COTTON IRRIGATION RESEARCH USING CENTER PIVOT AND SUBSURFACE DRIP METHODS IN THE TEXAS HIGH PLAINS

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Abstract

Within the Ogallala Aquifer region of Texas, the available irrigation capacity for a given field can change within a single growing season due to declines in well capacity, diverting water to higher value crops in dry years, or pumping volume restrictions. To better manage available water resources in the Texas High Plans, there is a need to determine cotton lint yield and irrigation water productivity as a function of changing irrigation capacities during major cotton growth periods. LEPA irrigated cotton was evaluated at the Texas A&M AgriLife Research Center at Halfway, Texas from 2010 to 2012. The treatment factors included in-season irrigation capacity (maximums of 0 in/d – **L** (low); 0.125 in/d – **M** (medium); and 0.25 in/d – **H** (high)) and irrigation application within cotton growth periods determined by heat unit (hu) accumulation, early vegetative/juvenile (< 950 hu); reproductive (950-1350 hu); and maturation (>1350 hu). Combinations of these factor levels resulted in 27 irrigation regimes or treatments. In all years, cotton yield and water productivity indicated that attempting to add water to the profile, or irrigating in excess of the evapotranspiration rate of the cotton plants early in the growing season, reduced irrigation water value compared to applying irrigation later in the growing season. This was attributed to water loss from excessive evaporation (high wind, low humidity) that often occurs in May and June in the Texas High Plains. Irrigation water value during reproductive and maturation periods resulted in water productivity in excess of 100 lb/ac-inch of water applied.

The recent increase in the use of subsurface drip irrigation (SDI) for cotton production in the Texas High Plains has resulted in questions concerning drip lateral position and orientation relative to crop rows. Field experiments were conducted at Halfway, TX to evaluate traditional SDI installations with crop rows spaced at 30 and 40 inches; crop row to lateral offsets of 0.0, 5 in, 10 in, and 15 in; and crop rows perpendicularly crossing SDI laterals spaced at 30 in, 40 in, and 60 in. Traditionally installed SDI with cotton rows spaced at 30 inches resulted in generally higher yield than those spaced at 40 inches; however, differences were not significant over the 5-year period. Yields were significantly different between individual rows of adjacent row pairs irrigated with single SDI laterals when row offsets were greater than 15 inches on 30-in row spacing. However, cotton plants from rows closest to the SDI lateral largely compensated for yield losses of rows farthest from the lateral. When considering perpendicularly crossing 60-in spaced laterals with 30-in wide crop rows, only modest declines in cotton lint yield (1.5 and 3.3%) occurred compared to traditional parallel row-lateral orientation with the same lateral and row spacing. With crop rows perpendicular to laterals, SDI lateral spacings resulted in average yields of 1608, 1668, and 1698 lb/ac at distances of 60-in, 40-in, and 30-in, respectively. Orienting rows perpendicular to drip laterals using 30-in crop row widths resulted in significantly higher yields and irrigation water use efficiencies than 40-in row widths at high irrigation capacity. As water availability declines, these results will provide producers additional information on installation and management of irrigation systems.