Morphological adaptations to water deficiency and recovery from drought stress in eight native grass species

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Introduction

As a consequence of climate change, periods of prolonged summer drought are expected to gain importance for temperate European biomes (BMBF 2003). The present study focuses on consequences of water deficiency on grassland productivity.

Methods

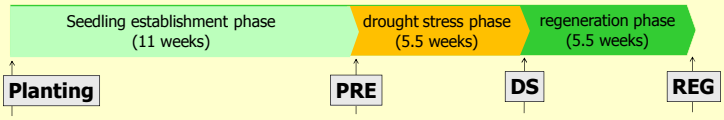
- 3-factorial pot experiment in greenhouse; 4 replications in randomized blocks

Table 1 Experimental design and factor levels

		Number of factor levels
Factor 1	plant species	8[i]
Factor 2	drought stress treatment	2[ii]
Factor 3	harvest date	2[iii]

[i] eight grass species and cultivars: *Agrostis stolonifera* cv. Barifera (agst); *Dactylis glomerata* cv. Horizont (dagl); *Deschampsia caespitosa* wild seeds (deca); *Festuca arundinacea* cv. Kora (fear); *F. rubra* cv. Tagera (feru); *Lolium perenne* cv. Premium (lope); *Poa pratensis* cv. Lato (poap); *P. trivialis* wild seeds (poat)
[ii] drought stress treatment (plant available soil water content: 10 %); control: well supplied with water (plant available soil water content: 70 %)
[iii] harvest dates DS and REG, see scheme below

- ten seedlings per species and pot planted in sand: vermiculite mixture (proportions of weight 92:8)
- complete shoot and root collected at three harvest dates:



PRE directly before drought stress treatment (one pot per species and block) – *data not shown here*

DS directly after drought stress treatment (one pot per species, treatment and block)

REG directly after regeneration phase (one pot per species, treatment and block)

- target variables:
  - tiller number per plant
  - Projected leaf area: scan of all green leaves of 10 tillers (one tiller per plant selected randomly), analysis with software WinRhizo
- Statistics: software package R (www.r-project.org)

Results

- species-specific response to drought stress in terms of tiller number and leaf area per plant (Fig. 1)
- At both harvest dates, species identity and drought stress treatment were highly significant explanatory factors for both tiller number and leaf area per plant (Table 2)

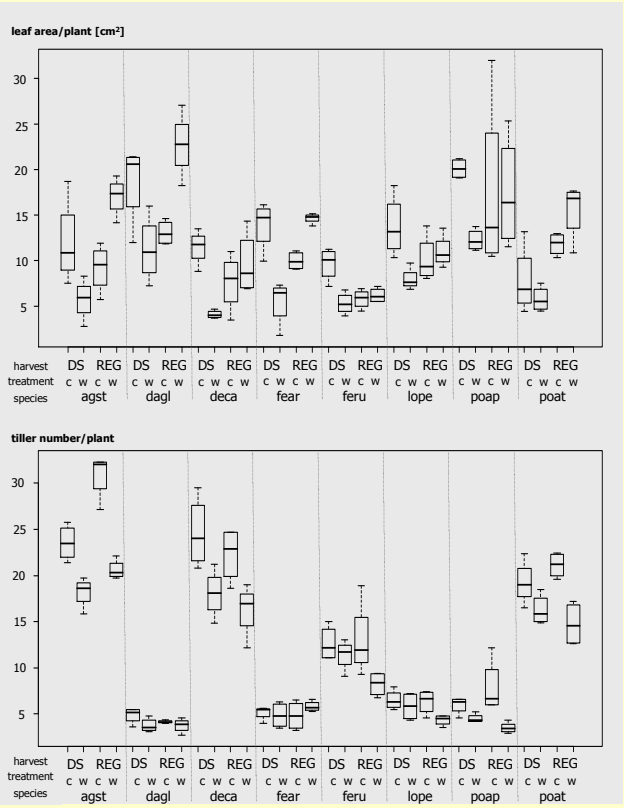


Fig. 1 Projected leaf area per plant (above) and tiller number per plant (below) in the investigated species directly after drought stress and after regeneration phase. DS: harvest directly after drought stress phase; REG: harvest directly after regeneration phase; w: water deficiency treatment; c: control. For species name abbreviations see Table 1

Table 2 Results of a two-way ANOVA on the experimental data. Significance levels: ***: $P < 0.001$; **: $0.001 < P < 0.05$; n.s.: not signif.

	DS		REG	
	leaf area/ plant	no. of tillers/ plant	leaf area/ plant	no. of tillers/ plant
species	***	***	***	***
treatment	***	***	***	***
species x treatment	n.s.	**	n.s.	***

Conclusion

Our results indicate species-specific drought tolerance strategies via different traits of organ priority under the conditions of environmental pressure.

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References

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