GENETIC VARIABILITY FOR EARLY GROWTH, ROOT DEVELOPMENT AND MYCORRHIZAL ASSOCIATION IN COTTON

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Abstract

The growth and development of the cotton root system is under genetic control but may be modified by the environment. One of the most important environmental factors that influence early root development and subsequent stand establishment is soil temperature. Soil temperature changes have also been shown to impact the association of mycorrhizal fungi with cotton roots which in turn influence early plant development. A series of studies were conducted to determine the impact of soil temperature regimes on early seedling development in a number of cotton genotypes and compare the results from controlled environments to chilling injury indices developed for the same genotypes as well as field performance. Seed of each of ten cotton genotypes having a range of "cold tolerance indices" defined as the sum of a metabolic chill index and an imbibitional chill index for each genotype, were planted in soil in small polyvinyl chloride (PVC) tubes in root growth chambers. The plants were grown for 30 days at soil temperatures of either 28C or 18C. Following the 30 day growth period, the plants were harvested, the roots washed free of soil and root lengths, root dry weights, and mycorrhizal colonization were measured. Field evaluations were also conducted and emergence of the genotypes evaluated.

There appeared to be a positive relationship between root length and root dry weights measured at 30 days and the "cold tolerance index" across all genotypes. The relationship also appeared to be stronger for plants grown at 18C suggesting a differential expression of the cold tolerance traits. There was also a relatively strong relationship between the field establishment index and root length of plants grown in controlled environments again with the stronger relationship being expressed for plants grown at 18C. Preliminary results also indicate very little relationship between the "cold tolerance index" and mycorrhizal associations. These results suggest that the "cold tolerance index" may be utilized as a prediction tool for assessing the impact of early root growth on plant establishment. Further research is underway to elucidate these relationships.

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