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Individualistic and Interactive Effects of Elevated CO_2 and O_3 on Structural and Functional Diversity of Soil Microbial Community in Wheat

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Abstract—*The atmospheric CO_2 and tropospheric O_3 concentrations are constantly rising due to the anthropogenic activities. Effects of elevated CO_2 (ECO_2) and O_3 (EO_3) not only alter plant growth but have the potential to exert variable impact on the structure and functioning of soil microbial communities in terrestrial ecosystems. Soil microbes critically affect plant and ecosystem responses to climate change by modulating decomposition of organic compound and cycling of nutrients. Moreover, soil microbial enzyme activities are the direct expression of the soil community to metabolic requirements and available nutrients. We hypothesized that ECO_2 and EO_3 would significantly affect the structure, abundance, functional composition, organic matter dynamics and metabolic response of soil microbial communities. Thus, present study was conducted with the objective to assess the effects of ECO_2 and EO_3 on soil microbial community and the ecosystem level processes they mediate with wheat as the experimental crop.*

The experiment was in Free-Air CO_2/O_3 enrichment technology with four treatments viz., Control, Elevated CO_2 (550±50ppm), Elevated O_3 (60±10ppb) and Elevated CO_2 + Elevated O_3. Soil sampling was done at critical stages of crop growth namely pre-sowing, CRI, anthesis and maturity. Shannon diversity index indicated that the microbial richness and abundance increases under ECO_2 and decreased under EO_3. Microbial biomass also followed similar pattern. Soil microbial biomass, soil extracellular enzymatic activity, along with N-availability were observed to be most sensitive indicators of soil quality, which significantly varied in response to ECO_2 and EO_3. This study provides the information regarding soil microbial community functions under projected climate change scenario especially in agro-ecosystems of Northern Indian agro-ecosystem which can be used for in depth scientific analysis.

Keywords*: Elevated CO_2, Elevated O_3, Soil microbial community, Microbial biomass, N-availability.*

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