Consequences Of Climate Change From Global Warming On Cotton Growth, Yield And Production Practices

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Increased temperatures from global climate change are projected to cause substantial losses in crop productivity. Global warming is the rise in the average temperature of Earth's atmosphere and oceans and its projected continuation. This warming trend is mainly the result of rising CO_2 levels in the atmosphere, the levels of which are accelerating dramatically. The increased CO_2 is mainly due to human activities such as deforestation and burning fossil fuels. High temperature is predominant among the factors that determine crop growth and productivity, and excessively high temperatures will be detrimental to growth and yield. "Cotton's Tolerance to Heat and Drought" has been identified as a top concern for US cotton growers. This session will review our current knowledge about causes of extreme weather related heat, the effect on cotton growth and yield, and production practices that minimize heat damage.

Cotton originates from hot climates, but does not necessarily yield best at excessively high temperatures, and a negative correlation has been reported between yield and high temperature. Cotton is particularly sensitive to high temperatures during reproductive development, and environmental stress during floral development represents a major limitation to high yields. The ideal temperature range for cotton is from 68 to 86ºF, but daily temperatures are usually well in excess of this optimum during the growing season, and this represents a major limitation to crop development and productivity. Furthermore, high temperatures can have both direct inhibitory effects on growth and yield, and indirect effects due to high evaporative demand causing more intense water stress. High, above average, temperatures during the day can decrease photosynthesis and carbohydrate production, and high night temperatures will increase respiration and further decrease available carbohydrates, resulting in decreased seed set, reduced boll size, decreased number of seeds per boll and the number of fibers per seed. Boll number and boll size, the basic yield components, are negatively impacted by high temperature, but boll retention is the most heat sensitive component.

Practices to minimize heat stress include the use of thermotolerant varieties, earlier planting dates, more attention to fertility and the use of plant growth regulators, judicious cultivation, and good water management. Increasing temperature and less available water will strongly influence both short-term and long-term fertility management. This is particularly with increasing CO_2 levels which will increase photosynthesis and vegetative growth necessitating more fertilizer. The increased heat and drought will strongly influence crop growth, and the use of PGRs will need to be more carefully monitored. The cotton crop, due to its perennial nature and indeterminate growth habit can compensate for short periods of stress, such that variation in temperatures during the cropping season allows some flowers during the flowering period to escape exposure to damaging temperatures so that some bolls are eventually produced. However, changing climate will effect cotton productivity and necessitate more attention to planning for both short-term and long-term perturbations in the weather.