WATER STRESS ALTERS THE COTTON YIELD AND FIBER QUALITY

Suresh Lokhande
K. Raja Reddy
Mississippi State University
Mississippi State, MS

Abstract

Drought stress depresses cotton growth and yield and affects fiber quality. Quantitative functional relationships between leaf water potential and cotton growth and yield and various fiber quality parameters are needed to develop a model for fiber quality. An experiment was conducted in naturally lit plant growth chambers to determine the influence of drought stress on cotton, cv. TM-1, growth, photosynthesis, boll and fiber growth parameters for plants grown at optimum temperature (30/22°C) and nutrient conditions. Four water deficit treatments imposed at flowering include a control which received 100% of evapotranspiration (ET), 80, 60 and 40% ET of the control. Midday leaf water potential, plant height and photosynthesis were measured twice weekly. Flowers and bolls were tagged daily on their appearance. Biomass production, boll components and fiber quality parameters were measured at the end of the experiment. Maximum stem elongation (4.1 cm d^{-1}) and photosynthesis (31.07 µmole CO_2 m^{-2} s^{-1}) were observed at optimum midday leaf water potential of –1.5 MPa, and declined linearly with increased water deficits conditions. Stem elongation was more sensitive to water deficits than leaf photosynthesis. Decreased vegetative growth and photosynthesis has resulted significantly lower biomass and fewer boll numbers per plant under water deficit conditions. Even though, all fiber quality properties showed linear relationship with midday leaf water potential and decreased with increased water deficits, stage-specific sensitivity was observed between midday leaf water potential and various fiber quality traits. Fiber length was more sensitive to leaf water potential between fiber initiation and one fourth of boll maturation (BMP) period (r^2 = 0.76). Fiber strength declined with increased midday leaf water potential and maximum correlation was observed between leaf water potential from one fourth of BMP to fiber maturity. Weaker fibers were produced when leaf water potential was below -2.5 MPa. Fiber uniformity and micronaire were also affected by water deficit conditions, and negative correlations were observed between midday leaf water potential and for these two fiber traits; three fourth to full BMP for micronaire and whole BMP period for fiber uniformity. The relationships between midday leaf water potential and growth, photosynthesis and fiber quality properties provide the necessary functional parameters to develop fiber models under optimum temperature conditions.