

Comparing physiological performance of two ecotypes of *Arundo donax* under drought

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Introduction

A. donax, (giant reed), is a widespread C₃ perennial grass originated from Asia. The biomass of this crop is used through different methods for energy production. High productivity, low input requirements and its adaptability to diverse environmental conditions make it an important bioenergy crop. *A. donax* is emitting isoprene, the most abundant biogenic volatile organic compound. Isoprene emission is suggested to prevent the oxidation of the photosynthetic apparatus under water deficit and enhanced drought tolerance. The water limitation in most of the land area directed the cultivation of bioenergy crops to marginal land with low water availability. However, due to the sterility of *A. donax* the conventional breeding is not possible. Therefore, finding drought tolerant ecotypes has a practical relevance for its cultivation in water limited regions.

Material & Methods

We compared a Bulgarian (BG) and Italian (IT) ecotype of *A. donax* under greenhouse conditions during drought exposure. Data for gas exchange (LI-COR), isoprene emission (PTR-MS) were obtained before, under different levels of drought, as well as recovery.

Results & Conclusions

- Drought induced isoprene emission in BG was associated with higher protection of the photosynthetic apparatus indicated by better recovery of Calvin cycle metabolism.
- High WUEi of *A. donax* under drought was due to the conserved control on stomatal conductance and reduction of water loss.
- In both ecotypes, drought impaired the photosynthesis at early stage by limitation of CO₂ diffusion and later at severe stage by biochemical limitation.
- Higher photorespiration of BG could contribute to a better protection of photosynthesis under drought.
- Enhanced photosynthesis of *A. donax* compared with other C₃ grasses is due to its high photosynthetic capacity rather than low photorespiration.
- Screening more ecotypes of *A. donax* to find drought tolerant ecotypes could be beneficial.

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Results

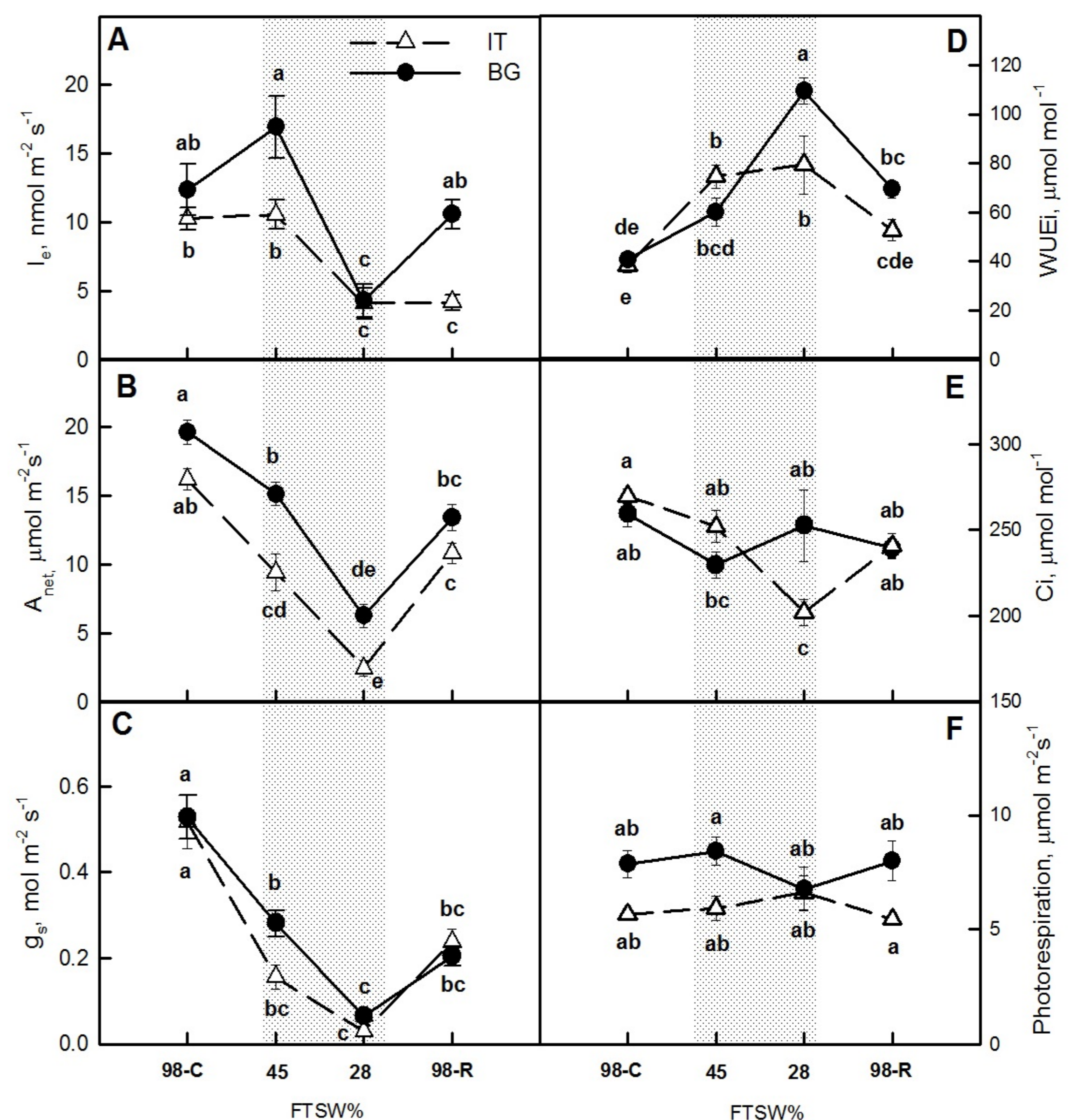


Figure. A) Isoprene emission, B) Photosynthesis, C) Stomatal conductance, D) Intrinsic water use efficiency, E) Intercellular CO₂ concentration, F) Photorespiration rate of Italian (IT) and Bulgarian (BG) ecotypes of *A. donax* at control, different levels of drought and recovery. FTSW: (fraction of transpirable soil water).

Table. Parameters obtained from fitting A-Ci responses curves measured at Control, mild (45% FTSW) and severe (28% FTSW) drought and recovery.

		Control	Mild drought	Severe drought	Recovery
J_{max}	IT	145.6 ± 5.7abc	121.1 ± 10.9bc	45.1 ± 1.7d	112.1 ± 5.9c
	BG	166.5 ± 7.6a	137.3 ± 18.2abc	57.9 ± 14.0 d	163.7 ± 8.9ab
V_{cmax}	IT	196.2 ± 15.9ab	161.5 ± 15.6b	58.6 ± 2.4c	167.4 ± 9.6b
	BG	210.0 ± 17.8ab	171.2 ± 28.7ab	75.6 ± 19.2c	253.1 ± 18.3a
TPU	IT	9.8 ± 0.3 abc	8.0 ± 0.8 bc	2.5 ± 0.2d	7.1 ± 0.4c
	BG	11.8 ± 0.6a	9.1 ± 1.3abc	3.6 ± 0.8d	10.5 ± 0.9ab