) and 126% (eCO_2+P) compared to control. Overall, we observed a distinguished pattern, in which eCO_2 mainly affected physiological responses, while P addition consistently affected aboveground development. The lack of response of aboveground components under eCO_2 suggests that the extra carbon assimilated was not necessarily used to aboveground development as shown by many studies. Our findings indicate that, in the short-term, eCO_2 is highly important in determining changes in plant metabolism whereas it has little impact on growth, even when nutrient limitation is alleviate. However there is still need to understand if such responses will persist in the long-term and in other species, as these processes are key factors in determining forest responses to climate change.

AmazonFACE Team: From the National Institute of Amazonian Research: Bruno T. T. Portela[1].
From University of Campinas: David M. Lapola