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2017

NATIONAL PEANUT BOARD/SOUTHEAST PEANUT RESEARCH INITIATIVE **Final report**
FINAL REPORT FOR WORK
DONE UNDER RESEARCH AGREEMENT

INSTITUTION: University of Georgia

PROJECT TITLE: Peanut water-use efficiency influenced by different planting patterns

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GACCP Budget No.:

EXPIRATION DATE: NPB CONTACT: Bob Parker/Maria Mehok
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FINAL REPORT: [on the 2017 SPRI/NPB project]

This is the final report for the 2017 SPRI/NPB project "Peanut water-use efficiency influenced by different planting patterns". The three-year study aims to determine the impact of single and twin-row planting patterns on water-use efficiency, yield, pod size and weight, and pod number per plant at the field scale.

The experiment was conducted at the Southwest Research and Education Center in Plains, GA, in 2017. Peanut were planted using single- and twin-row planting patterns in two quasi-flat 10-acre fields. Adjacent fields were selected to avoid any disparity in results due to different soil properties. UGA's recommendation is being used for application of fertilizers, pesticides, and herbicides.

The instrumentation consists of the eddy-covariance system and then soil CO_2 flux measurement system. The eddy-covariance system consists of a sonic anemometer CSAT3 (Campbell Scientific Inc., Logan, UT) and a fast-response CO_2/H_2O analyzer Li-7500 (Li-Cor Biosciences, Lincoln, NE), installed on a tripod at about 1.5 m above the ground in each field (Fig. 1). It measures and saves the three-dimensional wind components, temperature, and concentration of water vapor and carbon dioxide in 10 Hz with a CR1000 datalogger (Campbell Scientific Inc., Logan, UT). The data were collected to estimate peanut field evapotranspiration and CO_2 exchange with the atmosphere that indicates the canopy photosynthesis with daytime data.

Figure 1. Eddy-covariance system in the peanut field

The soil data incudes measurements from two soil CO_2 probes GMP343 (Vaisala, Finland) installed at a depth of 2 cm and 10 cm, thermocouples (home-made) at depth of 5 cm, and water content reflectometers CS616 (Campbell Scientific Inc., Logan, UT) at depth of 5 cm in each field (Fig.2), to simultaneously measure soil CO_2 concentrations, soil temperature and soil water content for estimating soil CO_2 effluxes. Each system was powered with a pair of batteries charged with a 120-W solar panel.

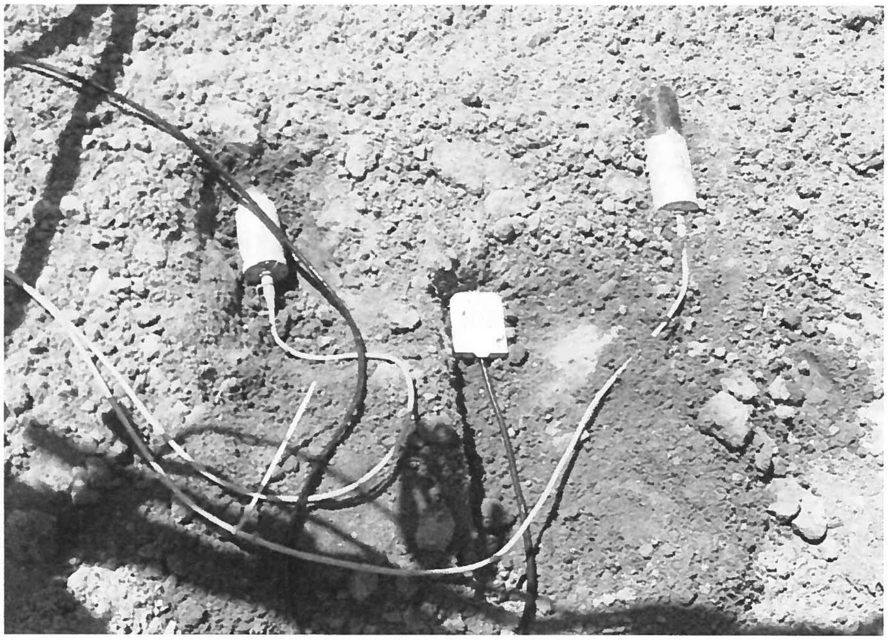

Figure 2. Soil CO_2 probes, thermocouples, and water content reflectometers in both peanut fields

The field visits were conducted for every week to check the working of the instrumentation and collect data stored in the dataloggers. The leaf area index in each field was also measured with a plant canopy analyzer LAI-2000 (Li-Cor Biosciences, Lincoln, NE) each week.

