Assessing the Role of Short Day Photoperiod on Dormancy, Cold Hardiness, and Raffinose Concentration in Grape Genotypes

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"Crop losses due to freezing injury have been unusually frequent in this decade with consecutive occurrences since 2003 resulting in losses of hundreds of millions of dollars" (Guinan 2007; Zabadal et al. 2007). Grapevines in temperate regions are very susceptible to freeze damage during the winter. There has been major crop loss this decade due to freeze injury costing Ohio and other states millions of dollars. To survive the low temperatures grapevines need to cold acclimate which results in the acquisition of cold hardiness. The objectives of this research was to determine morphological, physiological and biochemical changes of three grape varieties (Couderc 3309, Cabernet franc, and Concord) with varying cold hardiness in response to short-and- long day photoperiods. Morphological changes of cold sensitive and cold tolerant grape species were determined in response photoperiod by measuring shoot growth, periderm formation, and shoot tip abscission. Physiological changes of cold sensitive and cold tolerant grape species were determined in response to photoperiod by measuring water content, dormancy, and cold hardiness of buds. Biochemical changes of cold sensitive and cold tolerant grape species were determined in response to photoperiod by measuring soluble sugars in leaf and bud tissues. Grapevines which were exposed to a short photoperiod began to enter a state of dormancy shown by reduced shoot growth, shoot tip abscission, periderm formation, bud dormancy, and increased cold hardiness. Cold hardiness in buds analyzed by the thermal analysis method showed significant differences after 6 weeks between short-day and long-day vines for 3309 and Concord cultivars. The buds were able to withstand freezing at significantly lower temperatures for the short-day buds than the long-day buds. The biochemical results are still in progress and but will be compared to standards consisting of fructose, glucose, myo-inositol, sucrose, raffinose, and galactinol sugars to determine the levels present in plant tissues. It is expected that soluble sugar levels such as raffinose will increase in response to shorter photoperiods.