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Southeastern Peanut Research Initiative 2013
FINAL REPORT

+ Summary

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Project Title: Developing a Weather-Based Decision Support System for the Management of White Mold (Sclerotium Rolfsii) in Peanut

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Prepared by:
Nicholas S. Dufault, Extension Plant Pathologist, University of Florida
352-273-4623
nsdufault@ufl.edu

1. **Abstract**
Decision support systems (DSS) are frequently used by extension agents, crop consultants, growers and other agricultural clientele to provide accurate and timely management of plant diseases. Currently, the main DSS for peanut growers is the Peanut Rx disease risk index. Peanut Rx is an excellent pre-plant DSS tool, however, it does not include the site-specific weather conditions growers experience in their fields each year. Management programs may need to be adjusted to account for disease development related to the unique environments created from these weather conditions. In the Virginia-Carolina peanut production areas, researchers observed that the efficiency of prescription fungicide spray programs could be increased by combining them with the Phipps-Langston risk algorithm and a regression model developed by Smith et al. (Plant Disease, 2007. 91:1436-1444). By integrating these tools growers were able to manage their fungicide selections and timings more efficiently, and increase their overall profitability. Thus, it is hypothesized that by integrating Peanut Rx with weather-based models producers will have more robust information available to determine the best management practices (i.e. fungicide spray selection & timing) for their peanut fields. **Results?**

2. **Introduction**
Stem rot or white mold, caused by *Sclerotium rolfsii* Sacc., is a devastating disease of peanuts in the Southeastern U.S. Typically this disease is managed with fungicide specific sprays starting at 60 days after planting (DAP). However, recent fungicide experiments have indicated that S. rolfsii can be more efficiently managed with early season sprays applied between 20 and 40 DAP. The objective of this study was to develop a preliminary model that uses readily available soil temperature and rainfall weather data to assess early season optimal growth periods of *S. rolfsii*. The long term goal of this study is to use the models, along with Peanut Rx, to develop disease risk advisory systems for white mold across Florida with the ultimate aim of implementing it throughout the southeastern United States.

3. **Methods and Results**
Model Comparison
A soil temperature ratio (STR) was developed for monitoring periods when temperature was considered optimal for *Sclerotium rolfsii* growth and development. The ratio was calculated daily by dividing the:

$$\frac{Number\ of\ hour\ soil\ temperature\ is < 25°C}{Number\ of\ hours\ soil\ temperature\ is\ between\ 27\ and\ 35°C}$$

A day was consider to have optimal temperatures for growth when the ratio was 0.5 or less, which indicates that 2 times as many optimal temperature growth hours compared to non-optimal hours were present for that day.

To further refine periods of optimal S. rolfsii growth, a rainfall parameter established by Rideout et al. (2008) was used to determine when adequate moisture was present. If total rainfall accumulations were more than for 0.5 inches in the last 5 days or more than 1 inch in the last 10 days, then enough moisture was present for growth. A day was considered optimal for growth if both the STR and rainfall parameter indicated optimal conditions.

A previous growing degree day white mold model developed by Olatinwo et. al.(2009) was compared to the STR/rainfall model. A day was considered optimal for growth in their model when the average 2 m air temperature was between 25 to 35°C, average soil temperature was between 27 and 32°C and average relative humidity at 2 m was > 85%. These days were summed over the whole season compared to the total number of optimal days for the STR/rainfall model (Figure 2). In general, the STR/rainfall model predicted optimal conditions at the PSREU sooner with growing degree day accumulations starting 57, 42, and 8 days earlier for 2011, 2012 and 2013, respectively. Disease pressure from S. rolfsii in untreated plots at the PSREU indicate that 2011 growing season was the most optimal year for disease development, and 2012 and 2013 were less optimal.

