391
FL-89
1247
2013

2013 Southeastern Peanut Research Initiative

Final Report & Summary

Title: Influence of Palmer Amaranth Density on Peanut Water Use

Introduction

Palmer amaranth continues to be one of the most troublesome weeds in the southeast (Webster 2009). Peanut yield loss of 28% due to Palmer amaranth competition has been shown to result from 1 Palmer amaranth plant per meter (Burke et al. 2007). Although this weed has the potential to devastate peanut yield, numerous research trials have shown that timely application of preemergence herbicides can effectively manage this weed (Dotray et al. 1996, Sweat et al. 1998, Bond et al. 2006). The limitation of this program is that rainfall or irrigation is necessary to activate these herbicides. With approximately 30% of peanut irrigated in FL, a dry spring can result in preemergence herbicide failures.

There are postemergence options, but these products will not control weeds >3-4" in height (Mayo et al. 1995, Hager et al. 2003). If there is a situation where preemergence herbicides fail, these postemergence options will only provide a modicum of control.

Peanut yield will always suffer when weeds escape control. Although some experiments have been conducted that describe the impact of Palmer amaranth competition on peanut, these experiments have not been conducted in the drought prone soils common throughout the southeast. Moreover, we know almost nothing about how soil water is affected by these escaped plants. Preliminary research conducted in a drought year indicates that a single Palmer amaranth plant can create a circular water deficit with a radius of up to six feet. By having a better understanding about how Palmer amaranth competes for soil water can give us needed information to further develop IPM strategies for management of escaped weeds. Therefore, the objective of this research is to determine how Palmer amaranth soil water use impacts the peanut crop.

Methods

This study will be conducted at the University of Florida Plant Science Research Unit in Citra, FL and at the Jones USDA Research farm in Tifton, GA.

Peanut was planted in traditional fashion (5-6 seed per foot on 30" rows) with Palmer amaranth grown from seed and thinned to a 1 plant per plot density. Peanut was planted on April 30, 2013 at the Citra, FL location and May 9, 2013 at the Tifton, GA location with Palmer amaranth being planted the same day. The Palmer amaranth seed was sown in the row middle to maximize light interception and competitiveness. Soil access tubes were installed at the Citra, FL location at the time of planting to measure soil moisture to a depth of 1m. These tubes were placed in 2 foot increments radiating from each Palmer amaranth plant up to 8 feet away (Figure 1). Tubes were located in the row middle to determine the depth that each Palmer amaranth plant affected soil moisture. Control plots determined the soil moisture content of soil in a weed-free environment. Each treatment (control and 1 Palmer per plot) had 4 replications. Soil relative water content was measured with a soil moisture meter once weekly throughout the growing season. The measurements began when the Palmer reached 1-2' in height, approximately June 1, 2013. Prior to this, few differences in soil water content would likely be observed.

Additional physiological measurements were taken at each location to determine how this level of water deficit impacts peanut photosynthesis and stomatal conductance. Peanut leaves were measured at 0, 2, 4, 6, 8, and 10 feet from the Palmer amaranth in the plot with a Licor 6400 portable photosynthesis system. These parameters were measured on the same plots that have soil access tubes, thus consisting of four replications. The physiological measurements were taken in each plot containing the Palmer plant and compared to the control, weed-free peanut. Physiologlical measurements were also recorded on Palmer amaranth leaves in each plot.

These parameters defined not only how soil water content was affected by the presence of Palmer amaranth, but also defined how water use in peanut, as well as photosynthesis, was affected. At crop maturity, the plots were hand harvested in sections, 2 plants every two feet to determine the impact of Palmer amaranth competition in terms of soil water and photosynthesis reduction on final crop yield.

Results

At the Citra, FL location, a significant linear trend (p=0.0494) was found only at 10cm in depth with soil moisture increasing as distance from the Palmer amaranth plant increased. Unexpected, higher than average rainfall occurred at both locations during the 2013 season (Figures 2 and 3). We suspect this rainfall recharged the soil moisture profile so that any deficits created by the Palmer amaranth plant were replenished quickly.

However, at both locations, peanut photosynthesis followed a significant linear trend (p=0.0002) with peanut photosynthesis rate increasing as distance from the Palmer amaranth plant increased (Figure 4). Peanut stomatal conductance followed the same trend (p=0.0218). These data indicate that peanut transpiration and photosynthesis were affected by Palmer amaranth during the 2013 season.

