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"Soybean Drought Tolerance Research"

For the past eight years, we have evaluated varieties in maturity groups (MG) 00 through IV for their potential for avoiding late-season drought. These results indicate that when planted early (and depending upon the year and location), yields greater than 30 bushels/acre may be obtained under rainfed conditions. Furthermore, varieties from MG I and later respond very well to irrigation with yields similar to full-season soybean varieties (> 60 bushels/acre), but early MGs generally require substantially less irrigation than do full-season cultivars. A major goal of the current research is to evaluate yields of MG I through IV soybean compared to MG V and VI soybean when the crop is not irrigated fully.

At Fayetteville, we planted (May 30) with a grain drill (7.5 inch spacing) two cultivars from each of the MGs from I through V. Targeted populations were 220,000 plants per acre for MG I, II, and III cultivars and 150,000 plants per acre for MG IV and V cultivars. We constructed a line-source irrigation system that gave us seven irrigation treatments consisting of a fully irrigated treatment (irrigated at a 1.25-inch deficit) and six treatments that decreased incrementally in the amount of water applied, with the driest treatment being strictly rainfed. In this irrigation system, plots are planted parallel to a single irrigation pipe that has evenly spaced sprinkler heads. As you move perpendicularly away from the pipe, there is a decrease it the amount of irrigation delivered. The experiment was designed as a strip-split plot design with four replications. Strips were associated with irrigation treatments, and MGs were used as main plots.

Rainfall and irrigation amounts from emergence to R6 were determined for each of the 280 plots throughout the season. For the fully-irrigated treatment, soil moisture, stages of crop development, and canopy coverage measurements were made approximately two times per week. At maturity, plots were end-trimmed, a sample was taken for harvest index, and the five interior rows were combined for yield determination. A preliminary analysis of the data indicates several important points. First, under well-watered conditions, yields were similar (average 62 bu/ac) for cultivars from MG II through V, but between emergence and R6 only 18 inches of water was received (irrigation plus rainfall) for MG II cultivars where as 26 inches of water was received for MG V cultivars. In other words, the 44% greater amount of water received by MG V cultivars compared with MG II cultivars did not result in any yield increase. Secondly, under water-restricted conditions, yields of all MGs decreased linearly as the amount of water received was decreased, but the rate of yield decrease was substantially greater for early MGs compared with MGs IV and V. Taken together, these data indicate that equivalent yields can be produced with much less irrigation by growing early MG cultivars compared with MG V cultivars; however, when irrigated inadequately, yields for early MG cultivars will likely be decreased more than yields for later MG cultivars.

The Arkansas Irrigation Scheduling Program is being compared with a program developed by Dr. Purcell specifically for the high population densities and rapid growth of short-season soybean cultivars. This new system requires users to enter in an Excel spreadsheet maximum and minimum temperatures, rainfall (or irrigation), and estimates of canopy coverage for each day. We are comparing these two methods within one another and with soil-moisture measurements to determine if there are differences in when irrigation needs are indicated.