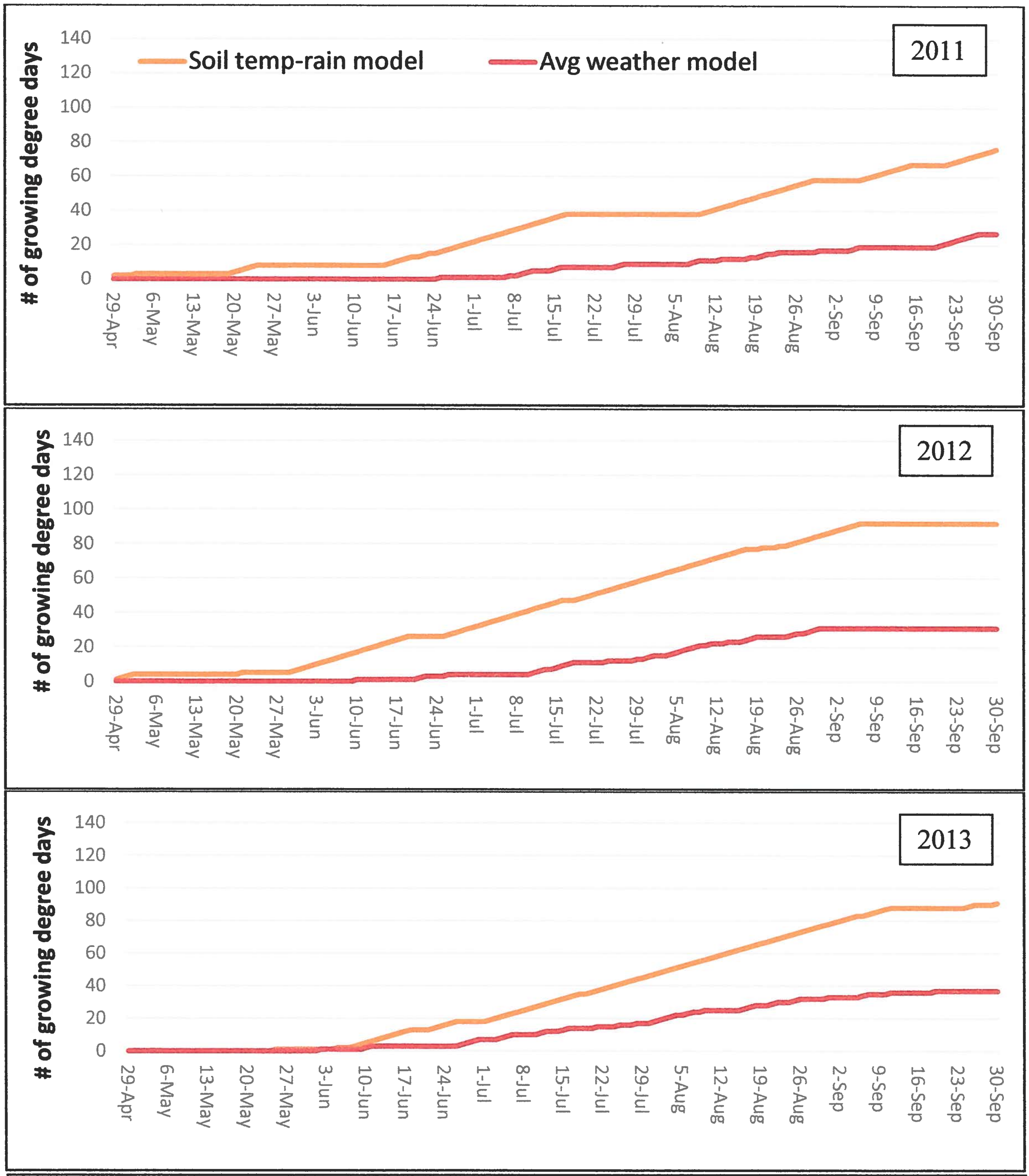

Figure 1: Comparisons between the soil temperature ratio/rainfall model and the average weather growing degree day model developed by Olatinwo et al. (2007). If a day was considered optimal for growth of the fungus then 1 day was added to the total number of growing degree days. This value is cumulative over the whole season. The max number of days that can be obtained between April 29th and September 30th is 185 growing degree days.

