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INSTITUTION: University of Georgia

PROJECT TITLE: Measurements of CO_2 nocturnal respiration as an indicator of stress response in peanuts

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FINAL REPORT:

Summary of 2005 Results

Research Title: Measurements of CO_2 nocturnal respiration as an indicator of stress response in peanuts

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Introduction

Due to rapid urban development during the last couple of decades in Georgia, demand for water has dramatically soared while competition for water availability between the rural and urban sectors has been on the rise. Furthermore, this water stress is likely to become a problem with numerous years of drought associated with climate variability and climatic changes. Thus, the optimization of irrigation based on available and required water resources and plant physiological thresholds is necessary to maximize water use efficiency.

The objectives are to study the nocturnal respiration rate in a peanut field and its relation with the occurrence of environmental stress and determine whether nocturnal CO_2 flux can be used as a tool for advance warning of water stress and irrigation management.

Methodology

Micrometeorological measurements were carried out over a non-irrigated peanut field near Vienna, Georgia. The measurements included CO_2 flux, evapotranspiration, net

radiation, sensible heat flux, soil water content, soil temperature and soil heat flux. The sensors used were high frequency CO_2 analyzer, three-dimensional sonic anemometer, net radiometer and soil CO_2, temperature and moisture sensors (Figure 1), weather station (Figure 2). The weather station monitored weather parameters such as air temperature and humidity, wind speed and direction, solar radiation, rainfall, etc. The data were logged every 30 minutes over the peanut growing season.

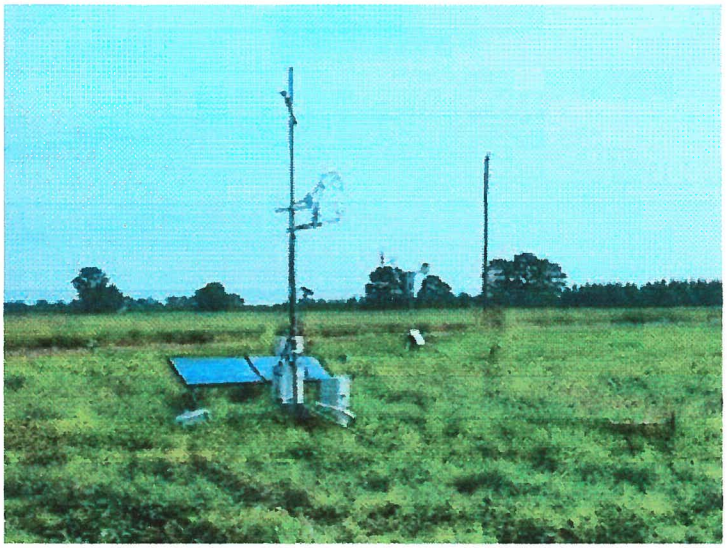

Figure 1. Experiment setup for CO_2 respiration measurements.

Figure 2. The Weather station instrumentation.

Preliminary Results

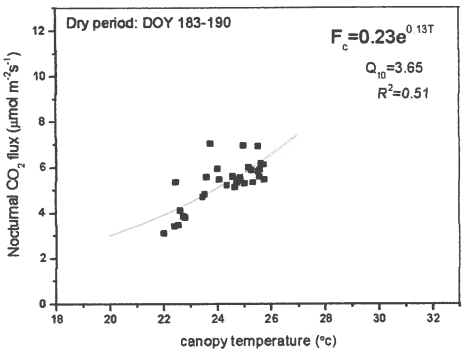

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Figure 3. Preliminary results of CO_2 respired at night as a function of canopy temperature and soil water content during one dry period.

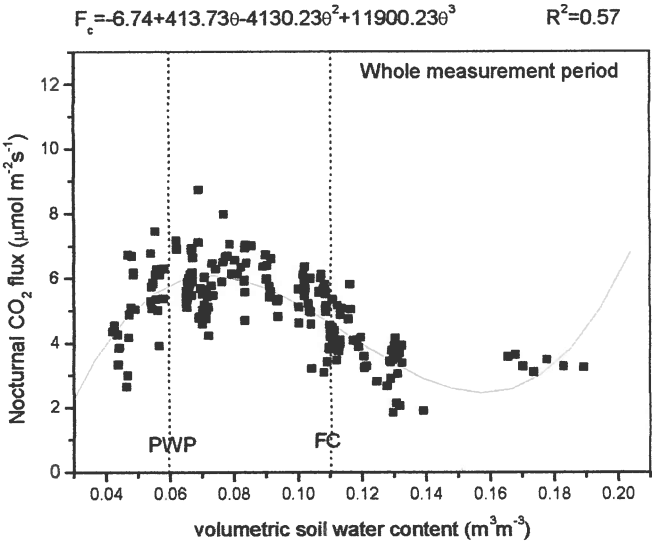

Figure 4. Preliminary results of nocturnal CO_2 flux during whole measurement period as a function of volumetric soil water content (PWP: permanent wilting point and FC: field capacity).

Preliminary results as shown in Figure 3 and 4, and help understand the characteristics of nocturnal CO_2 fluxes as a function of canopy temperature and soil water content. Without providing a full analysis of the data, the two figures illustrate well the dependence of the amount of photosynthates lost to the atmosphere by respiration and the underlying processes regulating this mechanism.