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NATIONAL PEANUT BOARD/SOUTHEAST PEANUT RESEARCH INITIATIVE

~~QUARTERLY~~ FINAL PROGRESS REPORT FOR WORK DONE UNDER RESEARCH AGREEMENT

THE UNIVERSITY OF GEORGIA - QUARTER ENDING DECEMBER 30, 2006

PROJECT TITLE: INCORPORATING WEATHER AND CLIMATE INFORMATION TO ENHANCE THE TOMATO SPOTTED WILT VIRUS RISK INDEX

INVESTIGATORS: Joel Paz, Gerrit Hoogenboom, Robert Kemerait, and John Beasley Jr.

Objectives

The objectives of this project are to examine the relationship of seasonal climate-based information, weather parameters, and the incidence of tomato spotted wilt virus (TSWV), and to develop a procedure to integrate localized weather and climate information into the TSWV index.

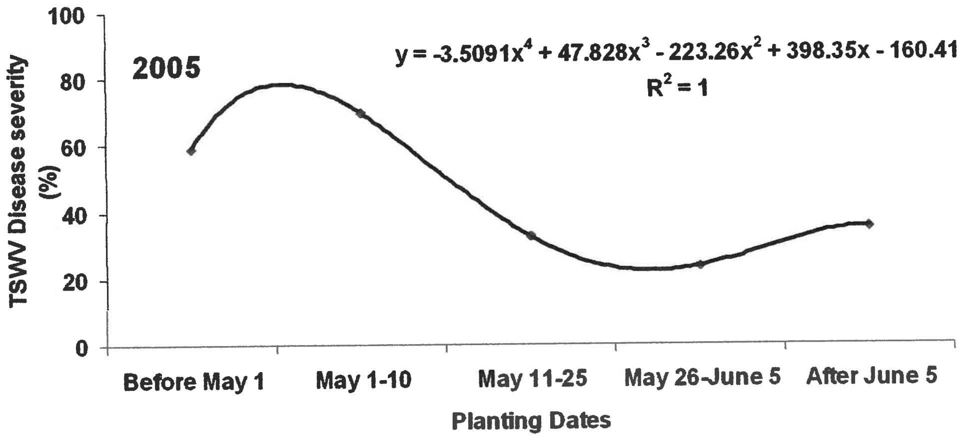
Progress

The impact of weather pattern on incidence of tomato spotted wilt, thrips-vector population dynamics, peanut planting-date (other components of TSWV risk index) and years of spotted wilt disease in Georgia peanuts are currently being evaluated. Incidence and severity of tomato spotted wilt of peanut have been extremely variable in Georgia peanut fields (Brown et al, 1996).

To address the above, Dr. Steve L. Brown provided two year survey data (2004 and 2005) on severity of tomato spotted wilt in Georgia peanut. Initial analysis established the significant effect of weather pattern (wet and dry in 2004 and 2005 respectively) on spotted wilt severity in both years.

Analyses thus far, indicate a significant interaction between varieties and planting date and confirmed the implication of various planting dates used in the risk index on TSWV severity (Fig. 1). In general, planting date is often determined by various weather factors especially, rainfall and temperature. Derived weather parameters such Growing Degree Days (GDD), total amount of rainfall, number of day with rainfall, soil temperature, evapo-transpiration, water balance, degree days, chilling hours and others are often based (to some extent) on rainfall and temperature. Therefore, the two are very essential in deciding the suitable planting date at the beginning of the planting season. These parameters are equally important for the host plant, the insect vector and for the initiation of infection by the virus. Planting date is the only component within the TSWV disease risk index that was thought to be directly related to the weather pattern.

Figure 1. Interaction between planting date and TSWV severity for Georgia Green in 2005.



Georgia Green was selected as a "working variety" within which further analyses were conducted to determine relationship between weather parameters and TSWV severity across survey locations. The survey data was partitioned by variety to minimize the variations. Georgia green was widely planted in both years and was the most represented variety in both years. At a later phase, the result will be applied to all the other varieties.

Models are being developed based on the 2004-5 survey data and derived weather parameters obtained from different county farm locations. This phase was intended to serve as a foundation on which a broad-base model will be developed through utilization of localized weather and climate information. The 2005 disease risk index point allocation system was adjusted to 2004 system (Brown et al, 2005). Although, differences were subtle between the two years, point reallocation was implemented to maintain uniformity and consistency across the two years and also to minimize variations, within and across the years.

In addition to the Total Risk Index points, environmental variables used in developing a best fitting model for predicting TSWV severity in Georgia peanut include; TmaxM, TminMar, TavMar, TmaxApr, TminApr, TavApr, TmaxMarApr, TminMarApr, TavMarApr, DD56-84JanApr, RainfallMar, RainDayMar, RainfallApr, RainDayApr, RainfallMarApr, RainDayMarApr, ChillHrs-Apr, EVTMarApr, and WBMarApr. Metrological data were extracted from Georgia Weather website (www.georgiaweather.net) based on county and field locations in the surveys. Criteria for selecting the best subset in multiple regression analysis included an overall *F* statistic significant at $P \leq 0.05$, a *t* test of estimated parameters significant at $P \leq 0.05$, values of R^2, residual plots and Mallow's *Cp* statistic. Analyses were performed using the Statistical Analysis System (SAS Institute Inc., Cary, NC) and DataFit (Oakdale Engineering, Oakdale, PA).