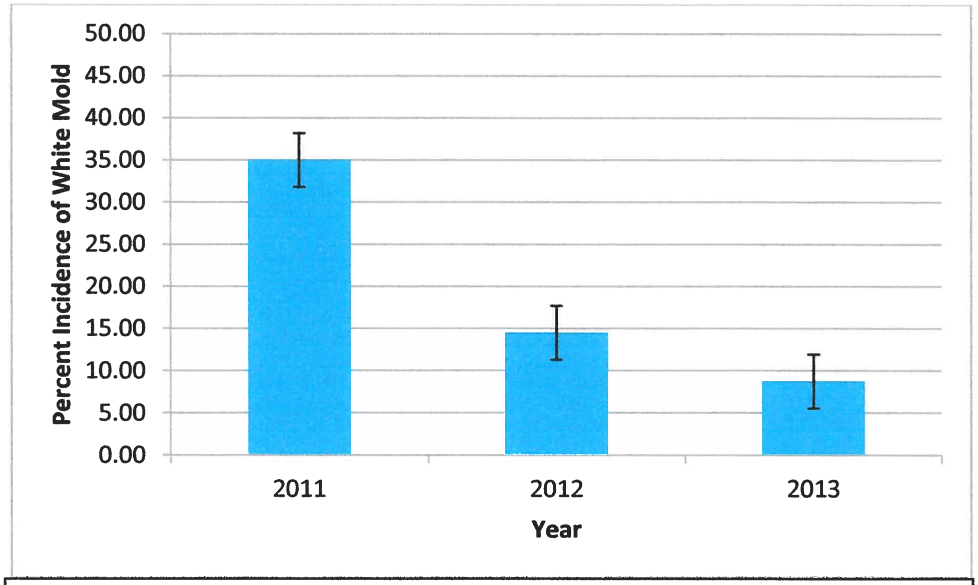

Figure 2: The percent incidence of white mold (*Sclerotium rolfsii*) from inoculated research plots at the Plant Science Research and Education Unit in Citra, FL. Incidence was based on the number of white mold signs found in 1 ft sections of the two row plots. Plots in 2011 and 2012 were inoculated with white mold, but in 2013 plots were not inoculated. 2013 plots were the 3rd year of continuous peanuts after 2 years of inoculations.

2013 Field Trial Results

Field studies were conducted at 4 separate locations in 2013 to assess the value of the STR/rainfall model in spray management decisions. Site specific information can be found in the table below. Fungicide applications (Proline @ 5.7 fl oz/A) at each site consisted of early season treatments at 0, 20, 30 and 40 days after planting (DAP). Each treatment had 4 extra white mold fungicide applications of Provost (8 fl oz/A) at 60, 75 and 105 DAP, and Abound (18 fl oz/A) at 90 DAP. Disease incidence readings were recorded at each site with the first observations occurring on 7/19, 10/15, and 7/31 at the Jay, Quincy and Citra sites respectively. The max number of white mold hits per foot of row in the untreated plots was 0.28 (Jay), 0.11 (Quincy), and 0.13 (Citra). No white mold symptoms or signs were observed in the Marianna planting.

The model reached moderate/high and high risk values in the month of June for the Citra, Jay and Quincy sites, but never reached that risk at Marianna (Figures 3 through 6). The model indicated at 30 DAP the risk was high for fungal development at Citra, Jay and Quincy, but not for the 20 or 40 DAP fungicide treatment sprays. Yield results for each site indicated that the 20, 30 and 40 DAP did not improve yields when compared to the standard 60 DAP for white mold control.

Facilty	*City*	*Planting Date*	*Plating Type*	*Variety*
West Florida Research and Education Center	Jay, FL	5/15/13	Twin Row	Georgia-06G
Plant Science Research and Education Unit	Citra, FL	5/12/13	Single Row	Georgia-06G
North Florida Research and Education Center	Marianna, FL	6/17/13	Single Row	Georgia-06G
North Florida Research and Education Center	Quincy, FL	5/15/13	Single Row	Georgia-06G

