

Effects of Ploidy on Photosynthesis, Transpiration Efficiency, and Growth of Annual Ryegrass Under Variable Atmospheric Carbon Dioxide and Water Conditions

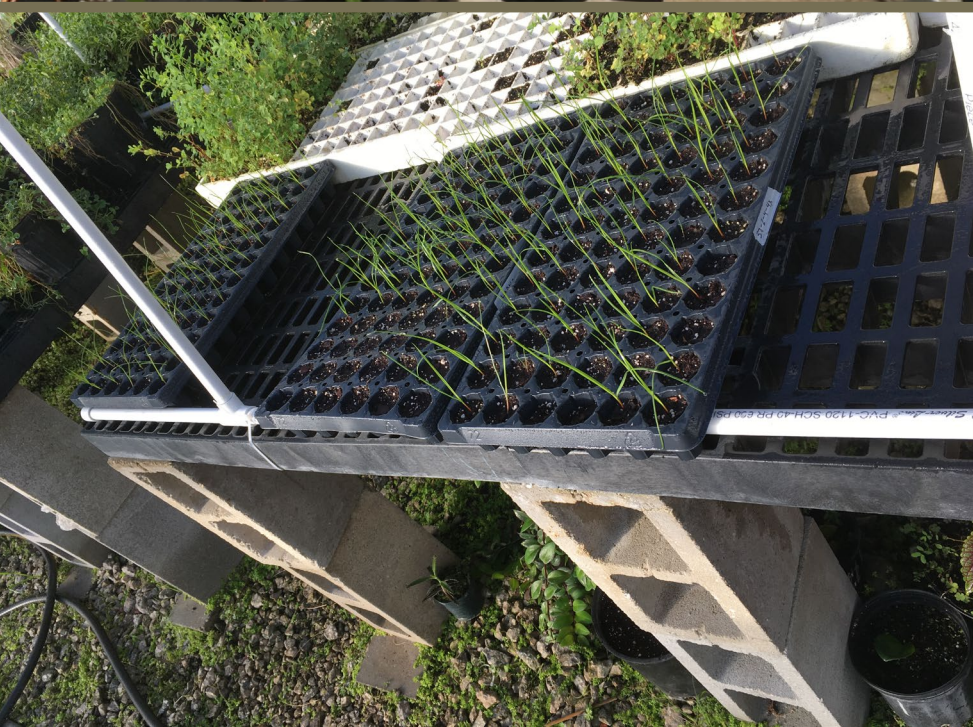
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Introduction

- ▶ Annual Ryegrass (*Lolium multiflorum* Lam.) is one of the most important forages in the southern U.S.
- ▶ Production in southeast occurs over dry season
- ▶ Effects of drought are likely to be exacerbated in the future
- ▶ Rising atmospheric [CO₂] can affect stomatal conductance, photosynthesis, and transpiration efficiency
- ▶ A better understanding of diploid and tetraploid annual ryegrass line responses to elevated atmospheric [CO₂] and drought is needed



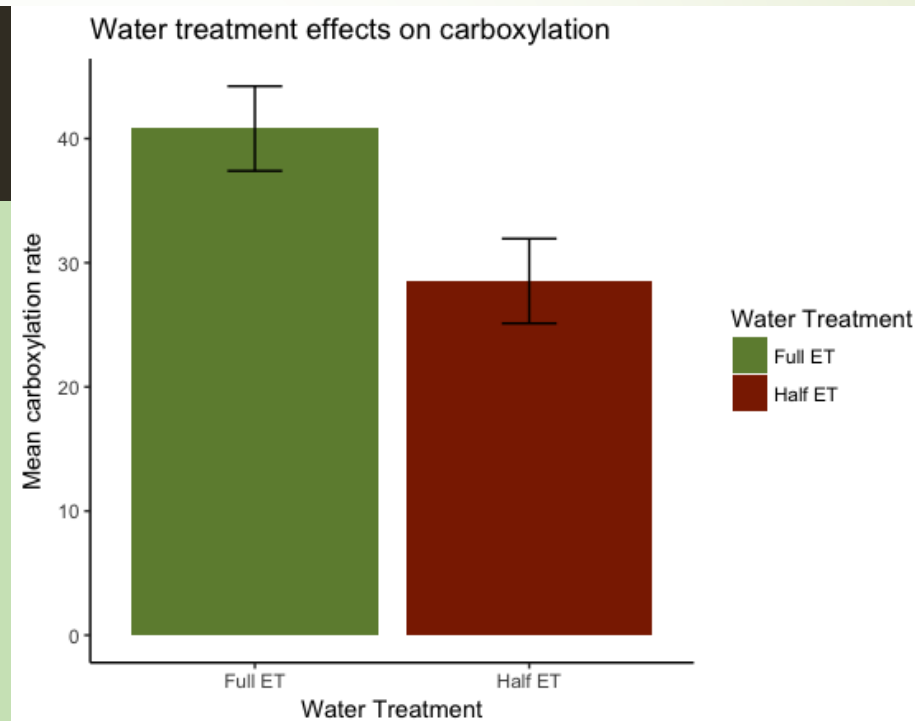


Materials and Methods

- Location: University of Florida Climate Change Greenhouse Facility in Gainesville, Florida
- Design: split plot
 - Main plot: CO₂ (800ppm & 400ppm)
 - Subplot: Irrigation and ploidy
 - Diploid and tetraploid lines from USDA wild population 241586 ("wild") and the cultivar Marshall were used
- Water treatments (full and half evapotranspiration were imposed one week after transplantation.
- Physiological data was taken using the LiCor6400XT
- Plants were then harvested for above ground biomass and roots were washed.
- Data was then analyzed using PROC GLIMMIX procedure (SAS Institute Inc., Cary, NC)

