CHLOROPHYLL FLUORESCENCE PARAMETERS AS RAPID INDICATORS OF COTTON SEEDLING VIGOR UNDER CONTRASTING GROWTH TEMPERATURE REGIMES

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Abstract

Vigorous seedling growth in cotton is desirable because it minimizes the negative impact of multiple early season stresses, and seedling vigor can be impacted by early season growth temperature or cultivar. OJIP fluorescence provides rapid information on a broad range of photosynthetic component processes and may be a useful surrogate for seeding vigor, but this possibility has not been evaluated previously in cotton. To this end, a controlled environment study was conducted with six cultivars selected based on seed characteristics that are widely indicative of vigor and under two growth temperature regimes (sub-optimal = 20/15 °C day/night temperature; optimal = 30/20 °C) for the first two weeks after seed germination. Thereafter multiple whole-plant vigor assessments were conducted along with extensive OJIP-fluorescence characterization in cotyledons. Growth temperature was the primary factor influencing multiple plant responses. Specifically, all whole-plant indicators of seedling vigor were negatively impacted by sub-optimal temperature as were all photosynthetic performance indices and quantum efficiencies. By comparison, most photosynthetic structural indicators or reaction center-specific fluxes were either unaffected or positively impacted by low growth temperature, largely because PSII antenna size increased. The performance index, PI_{ABS}, and the quantum efficiency, $Æ_{Eo}$, were the most sensitive to low growth temperature and exhibited the strongest relationships with whole-plant seedling vigor. Thus, OJIP parameters incorporating intersystem electron transport beyond PSII but not additional downstream processes may represent the most useful surrogates for whole-plant seedling vigor in cotton.