Title: *Funneliformis mosseae* improves growth and nutrient accumulation in wheat by facilitating soil nutrient uptake under elevated CO_2 at daytime, not nighttime

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Abstract (300 words limitation)

Almost all reports of plant responses to elevated CO_2 (eCO_2) concentrations have been executed under equal CO_2 concentrations over daytime and nighttime, while ambient CO_2 (ACO_2) can be 10-20 % greater during nighttime than during daytime. A simulation of currently atmosphere daytime or nighttime CO_2 concentrations would provide a closer observation on how plants could respond to forthcoming CO_2 rising. Arbuscular mycorrhizal fungus (AMF) always improves plant nutrient absorption and growth. However, interactive effects of eCO_2 and AMF on accumulations of carbon (C), nitrogen (N), phosphorus (P) and potassium (K) in plant and soil, and thus plant growth are rarely elucidated. To understand mechanisms of eCO_2 plus AMF on crop growth and soil fertility, wheat (*Triticum aestivum* cv. Yunmai) were grown over 12-weeks under plus or minus AMF (*Funneliformis mosseae)* inoculation and four CO_2 concentrations, i.e. (1) daytime/nighttime ACO_2 (410/460 ppm), (2) sole daytime eCO_2 ($DeCO_2$, 550/460 ppm), (3) sole nighttime eCO_2 ($NeCO_2$, 410/610 ppm), and (4) dual daytime+nighttime eCO_2 ($(D+N)eCO_2$, 550/610 ppm). Biomass of shoot and root, accumulations of plant C, N, P and K, activities of soil invertase and urease generally significantly enhanced, while concentrations of shoot and root N, P and K, and soil available N, P and K decreased under $DeCO_2$, $NeCO_2$ and $(D+N)eCO_2$. Compared with non-AMF control, effects of *F. mosseae* on above-mentioned characteristics were significantly positive under ACO_2, $DeCO_2$ and $(D+N)eCO_2$, while on accumulations of plant biomass, C, N, P and K were negative under $NeCO_2$. *F. mosseae* association generally mitigated soil nutrient restraints on wheat's response to $DeCO_2$, while $NeCO_2$ reduced AMF's positive effects on wheat. These results demonstrated that integrations of AMF's benefits to crops growing under natural habitats of $DeCO_2$ and/or $NeCO_2$ are vital in managing potential long-term consequences of forthcoming CO_2 rising on worldwide farming systems.

Keywords: Arbuscular mycorrhiza; biomass production; enzyme activity; nitrogen; phosphorus; potassium

Note: This abstract has been now rewritten from the previous sciforum-082918 (oral accepted but withdrawn by the editor due to > 50 % repetition mostly from the background and experiment design information)