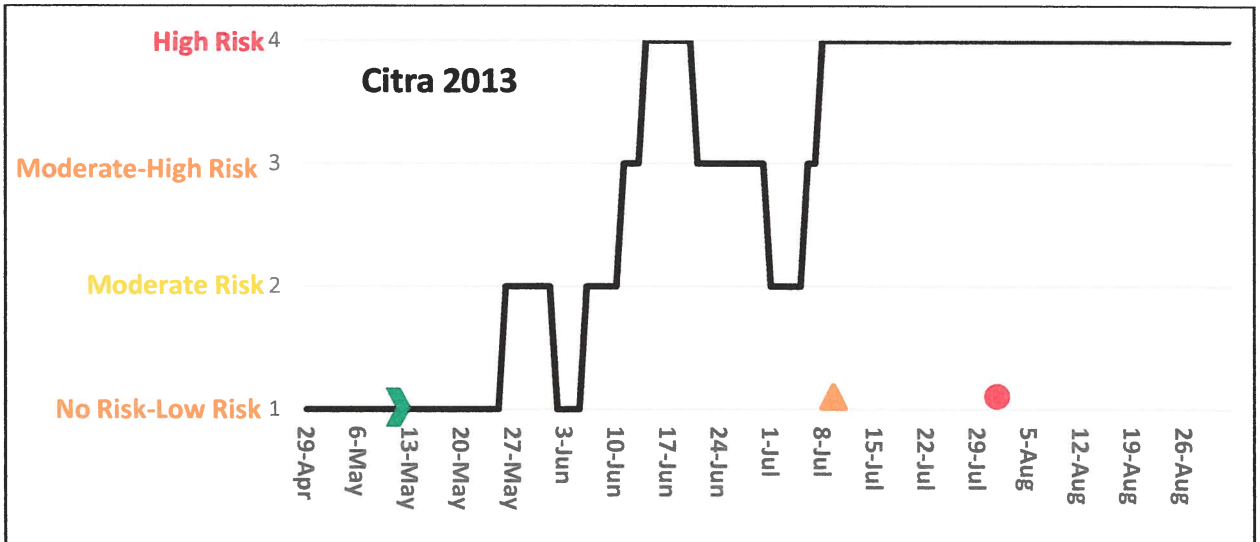

Figure 3: Daily risk values based on the soil temperature ratio (STR) using 2013 weather data from the Florida Automated Weather Network at the Plant Science Research and Education Unit in Citra, Fl. Risk values were calculated by summing the number of optimal days in the last 7 so that Low = 0 days, Moderate = 1 to 3 days, Moderate-High = 4 to 5 days and High was 6 to 7 days. A day was optimal if the STR was less than 0.5 and rainfall of 0.5 or 1 inch was present within the last 5 or 10 days, respectively. The symbols indicate planting date (❯), 60 days after planting (DAP) fungicides spray (▲); and when white mold was first detected (●). The 60 DAP spray was when typical white mold sprays are applied.

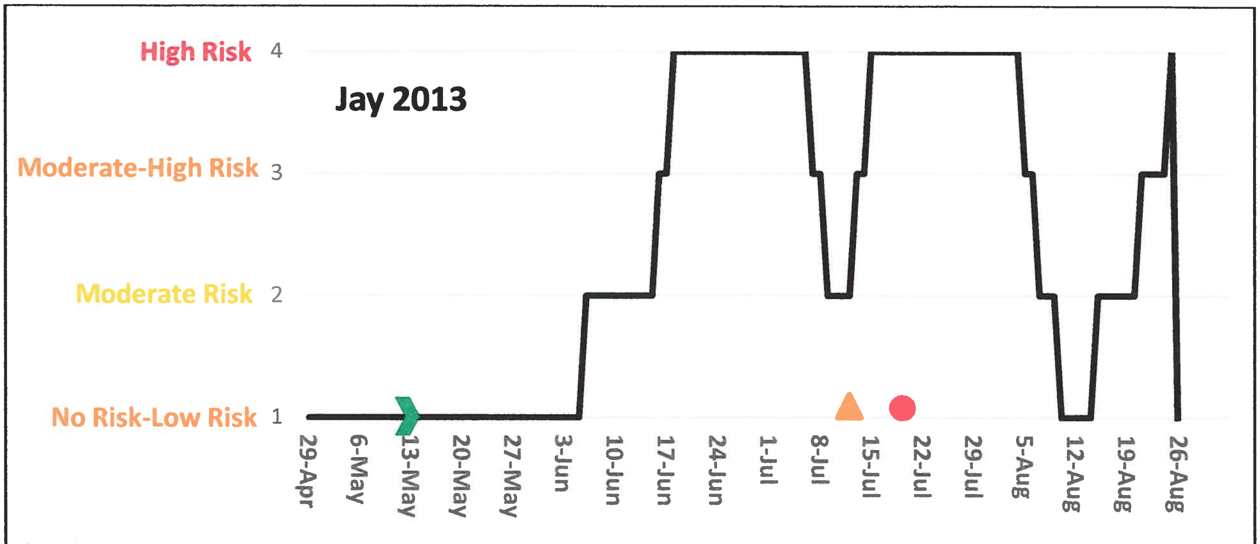

Figure 4: Daily risk values based on the soil temperature ratio (STR) using 2013 weather data from the Florida Automated Weather Network at the West Research and Education Center in Jay, FL. Risk values were calculated by summing the number of optimal days in the last 7 so that Low = 0 days, Moderate = 1 to 3 days, Moderate-High = 4 to 5 days and High was 6 to 7 days. A day was optimal if the STR was less than 0.5 and rainfall of 0.5 or 1 inch was present within the last 5 or 10 days, respectively. The symbols indicate planting date (❯), 60 days after planting (DAP) fungicides spray (▲); and when white mold was first detected (●). The 60 DAP spray was when typical white mold sprays are applied.

