MANAGEMENT OF COTTON GROWN UNDER SUB-SURFACE DRIP AND FURROW IRRIGATION WITH DIFFERING PLANT DENSITIES

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Abstract

Crop management practices such as irrigation and plant density may impact final lint yield in cotton. A field trial was conducted using four planting densities ranging from 6.5 to 16.1 plants m^{-2} on two irrigation schemes, sub-surface drip and furrow irrigation. This trial was conducted to identify potential growth and developmental changes related to cotton grown at differing plant densities and irrigation schemes. Yield was shown to be consistently higher for cotton grown on sub-surface drip irrigation when compared to conventional furrow irrigation. Also, the largest yields were observed among the lower plant densities grown on the sub-surface drip irrigation scheme. Due to the significant amount of rainfall experienced during the growing season, the benefits of irrigation may have potentially been offset. Utilizing a Smart Field™ system for monitoring canopy temperature and acquiring soil moisture and adding a dryland treatment would also be beneficial to this trial in the future.

Introduction

Urban water demand in Texas has grown rapidly in recent years causing water resources to become limited. Water designated for agriculture use is one of the main consumers of the water supply. Reducing agricultural water use while maintaining crop yields is one way to solve this problem. Sub-surface drip irrigation (SDI) is becoming more widely used as a way to decrease water use and to maintain or in some cases, increase crop yields. Also, due to the rise in planting seed costs, a proper plant density has the capacity to maximize cotton yield and fiber quality for a given level of available water. Planting to an optimum stand is one method of reducing cost and helping to insure satisfactory yield, since cotton yields are directly influenced by the number of plants obtained at planting (Bridge et al. 1973).

The objectives for this trial are to compare yield and fiber quality of cotton produced under sub-surface drip and furrow irrigation under differing planting densities, to examine the phenology and growth characteristics of a cotton crop under these differing irrigation strategies, to compare irrigation applied through SDI and furrow applied methods for their impact on water use efficiency relative to unit of yield produced, and to compare time of maturity based upon population densities over irrigation models.

Materials and Methods

A trial was conducted at the Texas AgriLife Research Farm in Burleson County on a Weswood silt loam. All treatments were arranged on a split plot design with one variety, Stoneville ST 5458 Bollgard 2 Roundup Flex® cotton. Irrigation schemes used were sub-surface drip irrigation (SDI), with replacement of 85% ET and conventional furrow irrigation. Treatments consisted of four population densities: 6.5 plants m^{-2}, 9.7 plants m^{-2}, 12.9 plants m^{-2}, and 16.1 plants m^{-2}. Each treatment was replicated four times. The trial was fertilized uniformly with 134 Kg of 32-0-0 liquid N per hectare. Biomass was collected at 86, 99, and 114 DAP. Canopy temperature readings, lint yield, and fiber quality were all evaluated. All treatments were harvested with a John Deere 9910 two-row, high drum spindle picker. Fiber quality measurements were determined by sending samples to The Fiber and Biopolymer Research Institute in Lubbock, Texas.

Table 1. Water Inputs (cm)

	Drip	Furrow
Irrigation	43.18	63.5
Precipitation	43.18	43.18
Total	86.36	106.68

Results and Discussion

In the growing season of 2010, statistical differences in yield between the two irrigation schemes can be observed with a decreasing trend. The population with 6.5 plants m^{-2} had the highest yield grown on furrow irrigation. However, the population with 9.7 plants m^{-2} grown on sub-surface drip irrigation had the highest yield overall. (Fig. 1). There were numerical trends in dry matter between the two irrigation schemes at 114 DAP. However, these trends are not statistically significant. This may be due to the considerable amount of rainfall experienced during the growing season that potentially offset benefits of irrigation (Fig. 2).

