EFFECTS OF PLOIDY ON PHOTOSYNTHESIS, TRANSPIRATION EFFICIENCY, AND GROWTH OF ANNUAL RYEGRASS UNDER VARIABLE ATMOSPHERIC CARBON DIOXIDE AND WATER CONDITIONS

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With agricultural intensification, there is increasing concern over water use by agricultural cropping systems, a concern that is further exacerbated by climate variability. Stomata play an important role in water use efficiency (WUE) and regulate gas exchange between plants and the environment. In numerous instances, it has been observed that plant tetraploid lines have longer stomata than diploid lines, which has been shown to decrease transpiration and increase growth tolerance to limited water. Research objectives were to investigate the effects ploidy level might have on photosynthesis, transpiration efficiency, and growth of annual ryegrass. We germinated seeds of two annual ryegrass *(Lolium multiflorum* Lam.) cultivars (USDA plant introduction 241586 and Marshall) that were treated with colchicine, resulting in plants with doubled chromosomes. The resultant diploid and tetraploid lines were grown under ambient (~400 ppm) and elevated (~800 ppm) atmospheric carbon dioxide and optimal versus water-limited conditions for approximately 90 days. Preliminary results showed significant effects of ploidy on stem dry matter, root to shoot ratio, and leaf to stem ratios ($p<0.05$). Additionally, it was found that there was an interaction effect of ploidy and CO_2 as well as water and CO_2 on the leaf to stem ratio ($p<0.05$). The tetraploid lines exhibited greater root:shoot and leaf:stem ratios, but the diploid lines produced more stem biomass than tetraploids. No significant differences were found in the aboveground or root biomass among the treatments.