Understanding Light Responses of Blackberry Cultivars Grown in South Carolina for Reducing White Drupelet Disorder

*Katlynn Murphy[1], Brian Lawrence[2], and Juan Carlos Melgar[3]

[1]Undergraduate Research Assistant, Plant and Environmental Sciences Program, Clemson University, [2]Graduate Research Assistant, Plant and Environmental Sciences Program, Clemson University, [3]Assistant Professor, Department of Plant and Environmental Sciences, Clemson University
katlynn@clemson.edu

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Abstract: White drupelet disorder in blackberries is an enigmatic physiological phenomenon that is exhibited by the white discoloration of one or more drupelets on a blackberry. It occurs during fruit ripening and is not tolerated by growers who rely on shipping to earn profits. It was suspected that excess photon energy driving the transfer of 'excited' electrons between the P680 reaction center of photosystem II within the thylakoid membranes of fruit chlorophyll lead to bleaching within individual drupelets by the development of hydrogen peroxide reactive oxygen species. Measurements obtained from a portable gas-exchange system revealed CO_2 assimilation across fifteen cultivars bearing fruit grown under standard field conditions in Upstate South Carolina controlled by light response to red and blue LED photon flux density ranging from 0 to 2,400 micromoles of photons per m^{-2} s^{-1}. Photosynthetic capacities paired cultivars classified into quantitative high, medium, and low performers in addition to qualitative characterization of having white drupelets or no white drupelets. White drupelets were found in cultivars that were saturated at high, medium, and low light intensities. The efficiency of the photosystem II using a fluorometer was similar among cultivars independent of white drupelets as well. Lipid peroxidation and ascorbate peroxidase activity were also tested from leaf tissue, however, there was no statistical significance across cultivars regardless of photosynthetic performance or incidence of white drupelets. All of these preliminary results suggest that intense photon influx is not the only factor involved in inducing white drupelets. Even though photons emitted within the ultraviolet (UV) spectrum do not directly participate in photosynthetic reactions, UV-B (280-320 nm) has been cited as playing a regulatory role in gene expression of certain flavonoids and antioxidants that protect against oxidative damage induced by UV exposure. Therefore, suggested future works should include investigation of phenolic qualities in fruit harvested from cultivars that shared photosynthetic performance but opposing incidence of white drupelet disorder.