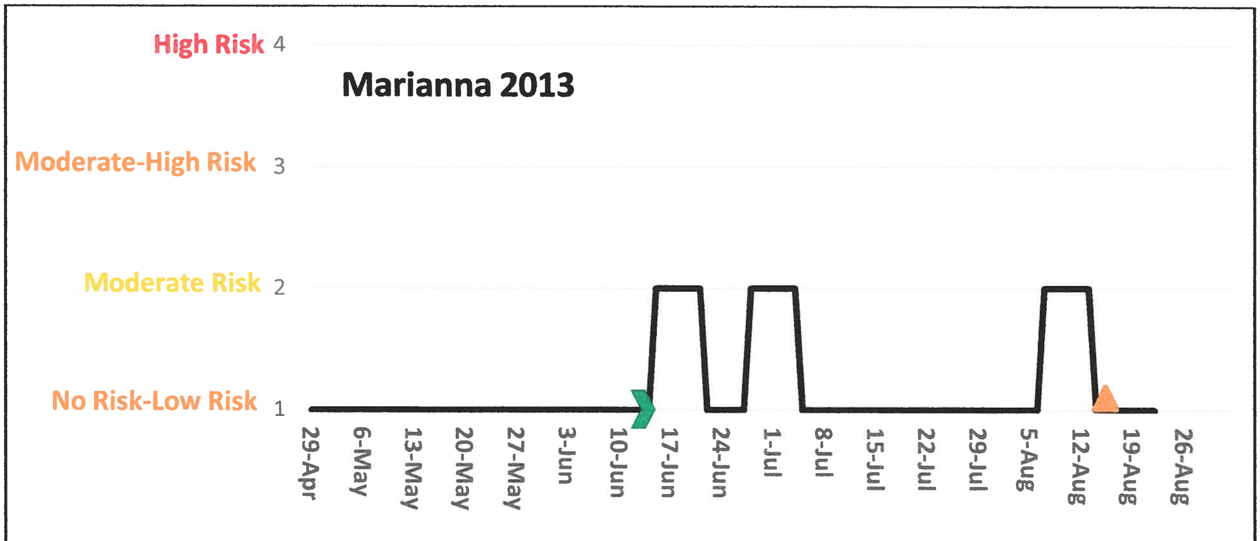

Figure 5: Daily risk values based on the soil temperature ratio (STR) using 2013 weather data from the Florida Automated Weather Network at the North Florida Research and Education Center in Marianna, FL. Risk values were calculated by summing the number of optimal days in the last 7 so that Low = 0 days, Moderate = 1 to 3 days, Moderate-High = 4 to 5 days and High was 6 to 7 days. A day was optimal if the STR was less than 0.5 and rainfall of 0.5 or 1 inch was present within the last 5 or 10 days, respectively. The symbols indicate planting date (❯), 60 days after planting (DAP) fungicides spray (▲); and when white mold was first detected (●). The 60 DAP spray was when typical white mold sprays are applied.

