Program 2C-2

Dealing With Heat

Presented by Dr. Derrick Oosterhuis

District Professor of Crop Physiology, University of Arkansas

A producer survey in 2011 identified "Cotton's Tolerance to Heat and Drought" 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 yield, and production practices that minimize heat damage. Increased temperatures from global climate change are projected to cause substantial losses in crop productivity by the end of the twenty-first century. High temperature is predominant among the factors that determine crop growth and productivity. 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. Although cotton is sensitive to high temperature at all stages of growth, it 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 high temperatures are usually in excess of this range 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. The number of seeds per boll is an important basic component of cotton yield, and heat stress causes a decreased seed number by compromising ovule fertilization.

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. Global warming has focused attention on the need for enhanced thermotolerance in commercial cultivars. Genotypic differences do occur in current upland cotton but the magnitude is relatively small, however, substantial thermotolerance exists in the wild and exotic cottons. Pima cotton yields have been improved by increasing high temperature tolerance, however progress has been slow to improve high temperature tolerance in Upland cotton. Most seed companies now test new varieties in Arizona to insure heat tolerance for the rest of the Cotton Belt. Increasing temperature and less available water will strongly influence both short-term and long-term fertility management. This is particularly with increasing CO2 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.

Program 15C-2

Changing Strategies For Nematode Management

Presented by Dr. Charles Overstreet

Professor and Specialist (Nematology), LSU AgCenter

Cotton production has seen some major changes during the past decade. Crop rotation is used much more extensively now than in the past. Nematicides have moved almost