The collected data, together with the 2016 experiment data, was processed and analyzed using Eddypro and Matlab software. The WUE is calculated as the ratio of CO_2 and H_2O fluxes over different growth stages of peanut. Following results were obtained during the project.

2016

A significantly greater CO_2 flux of peanut in twin-row planting pattern (31.8%) during the early growth period in 2016 was observed. However, for the later growth periods, the CO_2 fluxes of single and twin-row planting patterns were not different (Figure 3). The single and twin-row planting patterns did not show any difference for H_2O fluxes in any of the growing periods (Figure 4). The WUE of twin-row was significantly greater than that of single-row for periods with aGDD <500 by 27.4% and 500-1000 by 11.1%. However, WUE difference was not reported during the period with aGDD 1000-2000 (Figure 5). During 2018, the WUE of twin-row was significantly greater than that of single-row for periods with aGDD 1000-2000 by 9.3% and >2000 by 9.5%. But, WUE difference was not reported during the period with aGDD 500-100 (Figure 5).

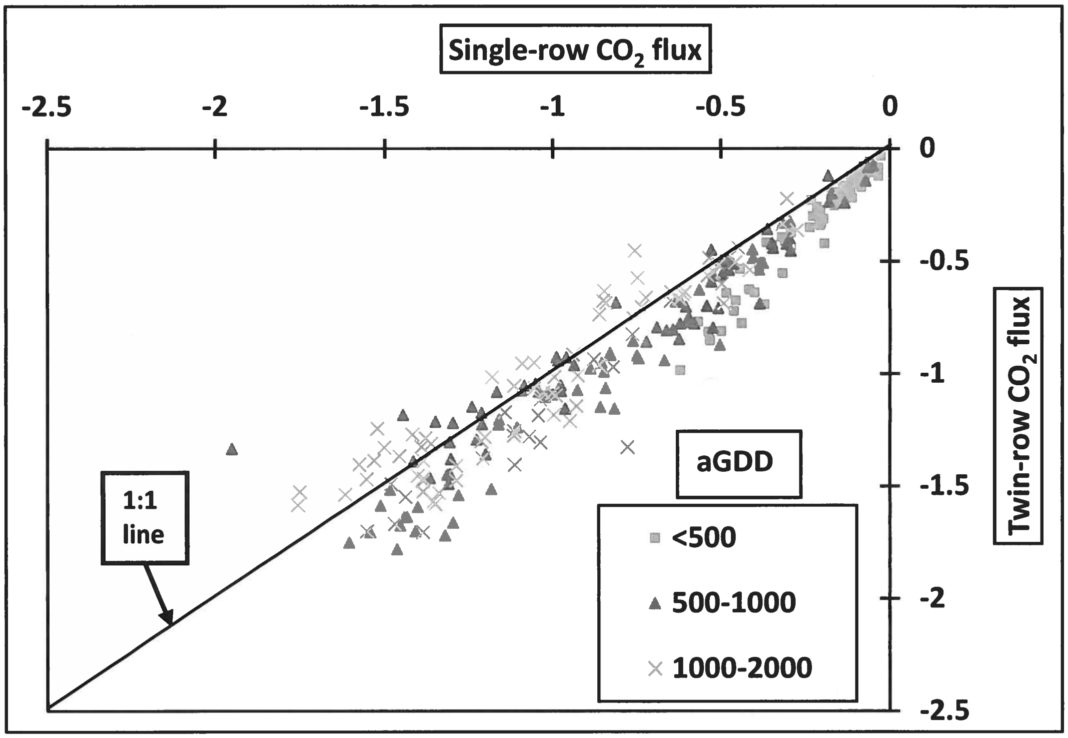

Figure 3 The comparison of 30-minute average CO_2 flux (mg $CO_2/m^2/s$) of single and twin-row planting patterns for different aGDD for 2016