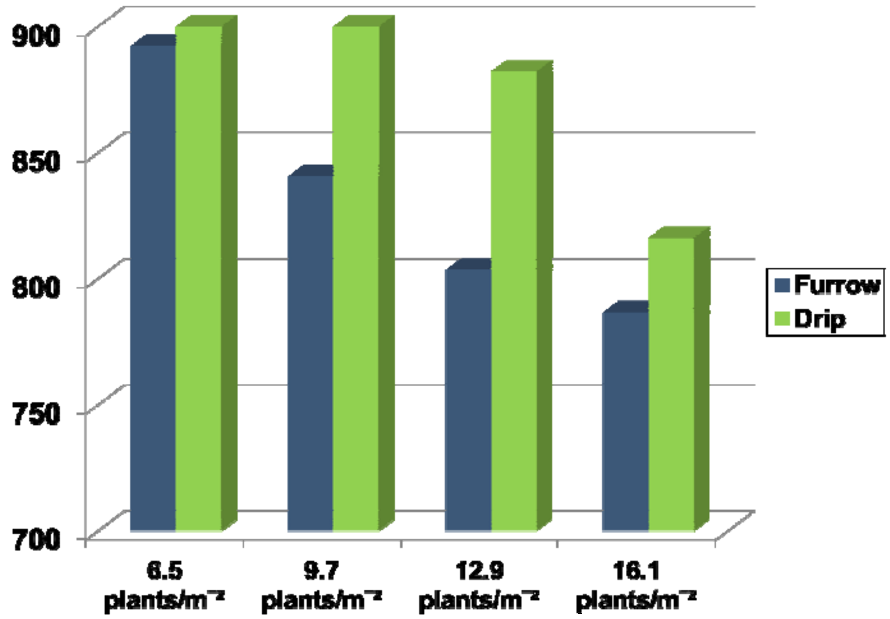

Figure 1. Lint yield (kg/Ha)

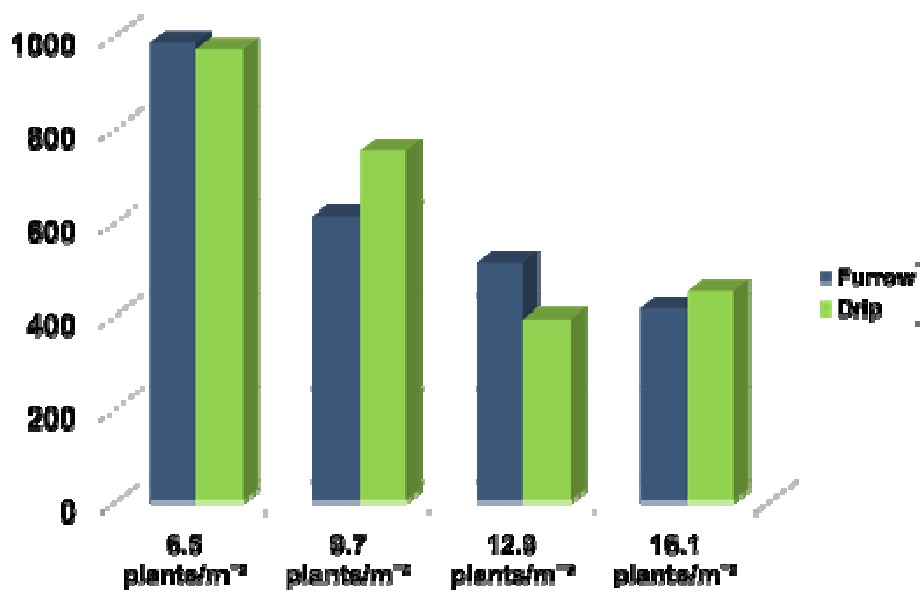

Figure 2. Biomass 114 DAP (g/m)

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References

Bednarz, C.W., D.C. Bridges, and S.M. Brown. 2000. Analysis of cotton yield stability across population densities. Agron. J. 92:128-135

Bridge, R.R., W.R. Meredith, and J.F. Chism. 1973. Influence of planting method and plant population on cotton (*Gossypium hirsutum*). Agron. J. 65:104-110.

Feng, L., et al. 2010. Effects of irrigation and plant density on cotton within-boll yield components. Agron. J. 102:1032-1036