Submitted Abstract

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First Author First Name Last Name	 Elena (1) Tello-García
Submitting Author First Name Last Name	 Elena Tello García
Correspondence	elena.tello-garcia@uibk.ac.at
Co-Authors **>> E-Mails will be not listed**	Mandolini, Edoardo (2); Tasser, Erich (3); Probst, Maraike (2); Peintner, Ursula (2); Tappeiner, Ulrike (1); Leitinger, Georg (1)
Organisations	1: Department of Ecology, University Innsbruck, Austria 2: Department of Microbiology, University Innsbruck, Austria 3: Institute for Alpine Environment, Eurac Research, Bozen, Italy
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Abstract

Drought compromises water availability, affects biomass productivity and acts as a filter that determines which plant species or functional groups persist. In grasslands, usually legumes such red clover (Trifolium pratense) are more influenced by drought than other functional groups like grasses or herbs. How plant species cope with stressors like drought depends mostly on their functional traits. Recently, it has been increasingly emphasized the importance of the belowground plant traits and the resulting plant-soil interactions in the plant's response to climate change. Plant roots host symbiotic microbes like arbuscular mycorrhiza fungi that enhance water retention and pathogen defence, or Rhizobia, which provide nitrogen to the plant. In this study, we analyse the effects of drought on plant-soil interactions and plant traits of red clover (Trifolium pratense), as well as how they affect plant productivity. To do so, we performed an experiment with pots with a soil collected in a meadow used for hay production located in the Austrian Alps. Half of the pots were filled with native soil, and the others were filled with the same soil, but sterilized. In these pots, we planted red clover and simulated two drought periods. We saw that the disruption of the soil microbial community by sterilization caused an increase in plant productivity under humid conditions. However, red clover in sterilized soil decreased productivity significantly under drought. Plant individuals showed a fast growth at the beginning of both drought periods, enhanced by a change on the plant traits. Leaves got thicker and smaller, the stomata density decreased, while roots got longer and thinner to increase the root absorption area. However, red clover in native soil did not show big changes on plant traits caused by drought, but had similar productivity than the humid variant. Therefore, we conclude that a stable plant-soil system with a more diverse microbial community and a higher abundance of Rhizobia can cope with drought easily, showing a conservative strategy. While in a disrupted system caused by sterilization, plants can grow faster because they give less energy to the few microorganisms, but they are less supported by the microorganisms under drought. Even when red clover changes plant traits, it is not enough to maintain the productivity rate that it had in humid conditions.