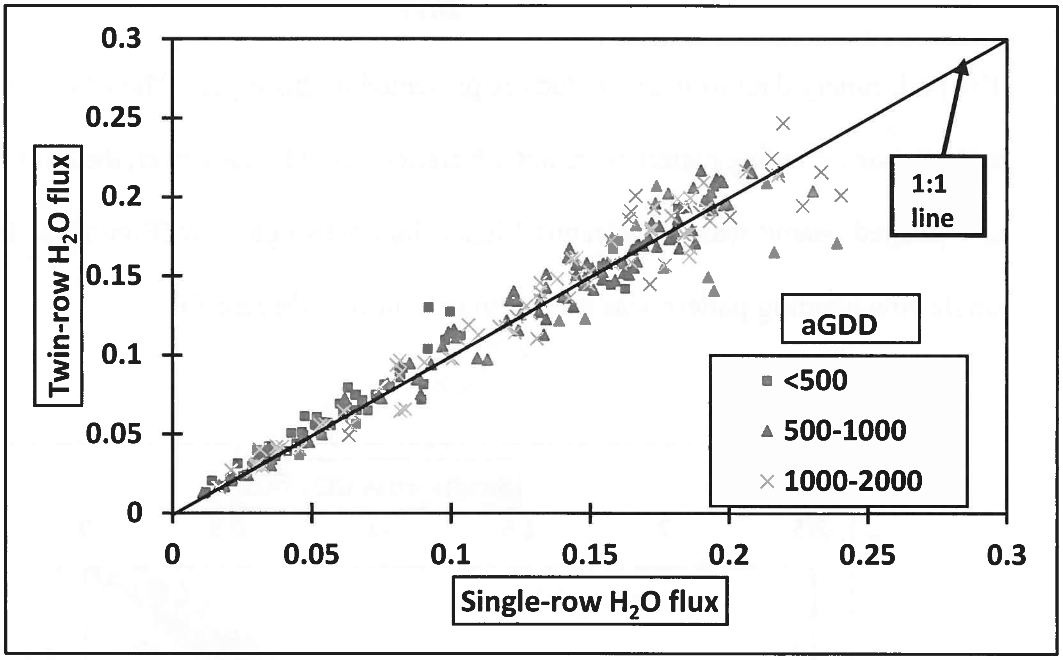

Figure 4 The comparison of 30-minute average H2O flux (g $H_2O/m^2/s$) of single and twin-row planting patterns for different aGDD for 2016

