The Effect of recurrent drought on the efficiency of photosynthetic light use by fescue (*xFestulolium loliaceum* Huds. P. Fourn.)

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Introduction

Global climate change is expected to increase the frequency and severity of droughts in most crop-growing regions of the world. Therefore, plants will have to cope more often with environmental stress in the future, which they can potentially cope with through their high plasticity and different protection mechanisms. It has been shown in recent years that plants can shape stress memory by helping them cope better with repetitive stress. Stress memory was defined as genetic, epigenetic, and physiological changes in plants under stress conditions that alter responses to repetitive stress of the same generation or new generation. Plants have been reported to benefit from the effects of previous stress to increase tolerance to subsequent stresses.

Photosynthesis is the most important and sensitive physiological process affected by drought stress. Drought stress inhibits gas exchange through the mouthpiece, disrupting photochemical reactions, reducing non-cyclic electron transport, disrupting ATP synthesis, and creating excess energy in plant chloroplasts, producing active oxygen compounds (ADJs) that degrade photosystem II (PSII). This leads to degradation of chlorophyll and a decrease in its concentration, which can lead to plant chlorosis, reduced growth and final yield.

The aim of this study was to determine the effect of recurrent drought on chlorophyll *a* fluorescence indices of hybrid fescue (x*Festulolium loliaceum* Huds. P. Fourn.).

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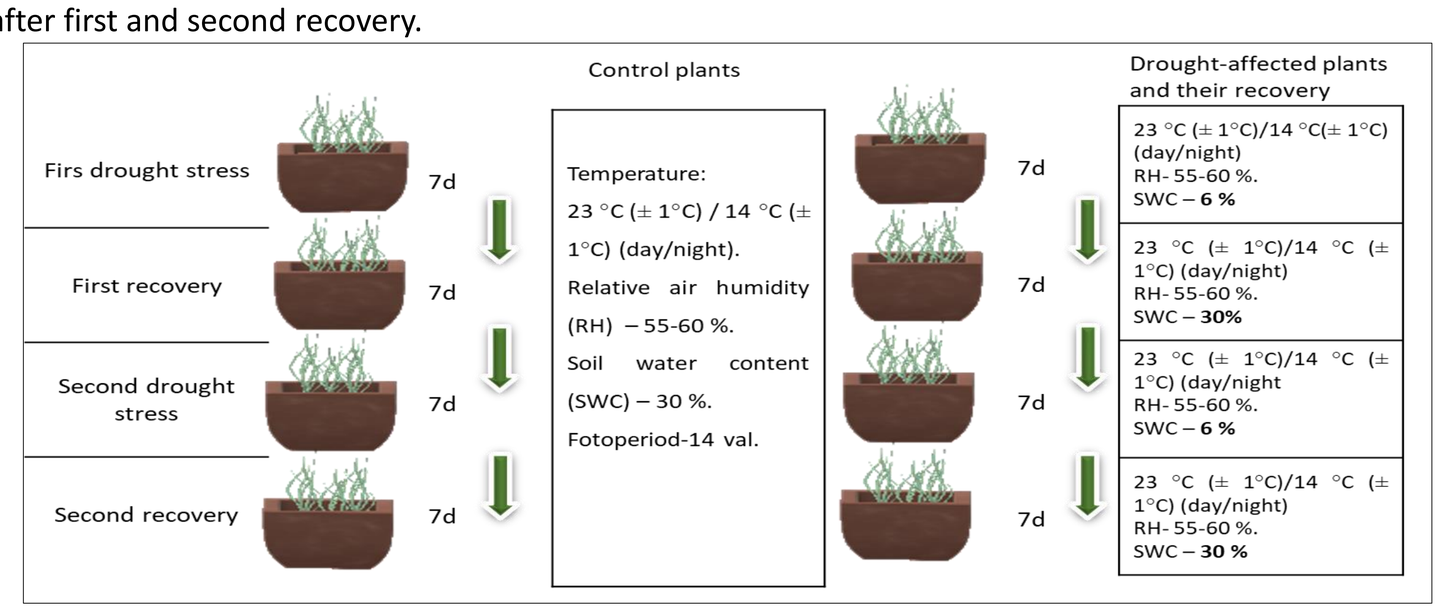
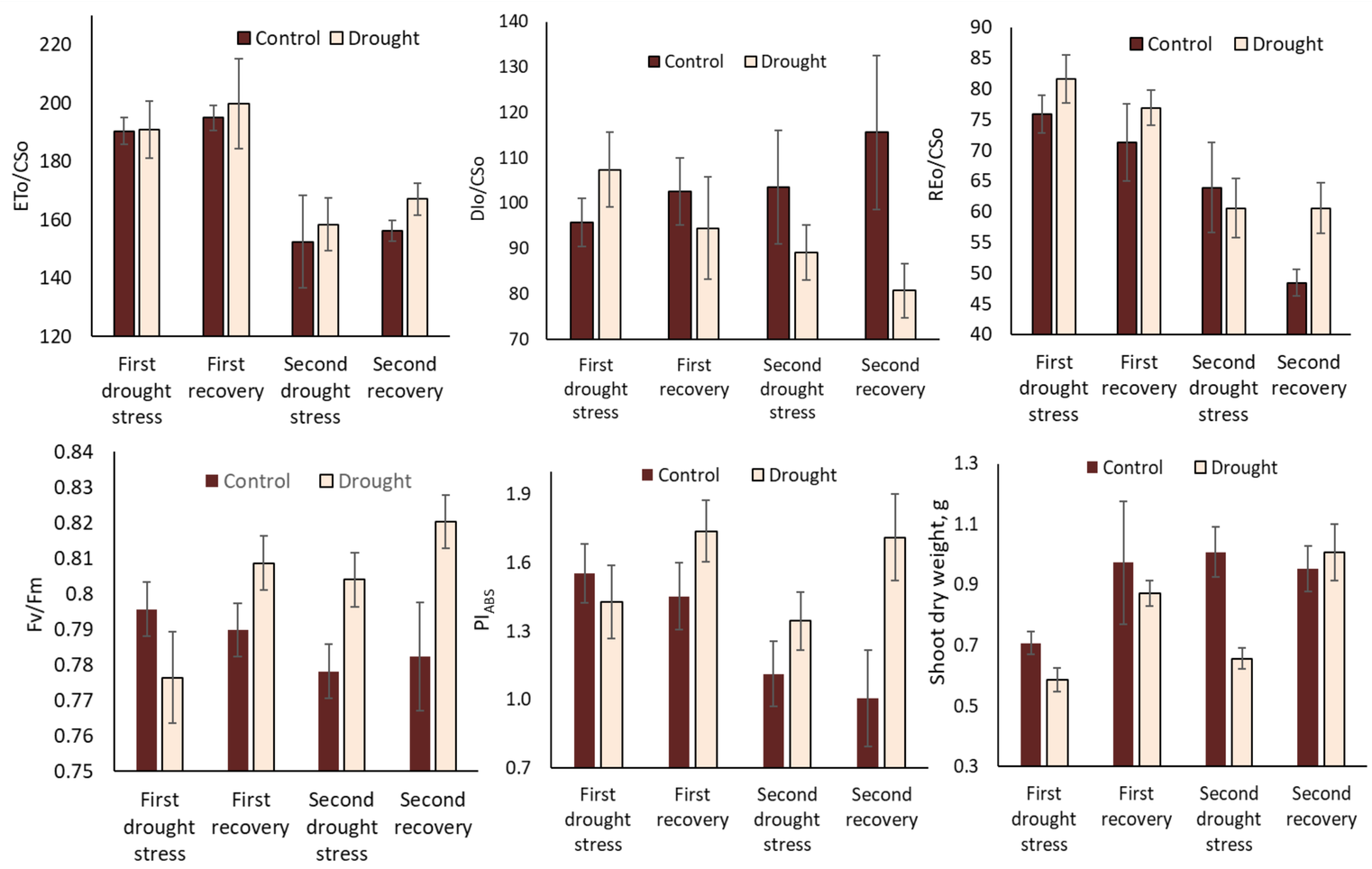
Methodology

