Report for 2021 project "Impact of Seed Rate on Peanut Water-use Efficiency and Yield"

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Seeds are one of the most expensive variable input, accounting 18% of variable cost (https://agecon.uga.edu/extension/budgets.html). A higher seed rate results in increased competition between plants for water, space, and light (Humphrey and Schupp, 2000) and higher seed cost. On the other hand, a lower seed rate can cause increased loss from TSWV (Branch et al., 2003; Wehtje et al., 1994). UGA Extension recommends planting 6-7 seeds/ft to maintain a final plant stand of at least 4 plants/ft to reduce the risk of TSWV (Kemerait et al., 2018). Seeding rate strategies also impact irrigation management strategies. This study proposes to quantify water-use efficiency (WUE) and yield difference among peanut in three different seeding rates.

Like year 1 of the present project, the second year of the study was also conducted at the UGA Southwest Research and Education Center, Plains GA. Three flat and irrigated fields were selected to plant peanuts in twin-row pattern with 4.5 seed/ft, 7 seed/ft, and 9.5 seed/ft. An eddy-covariance system was installed in each field. The eddy-covariance system provides continuous 10 Hz time series of 3-dimentional wind components, temperature, CO_2 and H_2O concentration. The time series were processed to calculate CO_2 fluxes and evapotranspiration (ET) data throughout growing season at the field scale. These data are used to calculate the WUE. Plant samples was taken at the time of digging up for yield measurements. The peanut leaf area index (LAI) was also measured weekly using the LI-2000 plant canopy analyzer.

The preliminary results show that LAI varies with seeding rate and growing stage (Figure 1). In the early growing period, LAI increased with seeding rate, which is similar to the results in 2020. However, at the late growing period, LAI of 9.5 seeds/ft became the smallest and LAI of 4.5 seeds/ft became the largest, which is reverse to 2020 results. Peanut ecosystem with 9.5 and 7 seeds/ft usually had larger CO_2 fluxes than 4.5 seeds/ft across almost whole growing season until final couple weeks (Figure 2a). Evapotranspiration of 7 seeds/ft was usually significantly higher except last 10 days, while peanuts with 9.5 seeds/ft presented smallest ET except the early in growing stage (Figure 2b). As the ratio of CO_2 flux to evapotranspiration, WUE of 7 seeds/ft was lowest during the growing season, while 9.5 seeds/ft presented highest WUE across almost whole growing season until final couple weeks (Figure 2c), which is different from 2020. 9.5 seeds/ft gives higher yield than 4.5 seeds/ft. On the other hand, peanut with 7 seed/ft gave the highest yield while 9.5 seeds/ft presented lowest yield, which is also different from 2020. To sum up, seeding rate affects peanut LAI, water-use efficiency, and yield, and the 2021 results are different from 2020. It might be related to the much rainfall and rainy days in 2021. More experiments with different weather patterns are still needed to make robust conclusions.

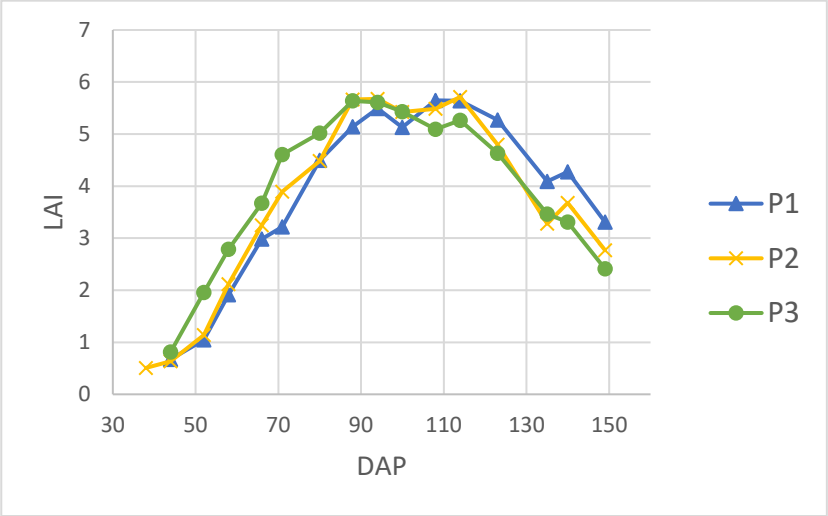

Fig. 1 Variation of peanut leaf area index through the growing season with different seeding rates: P1, 4.5 seeds/ft; P2, 7 seeds/ft; and P3, 9.5 seeds/ft