Results and discussion

Effect	<u>VC_{max}</u>
Ploidy	NS
Cultivar	NS
Water	***
Ploidy x Cultivar	NS
Ploidy x CO ₂	NS

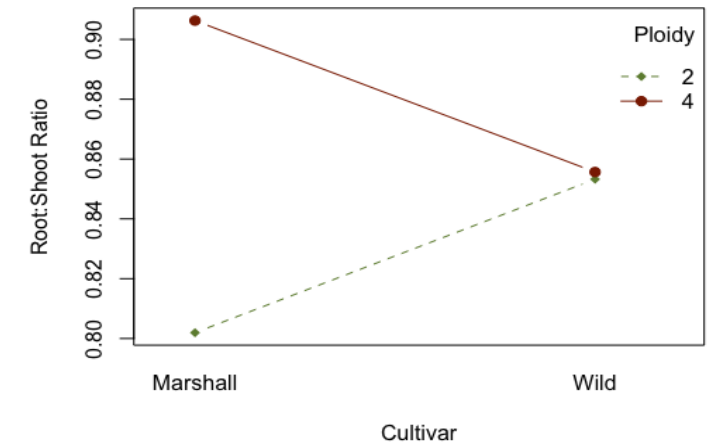


Note: NS, *, **, and *** represent $P > 0.05$, $P < 0.05$, $P < 0.01$, and $P < 0.001$ respectively

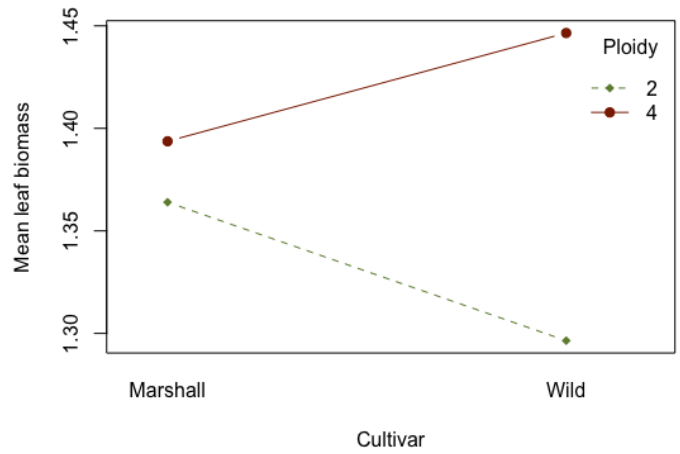
Effect	Leaves	Stems	Root: Shoot
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Ploidy	***	NS	***
Cultivar	NS	NS	NS
Water	NS	NS	NS
Ploidy x Cultivar	*	***	***
Ploidy x CO ₂	NS	NS	**

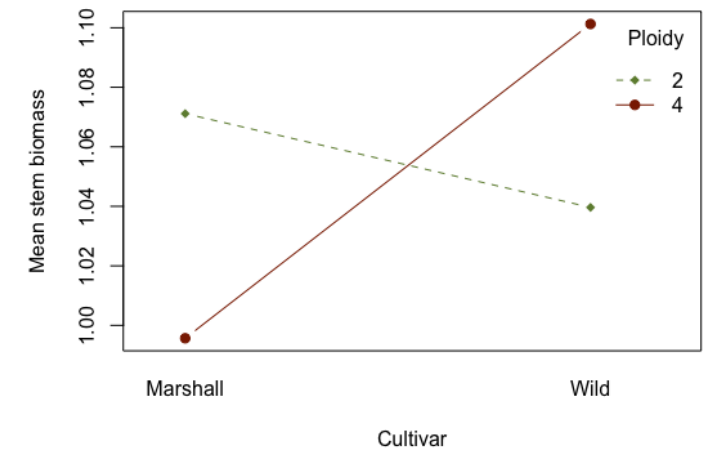
Ploidy and cultivar effects on root:shoot ratio



Ploidy and cultivar effects on leaf biomass



Ploidy and cultivar effects on stem biomass



Conclusion and future work

- In most cases, tetraploid lines of the cultivar Marshall and the wild population outperform those of the diploid lines in elevated atmospheric CO₂ conditions of up to 800ppm.
- It would be beneficial to repeat this experiment with other wild populations of annual ryegrass because we saw such significant difference in biomass amounts and ratios between the wild population and Marshall in this experiment.