Peanut yield also exhibited a significant linear trend (p=0.0279) when data from each location were combined (Figure 5). For each foot that the peanut plant was located away from the Palmer amaranth plant, peanut yield increased 4.27 grams per plant. Number of pods per peanut plant exhibited a similar trend (p=0.0051), with pod number increasing by 3 for each foot the peanut plant was located away from the Palmer amaranth plant.

Although we did not document a substantial area of water depletion due to each Palmer amaranth plant, peanut transpiration, photosynthesis, and yield were significantly impacted. This could be due to several factors, including light, but we cannot draw a conclusion at this time.

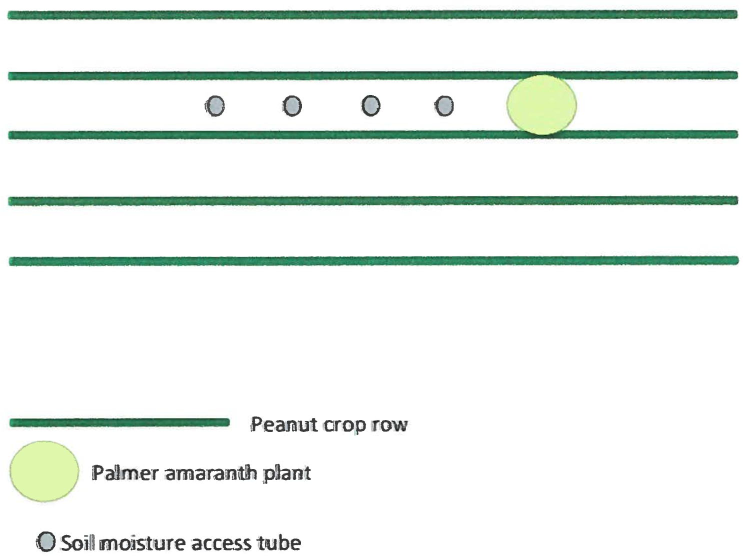

Figure 1. Diagram of plot layout.

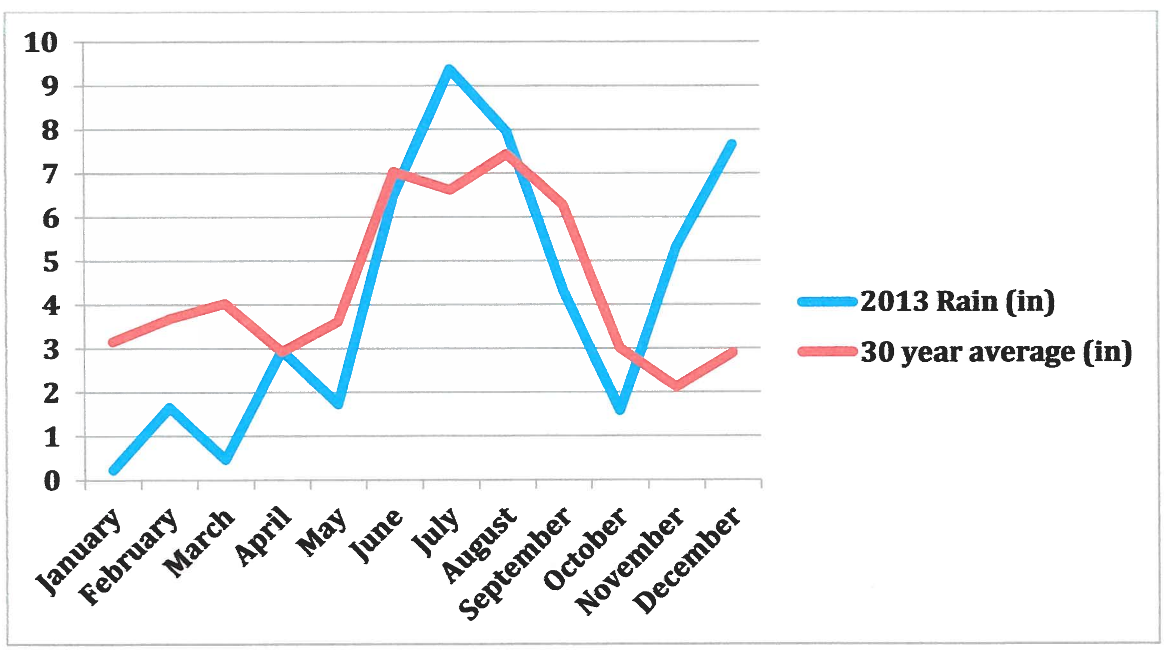

Figure 2. Monthly average rainfall in Citra, FL during 2013 as compared to the 30-year average.

