Geophysical Research Abstracts
Vol. 19, EGU2017-11949, 2017
EGU General Assembly 2017

Response of detritus food web and litter quality to elevated CO_2 and crop cultivars and their feedback to soil functionality

Zhengkun Hu (1), Xiaoyun Chen (1), Chunwu Zhu (2), Michael Bonkowski (3), Shuijin Hu (4), Huixin Li (1), Feng Hu (1), and Manqiang Liu (1)

(1) Nanjing Agricultural University, Soil ecology, Collage of resources and environmental sciences, China (zhengkunhu@sina.com), (2) State Key Laboratory of Soil and Sustainable Agriculture, Institute of Soil Science, Chinese Academy of Sciences, Nanjing, 210008, China (cwzhu@issas.ac.cn), (3) Department of Terrestrial Ecology, Institute of Zoology, University of Cologne, D-50674 Köln, Germany (m.bonkowski@uni-koeln.de), (4) Department of Entomology and Plant Pathology, North Carolina State University, Raleigh, NC 27695, USA (shuijin_hu@ncsu.edu)

Elevated atmospheric CO_2 concentrations (eCO_2) often increase plant growth and alter the belowground detritus soil food web. Interactions with agriculture management may further modify soil process and the associated ecosystem functionality. Little attention, however, has been directed toward assessing the responses of soil food web and their feedback to soil functionality, particularly in wetland agroecosystems.
We report results from a long-term free air CO_2 enrichment (FACE) experiment in a rice paddy field that examined the responses of detritus food webs to eCO_2 (200 ppm higher than ambient CO_2 (aCO_2)) of two rice cultivars with distinctly weak and strong responses to eCO_2. Soil detritus food web components, including soil microbes and microfauna, soil environment as well as resources availability variables, were determined at the rice ripening stage. To obtain the information of soil functionality, indicated by litter decomposition and enzyme activities, we adopted a reciprocal transplant approach that fully manipulate the factors of litter straw and food web components for the incubation of 120 days.
Results about the field investigation showed that eCO_2 lead to a higher C/N ratio of litter and soil compared to aCO_2, especially for the strong responsive cultivar. eCO_2-induced enhanced carbon input stimulated the fungal decomposition pathway by increasing fungal biomass, fungi: bacteria ratio and fungivorous nematode. Results from the manipulative incubation experiment showed eCO_2-induced lower quality of straw decreased cumulative C mineralization, but changes in detritus food web induced by eCO_2 and strongly responsive cultivar lead to an increased CO_2 respiration coincidently within each straw type, mainly due to the adaption to the high C/N ratio environment which increased their functional breadth. Based on SEMs and curves of carbon mineralization rate, soil communities showed significant effects on C release at the early stage through mediating enzyme activities involved in carbon and nutrient cycling.
Our results indicated that resource quality played a pivotal role in mediating soil functionality as it primarily determined the rate and degree of decomposition, but soil community composition could modify how resource quality affected this soil process. eCO_2 and crop cultivar migration significantly altered straw quality and soil community composition, and thus affected soil functioning. Our findings highlight that alterations of soil functional guilds under future climate and appropriate agricultural strategy change the carbon and nutrient cycling of ecosystem.

Key-words: Global change; Nitrogen input; Crop cultivar; Rhizosphere food webs; Root microbiome; Microbial community; Soil fauna