Impacts of Melatonin on the Drought Tolerance of Turfgrass (*Festuca arundinacea*)
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I researched plant responses to different conditions, to better understand how photosynthetic pathways operate at a leaf scale. Specifically, I worked in a team of other undergraduate researchers to examine how melatonin impacts the ability of turfgrasses to handle drought stress. This research of plant physiology at a leaf scale is meant to be coupled with measurements of optical properties at a global scale. Satellite-level measurements of parameters related to photosynthesis have been conducted in multiple ways, in order to develop a method of studying photosynthesis globally. The most promising satellite measurements have been of solar-induced fluorescence (SIF) by the chlorophyll of plant leaves. However, while SIF has been found to track photosynthesis at the landscape scale, this has not always been the case at the leaf scale. Therefore, the Logan Lab seeks to study the leaf scale further. We used melatonin this summer, because melatonin has been found to increase photosynthesis in plants, and increased photosynthesis has not been studied as much as the inhibition of photosynthesis (Cui et al., 2017; Xie et al., 2018; Wang et al., 2012).

We hypothesized that melatonin would increase photosynthetic rates and greenness in turfgrass subjected to moderate and severe drought. In addition to a control treatment of no melatonin administered, we gave some plants a pre-treatment of 50 µM melatonin in the water we irrigated them with and gave a third group of plants a 50 µM melatonin foliar spray every other night (after Ahmad et al., 2020; Xie et al., 2018). Within each melatonin treatment group, we kept some plants well-watered, subjected another group to a moderate drought, and another to a severe drought. We used the LI-6800 Portable Photosynthesis System to measure both the rate and efficiency of turfgrass photosynthesis, took pictures of our plants regularly and used ImageJ software to quantify their greenness, and used high-performance liquid chromatography to measure leaf chlorophyll content of the turfgrasses.

The drought treatments significantly decreased the photosynthetic rates and greenness of the turfgrass. However, contrary to our hypothesis, melatonin was not found to impact the photosynthetic rates or greenness within any of the drought treatments (Figure 1).

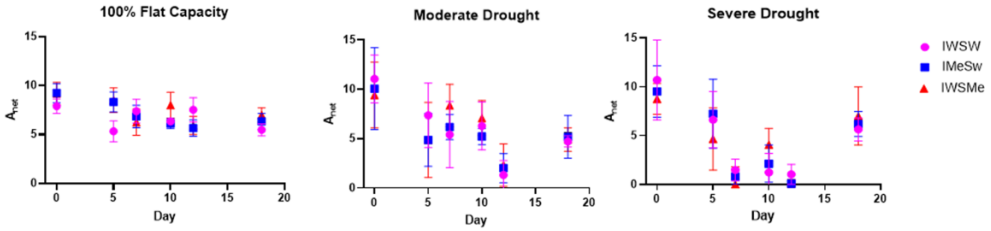

Figure 1. Photosynthetic rates of turfgrasses at no, moderate, and severe drought, across three melatonin treatments: none (pink), melatonin irrigation (blue), and melatonin spray (red).

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