Cropping system modulates the effect of drought on Ammonia-oxidizing communities

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The severity of droughts is predicted to increase across Europe due to climate change. Droughts can substantially impact terrestrial nitrogen (N) cycling as well as the corresponding microbial communities. Here, we investigated how ammonia-oxidizing bacteria (AOB), archaea (AOA), and comammox respond to simulated drought in a rainout shelter experiment in the long-term DOK field trial comparing organic and conventional agricultural practices since 1978. This study is part of the MICROSERVICES (BiodivERsA) project aiming to understand and predict the effects of climate change on crop-associated microbiome and ecosystem functions. For this purpose, we monitored the diversity, composition, and abundance of ammonia-oxidizers for five months by Illumina sequencing and quantitative real-time PCR using the *amoA* gene as molecular marker.

We found that the effect of drought varied depending on the ammonia-oxidizing community but also on the agricultural practices. The community structures of AOA and comammox were more strongly affected by drought compared to the AOB community structure. Drought also had a stronger impact on the community structure in the biodynamic (organic) cropping system than in the conventional systems. The abundance of ammonia oxidizers was influenced by drought with comammox Clade B exhibiting the strongest sensitivity to drought. We further found a significant effect of the interaction between drought and agricultural practices on the abundance of all ammonia-oxidizers groups except AOB. In summary, our study showed that the impact of drought was modulated by agricultural practices and varied with time as well as among ammonia-oxidizer members. These results highlight the importance of agricultural management practices for the response of the ammonia-oxidizing community to drought.