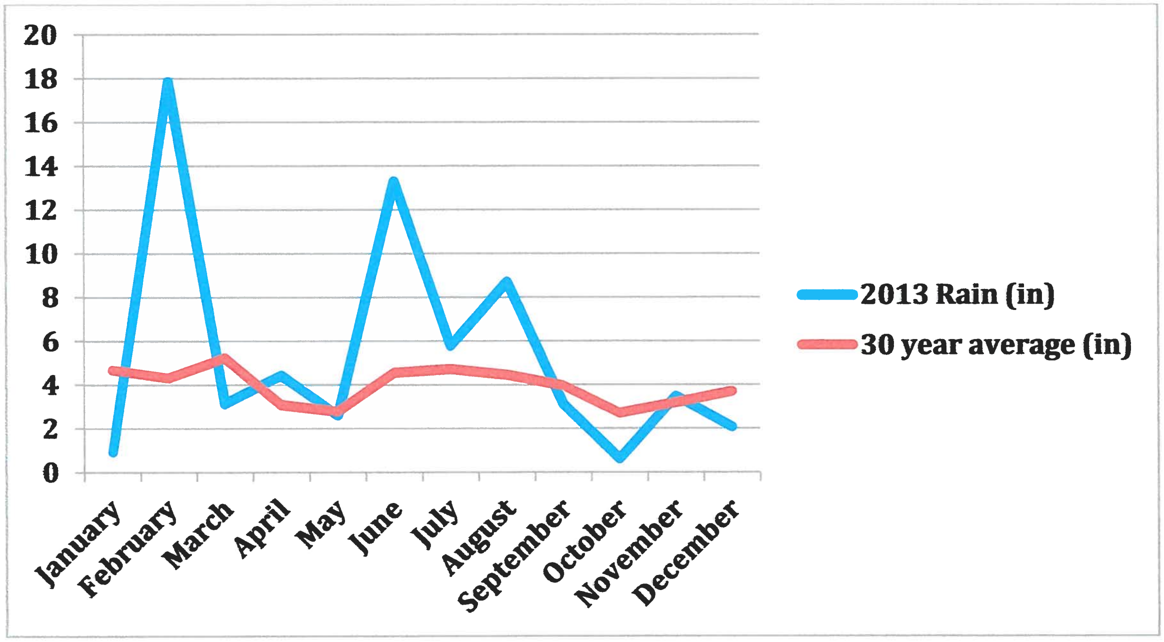

Figure 3. Monthly average rainfall in Tifton, GA during 2013 as compared to the 30-year average.

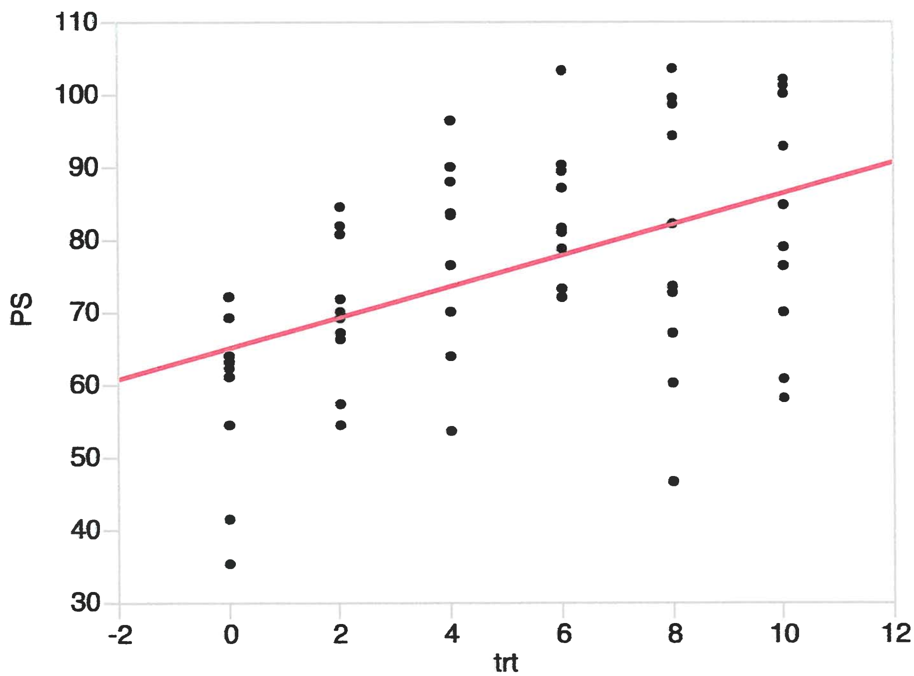

Figure 4. Peanut photosynthesis, presented as percent of control, increases as distance from Palmer amaranth plant increases. Data are combined Citra, FL and Tifton, GA locations.