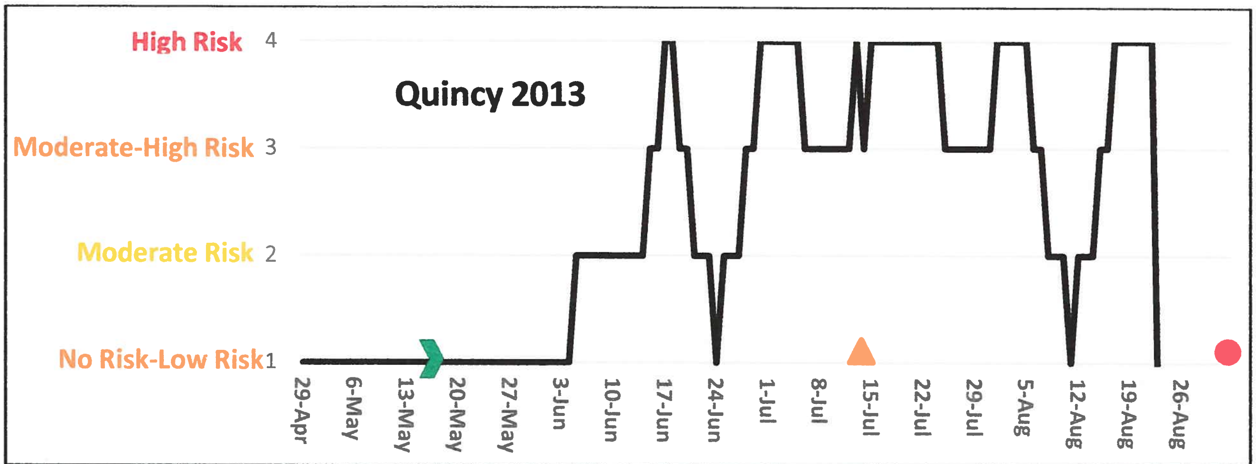

Figure 6: Daily risk values based on the soil temperature ratio (STR) using 2013 weather data from the Florida Automated Weather Network at the North Florida Research and Education Center in Quincy, FL. Risk values were calculated by summing the number of optimal days in the last 7 so that Low = 0 days, Moderate = 1 to 3 days, Moderate-High = 4 to 5 days and High was 6 to 7 days. A day was optimal if the STR was less than 0.5 and rainfall of 0.5 or 1 inch was present within the last 5 or 10 days, respectively. The symbols indicate planting date (❯), 60 days after planting (DAP) fungicides spray (▲); and when white mold was first detected (●). The 60 DAP spray was when typical white mold sprays are applied.

Table 1: Recommendation results for early season *Sclerotium rolfsii* specific fungicide sprays[a] based on risk ratings from the model.

	Risk Indicated An Application[b]	Risk Indicated Withhold Application[c]
Application Needed	0	0
Application Not Needed	3	9

[a] Early season *S. rolfsii* spray treatments were 0, 20, 30 or 40 days after planting (DAP). Normal season spray programs began at 60 DAP and continued until 120 DAP.

[b] A stem rot specific fungicide application was recommended when the model indicated mod-high and high risk scenarios based on the previous 7 days of optimal growth.

[c] A stem rot specific fungicide application was withheld when the model indicated no/low and moderate risk scenarios based on the previous 7 days of optimal growth.

Table 2. Yield data from white mold plots at different locations in Florida.

Site	Early Spray[a]	Yield (lb//A)[b]	
Citra, FL	None	4764	a
	20 DAP	3948	a
	30 DAP	5055	a
	40 DAP	4665	a
Jay, FL	None	6000	a
	0 DAP	4960	b
	30 DAP	5184	ab
	40 DAP	4912	b
Marianna, FL	None	5159	a
	20 DAP	5476	a
	30 DAP	5124	a
	40 DAP	5308	a
Quincy, FL	None	3873	a
	20 DAP	3686	ab
	30 DAP	3054	c
	40 DAP	3552	ab

[a] Days after planting (DAP) a treatment of Proline® @ 5.7 fl oz/A was applied for early season white mold control.

[b] Values followed by a different letter are significantly different according to Fisher's least significant difference test at an alpha of 0.05

4. Summary

In general, 2013 was a low disease pressure year for *S. rolfsii* in Florida. Much of the state had above average rainfall associated with cooler than average temperatures, which led to significant leaf spot disease problems. Because of these conditions, stem rot was not observed until later in the season. The model performed well at most field sites, and did not indicate higher risk situations until a little more than a month after the peanuts had been planted. Out 12 possible early season spray scenarios the model only warned of 3 high risk situations. Overall, the results indicate that in years with non-optimal conditions for white mold the DSS performs well, and can provide growers with more information to reduce the use of early season fungicide sprays for white mold of peanuts. Many factors can affect disease intensity, and continued research to understand these affects is critical to obtaining optimal peanut yields. As new resistant and tolerant varieties are developed, researchers will need to determine disease inputs carefully and over multiple seasons. This study is part of a 3 year study looking at the utility of the new DSS with Peanut RX. Further testing is needed to assess the performance of the model in conditions where a fungicide application is needed, and in conjunction with the Peanut Rx and site specific weather data.