Towards the development of field methods to characterize environmental controls on rhizosphere priming effects

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We sought to better understand how precipitation and temperature mediate the magnitude and biogeochemical consequences of rhizosphere priming effects, as a first step to improving representations of root-microbe interactions in ecosystem and earth system models. We conducted two field experiments at the Boston-Area Climate Experiment (BACE) - an old-field ecosystem subjected to experimental changes in precipitation (-50% and +50% of ambient precipitation) and warming (from +1°C to +4°C above ambient) since 2008. In experiment one, we quantified how warming and precipitation influence the magnitude and fate of root- and mycorrhizal-derived C inputs. Over a four-month period, root production was greater than hyphal production, although warming had opposite effects on roots (decreased) and hyphae (increased). Greater inputs of root- and mycorrhizal-derived C enhanced microbial activity and accelerated nutrient cycling, especially phosphorus (P) availability. In a second field experiment, we released to soil root exudate mimics of varying chemical quality semi-continuously for four weeks. We found that changes in exudate quality had small but significant effects on microbial processes, often interacting with N availability and temperature-induced changes. Our preliminary results provide some of the first field-based estimates of the extent to which changes in soil moisture and temperature may directly and indirectly alter SOM dynamics via rhizosphere processes, and lay the groundwork for the development of mechanistic models of SOM decomposition under climate change.