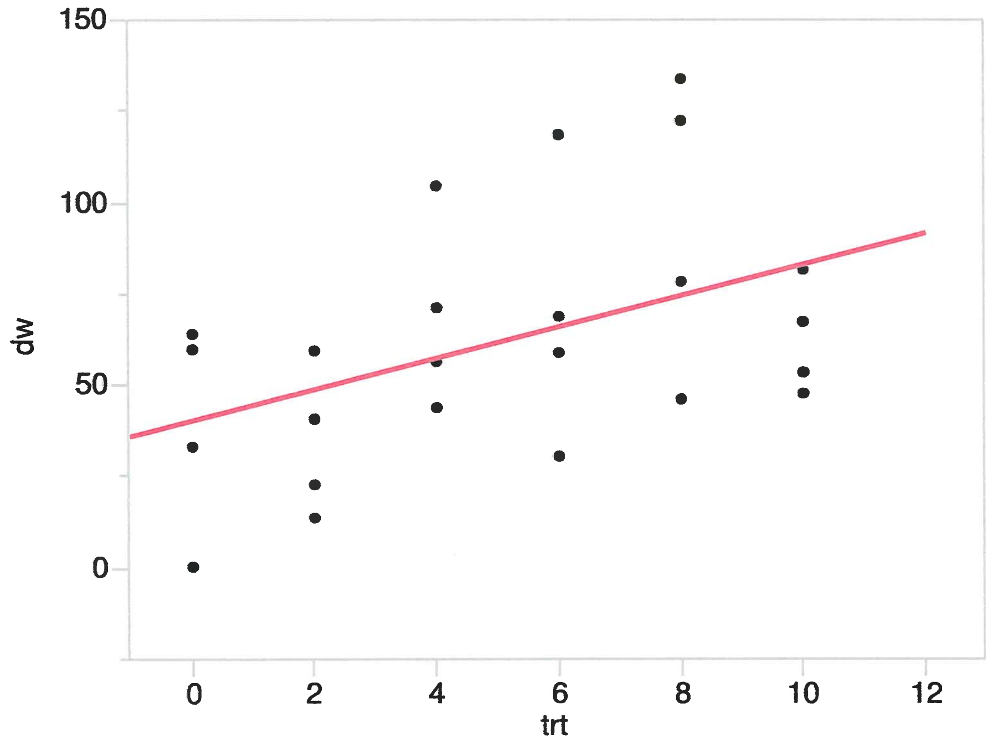

Figure 5. Peanut yield, presented as dry weight (g), increases as distance from Palmer amaranth plant increases. Data are combined Citra, FL and Tifton, GA locations. Line indicates linear trend of increasing peanut yield as distance from Palmer amaranth plant increases.

Literature Cited

Bond J.A., Oliver L.R., and Stephenson IV, D.O. 2009. "Response of Palmer amaranth (*Amaranthus palmeri*) accessions to glyphosate, fomesafen, and pyrithiobac." Weed Technol. 4:885-892.

Burke I.C., Schroeder M., Thomas W.E., Wilcut J.W. 2007. Palmer amaranth interference and seed production in peanut. Weed Technol. 21: 367-371.

Dotray P.A., Keeling J.W., Henniger C.G., Abernathy J.R. 1996. Palmer amaranth (*Amaranthus palmeri*) and devil's-claw (*Proboscidea lousianica*) control in cotton (*Gossypium hirsutum*) with pyrithiobac. Weed Technol. 10: 7-12.

Hager A.G., Wax L.M., Bollero G.A., Stoller E.W. 2003. Influence of diphenylether herbicide application rate and timing on common waterhemp (*Amaranthus rudis*) control in soybean (*Glycine max*). Weed Technol. 17: 14-20.

Mayo C.M., Horak M.J., Peterson D.E., Boyer J.E. 1995. Differential control of four Amaranthus species by six postemergence herbicides in soybean (*Glycine max*). Weed Technol .9:141-147.

Sweat J.K. 1998. "Herbicide efficacy on four Amaranthus species in soybean (*Glycine max*)." Weed Technol. 12:315-321.

Webster T.M. 2009. Weed survey- southern states. Proc. South. Weed. Sci. Soc. 62:510-525.