Plants of *xFestulolium loliaceum* (Huds.) P.Fourn., var. 'Lina DS' were grown in pots filled with a mixture of field soil, perlite and fine sand (volume ratio 5:3:2) in the greenhouse. When plants reached three leaves development stage, drought stress was imposed the first time. Drought was applied by withholding watering for 7 days and after this period plants were re-watered to 30% of SWC and left for 7 days for recovery, after this the plants were again subjected to drought stress and their recovery was monitored again.

Chlorophyll *a* fluorescence parameters measurements were taken with the Plant Efficiency Analyser, PEA (Hansatech Instruments, Ltd., King's Lynn, Norfolk, England) with randomly selected youngest fully expanded leaves on the last (7th) day of the exposure of first and second drought and after first and second recovery.



Results



The effects of drought on electron transport flux per CS (ETo/CSo), dissipated energy flux per CS (DIo/CSo), reduction of end acceptors at PSI electron acceptor side per CS (REo/CSo), Fv/Fm ratio, performance index (PI_{ABS}) on absorption basis and shoot dry weight of hybrid fescue (x*Festulolium loliaceum* (Huds.) P. Fourn.).

Main conclusions

The first wave of drought had a negative effect on dry mass of shoots ($p<0.05$), but the effect on the chlorophyll *a* fluorescence indices was insignificant.

The second drought wave also did not significantly change ($p>0.05$) any of the studied chlorophyll *a* fluorescence indices, but a slight increase in Fv/Fm, ETo/CSo and PI_{ABS} and a decrease in DIo/CSo were observed, which could mean that during the second drought the photosystem was more resistant to stress compared to the first drought wave. However, despite the improvement of the mentioned indicators, drought significantly ($p<0.05$) reduced the shoot dry mass.

The plants affected by the second wave of drought recovered more intensively, as the values of the studied indicators showed almost complete recovery compared to the corresponding controls.