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Influence of mowing frequency on N competitions between plant and microorganisms of temperate grasslands under extreme drought

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Global warming is predicted to have large effects on local climatic events in Central Europe such as the occurrence of summer droughts during growing seasons. This could impact on the N distribution between plants and soil microbes. We test the effects of simulated extreme droughts combined with mowing frequency on semi natural grassland during one growing season. The changes in the N competition strength of plants and microorganisms were quantified through the fraction of inorganic N uptake by the plants and microorganisms (1, 4 and 16 days) after the application of a concentrated solution of labeled ammonium nitrate ($N15H4\text{-}N15O_3$) in the upper soil. Extreme droughts were simulated for late spring and summer seasons using a rain out shelter system and reducing water income with an equivalent of 1000-year drought. The control was a weekly average of the rain from the last 30 years. Mowing regimes were organized into two and four mowing a year. The microbial biomass and microbial N did not differ significantly for different drought scenarios. Mowing regimes seems to have a positive impact on the microbial and plant biomass and on the N-status. Rapid microbial N-uptake: 10 - 20% already after 1 day, 20 - 30% after 4 days. Rapid N-inclusion in plants: 10 - 50% after 1 day. Summer drought favors N-inclusion in plants, much more than spring drought. This shows that mowing frequency and extreme drought have positive N-inclusion for plants, improving the N-supply after mowing (less biomass and higher N-inclusion). Adaptation strategies of microorganisms improve N-supply in the short-term. We conclude that mowing frequency is a good management strategy to induce adaptation strategies on semi grassland ecosystems.

Key words: climate variability; mowing frequency; summer drought; plant and microbial biomass; N15; N-inclusion; N-uptake.