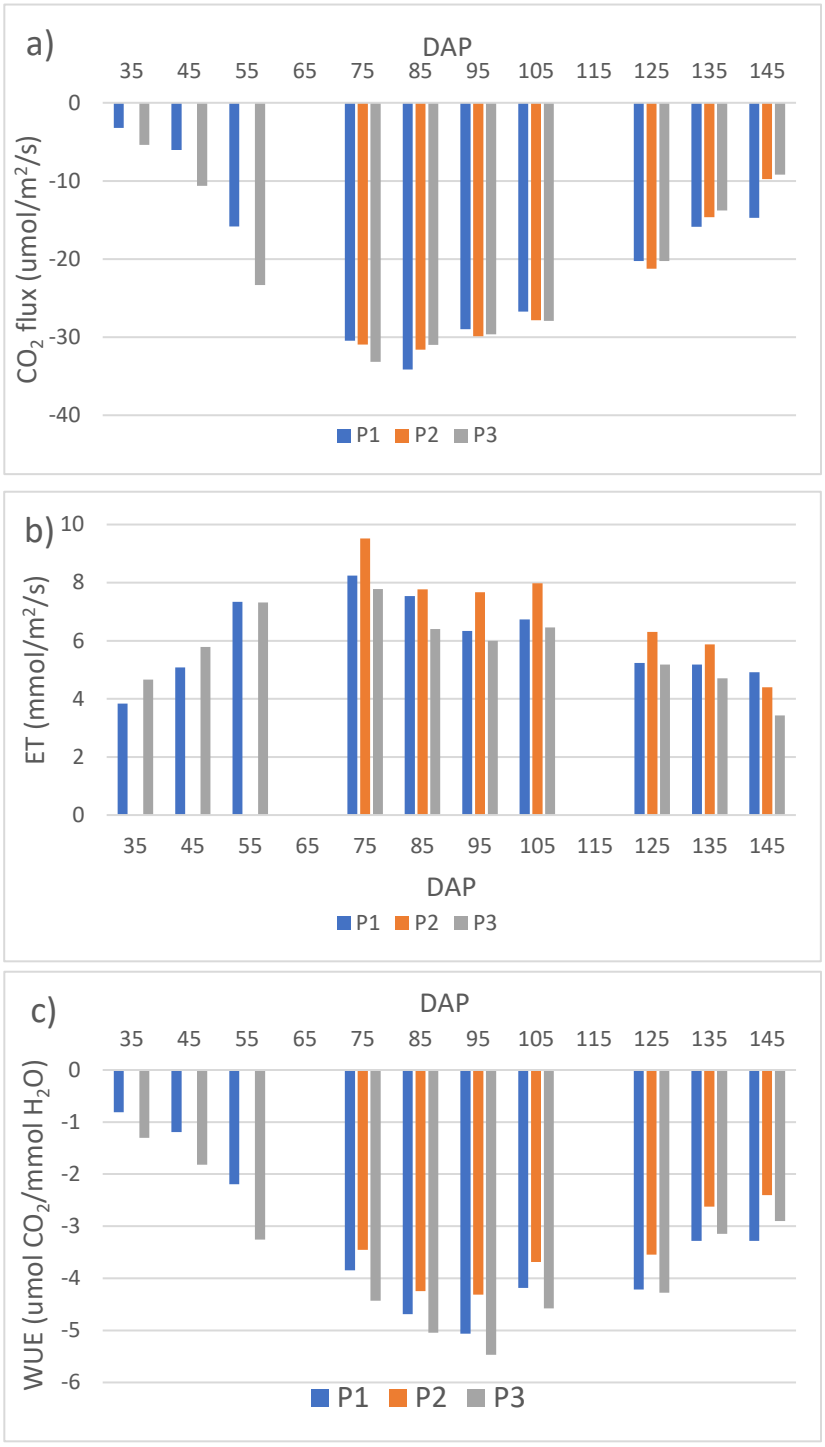

Fig. 2 Comparison of a) CO_2 fluxes, b) evapotranspiration, and c) water-use efficiency in growing season between seeding rates P1 (4.5 seeds/ft), P2 (7 seeds/ft), and P3 (9.5 seeds/ft)