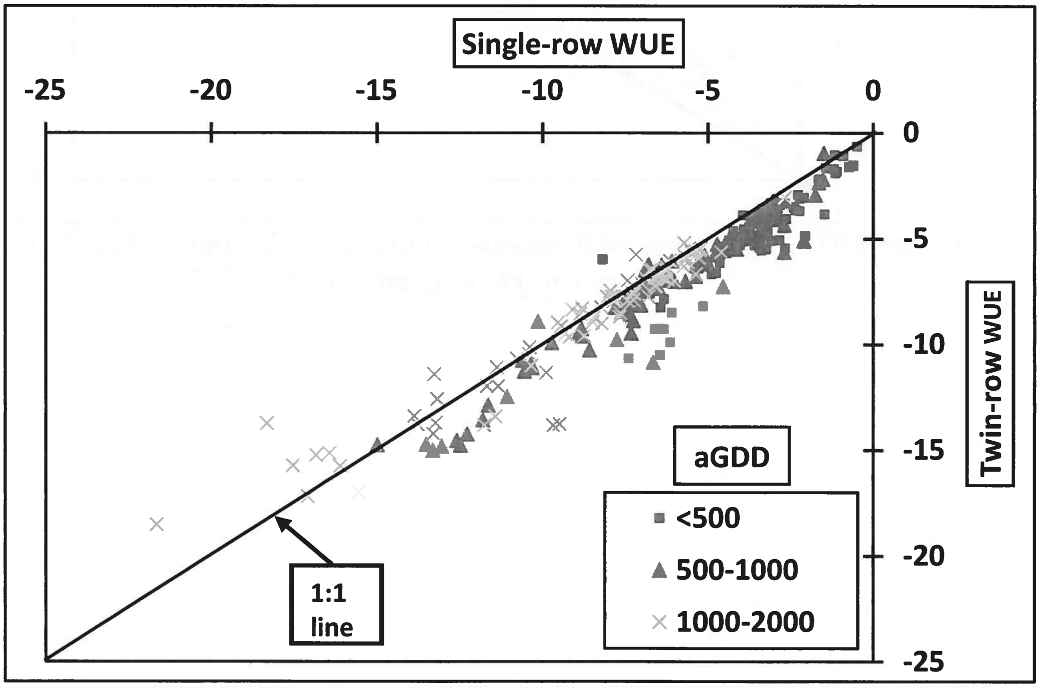

Figure 5 The comparison of 30-minute average WUE (mg CO_2/ mg H_2O) of single and twin-row planting patterns for different aGDD for 2016

2017

The preliminary data from 2017 study is presented in this report. The CO_2 fluxes of single and twin-row planting pattern were not different (Figure 6). However, the H_2O flux of twin-row planted peanut was significantly higher than the single-row (Figure 7). The WUE of single-row planting pattern was greater than twin-row (Figure 8).

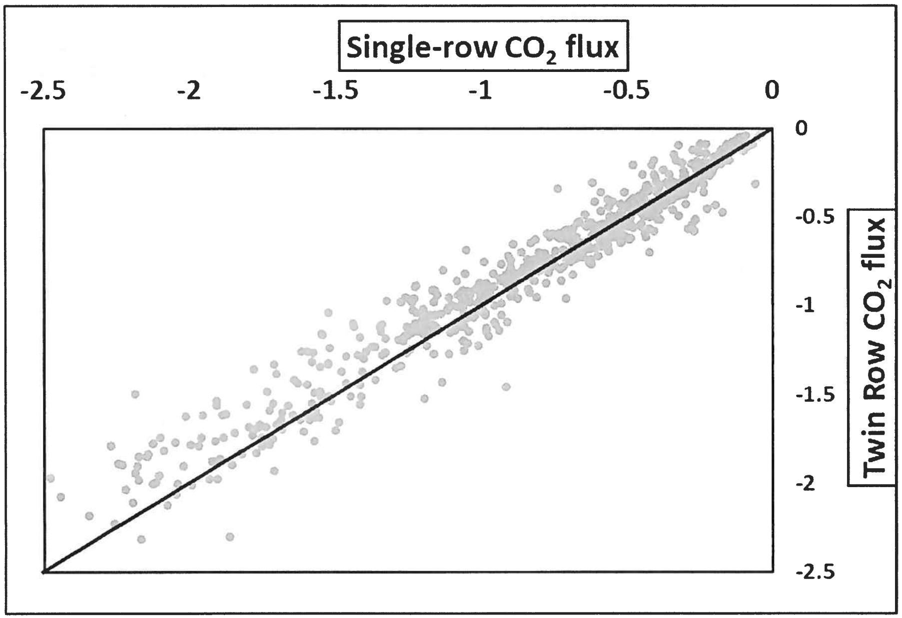

Figure 6 The comparison of 30-minute average CO_2 *flux (mg* $CO_2/m^2/s$*) of single and twin-row planting patterns for 2017*

