The underlying mechanisms of post-drought yield outperformance in *L. perenne*

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**Introduction** Reoccurring drought events can severely restrict forage production. However, experimentally drought stressed temperate forage grasslands have recently been reported to recover quickly after drought stress and re-wetting (DRW) and to be even more productive after drought than non-drought stressed control plots (Hofer et al., 2017; Hahn et al., in press). Although several studies show increased nutrient availability and microbial activity after DRW in grasslands (Bünemann et al., 2013; Sundert et al., 2020), an in-depth understanding if or how these mechanisms determine forage yield recovery is still missing.

**Methods** This study examined the effect of a 2-month experimental summer drought under different nitrogen (N) fertilizer applications on the recovery of high-input *Lolium perenne* swards after re-wetting. Yield performance, physiology, nutrient availability and soil microbial activity were assessed over 2 years during and after the drought treatment. In addition, a post-drought transplantation experiment of control and DRW soil and plants withdrawn from the field was conducted to disentangle plant physiological and soil nutrient cycling effects on yield recovery after drought.

**Results** Under all N applications, DRW outperformed the control yield in the field and showed higher N mineralization rates and higher soil N and K availabilities. Transplanted DRW plants showed longer but thinner leaves and decreased yields compared to control plants, irrespective of the soil's DRW treatment. In contrast, DRW soils induced strongly increased *L. perenne* yields (on average +25%) compared to control soils. In summary, our data show that despite impaired plant growth after DRW, formerly drought stressed swards surpass control yields by profiting of higher mineralization rates and higher nutrient availability.

**References**

