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Temporal variation in the nitrogen uptake competition between plant community and soil microbial community

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1. Subalpine grasslands are characterized by important seasonal variations and like in others cold environments, the existence of seasonal variations of nitrogen (N) dynamics is strongly plausible. It has been shown that plants and microbes were in competition for nitrogen acquisition mainly during the growing season and particularly at plant biomass peak. During snowmelt, plants could benefit from a decrease in competition potential by microbes given a greater N uptake and freeze-thaw cycles restricting microbial growth. In managed grasslands, these probable interactions are furthermore influenced by recent changes in management, and associated modifications in plant and microbial communities. A previous isotope tracing experiment during the biomass peak suggested that in more intensely managed grasslands, plants exerted a greater control over N cycling than microorganisms, and that soil N availability was stimulated by a greater nitrogen uptake by plants and microbes allowing nutrients to be more readily returned to the soil.
2. A pulse of 15N was added to estimate if the dynamics of N uptake between plants and microbes observed at the biomass peak was applicable at snowmelt. We also asked if the modifications of N dynamics observed depend on management activities across four different grassland types representing decreasing management intensities, from formerly cultivated terraces, either mown or only lightly grazed to unterraced permanent grasslands, either mown or only very lightly grazed.
3. In all grasslands, N pools of aboveground plants were smaller in May than in July while root N pools were greater, and the intrinsic plant uptake was 2 at 5 times weaker in May. N microbial pools were higher in May that in July, while microbial N uptake was 10 to 100 times smaller during snowmelt than at the biomass peak. In spite of the fact that microbial N pools were still larger than the plant N pool, in terms of plants vs microbes competition for N, a microbe N uptake / plant N uptake ratio in favour of plant communities showed that that plants were more competitive than microbes for N acquisition in May, contrary to previous observations in July. Management had no effect on this change in N dynamics.
4. Like in alpine ecosystems, subalpine grasslands are subjected to temporal variations in plants and microbes N acquisition with during snow melt a change of N partitioning in favour of plant communities which can acquire a greater quantity of nitrogen than microbial communities. The microbial capacity to compete for N appeared limited by successive freeze-thaw cycles which decrease microbial N pools, and thereby benefitting plants. However, this seasonal dynamics was not altered by management.