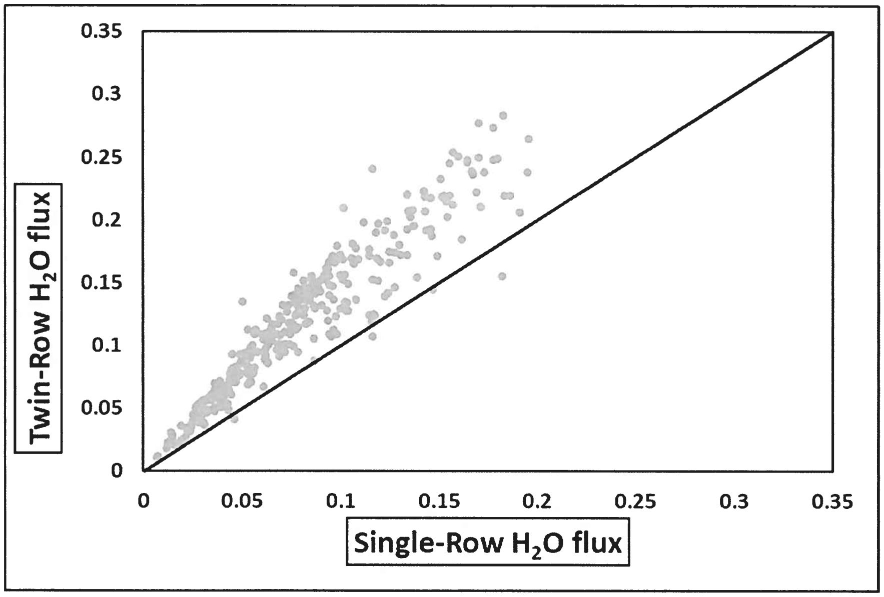

Figure 7 The comparison of 30-minute average H_2O flux (g $H_2O/m^2/s$) of single and twin-row planting patterns for 2017

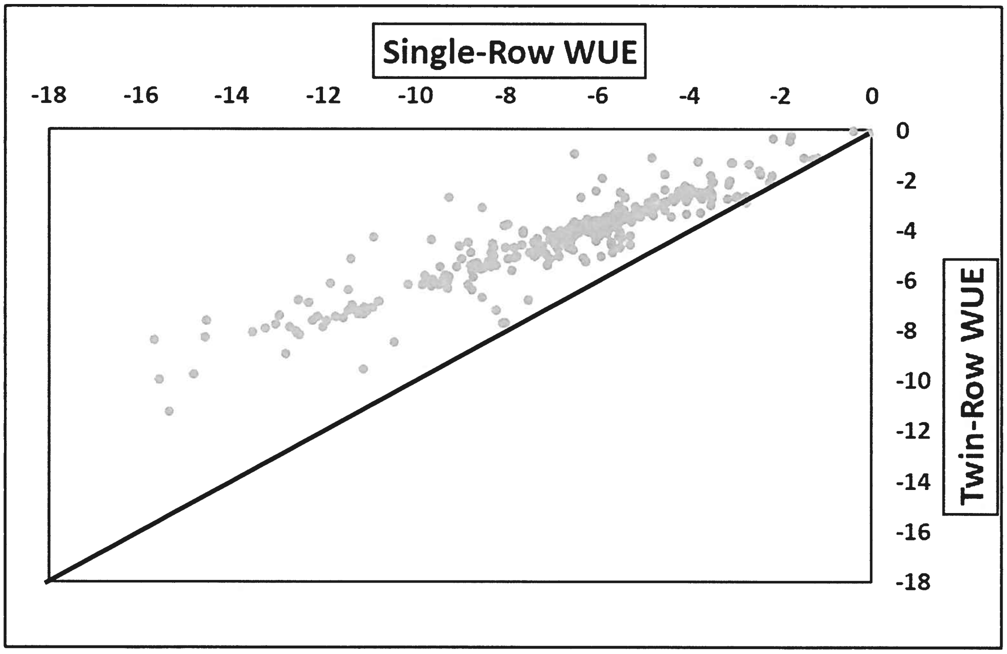

Figure 8 The comparison of 30-minute average WUE (mg CO_2/ g H_2O) of single and twin-row planting patterns for 2017