ASSESSING THE PHYSIOLOGICAL BASIS OF YIELD RESPONSE TO IRRIGATION IN COTTON CULTIVARS WITH EXPECTED DIFFERENCES IN CROP WATER USE EFFICIENCY

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Abstract

Drought is known to reduce cotton yield, and while the effects on its final yield have been subject of many studies during the past years there haven't been any study to assess the impact of the underlying physiological processes to the final yield. The need for this work comes from the fact that studies assessing physiological basis of yield responses have been conducted on other crops but not on cotton yet. The study have been conducted in the Stripling Irrigation Research Park, Camilla, GA: a cultivar (ST 6182) have been planted and put under three different irrigation treatments: well-watered (100% of ETc), over-irrigated (125% of ETc), and dryland. The data collection started after squaring: after two week the data collected have been: concerning plant water status: predawn water potential (ψ_{PD}) and midday water potential (ψ_{MD}), and concerning physiological parameters we collected data with the instrument LI-6800: predawn assessed Dark respiration and Leaf Temperature, while at midday we collected Net photosynthesis (An), Stomatal conductance (g_s), Intercellular CO2 concentration inside the leaf (Ci), quantum yield of photosystem II (Φ_{PSII}), Electron transport rate (ETR), the temperature of the leaf (Tleaf) the temperature of the air (Tair), Tleaf-Tair and leaf to air vapor pressure deficit (LAVPD). We also collected weather data and growth development data and light interception data (using a ceptometer). Lastly the bolls have been collected, and yield quality and quantity data have been analyzed. We expected to see reduction in the yield in all cultivars, and we expected it to be driven mainly by reduced photosynthetic rate on the cultivars with reduced stomatal conductance, and by drought damages, especially on electron transport chain and photosystem II, on the cultivars that have a higher stomatal conductance due to the fast loss of water. We expected also a significant difference in plant water potential between the cultivars and we will try to correlate it to other physiological processes in cotton. The results showed instead a lower yield with the increase of irrigation: this was mainly driven by an higher Harvest Index in rainfed plots due to higher boll retention and because irrigation seemed to have promoted canopy development instead of bolls growth. This study will help future researcher in breeding and managing cotton for high quality yield under drought conditions.