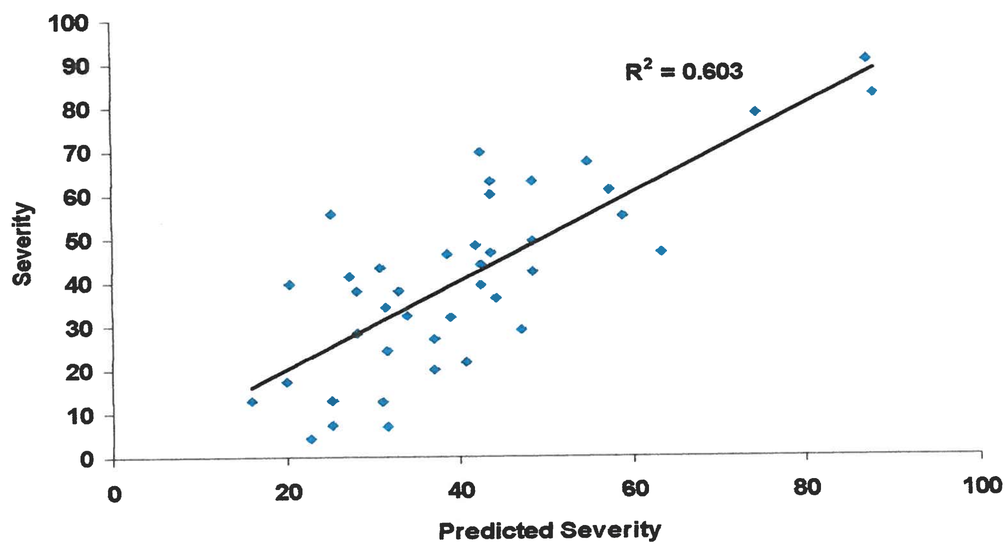
The best fitting regression equation, accounting for approximately 60% of the variation in TSWV severity within Georgia Green in 2004 and 2005 could be summarized by the equation; $Y = EXP(-8.393+0.021*X1-0.322*X2+0.113*X3+0.240*X4-0.508*X5)$ as a function of Total Risk Index, Total amount of rainfall in April, Total amount of rainfall in

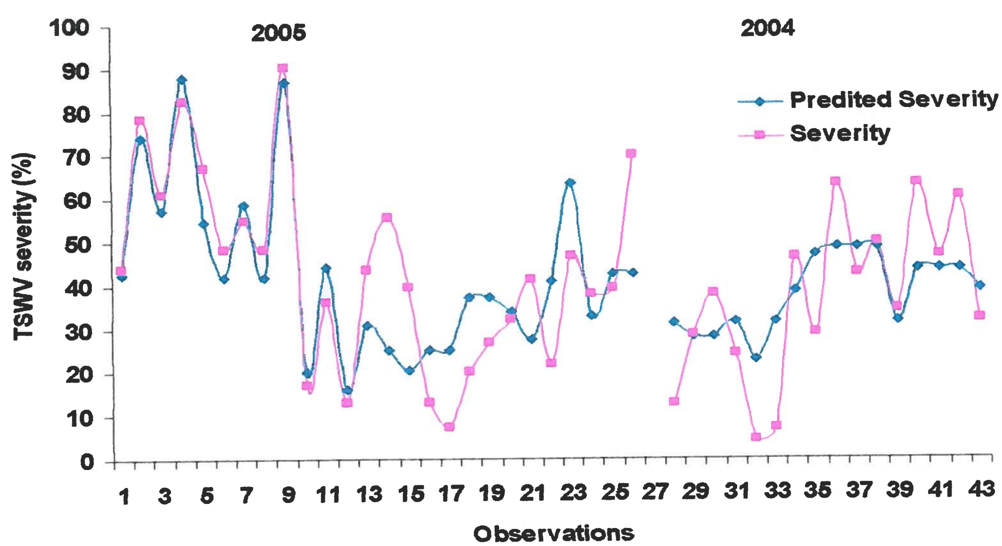
March, Average temperature in March and April (mm), and Evapo-transpiration in March and April (Fig. 2).

Table 1. Regression variable results

	Variable	Coefficient	Prob.(t)
	Intercept	-8.393	0.017
X1	IndexTotal	0.021	0.000
X2	RainfallApr	-0.322	0.000
X3	RainfallMar	0.113	0.005
X4	TavMarApr	0.240	0.001
X5	EVTMarApr	-0.508	0.010

Figure 2. Modeling TSWV severity within Georgia Green from 2004-2005 survey data





The impact of weather on thrips-vector population dynamics, and peanut planting-date based on historical weather data and years of spotted wilt disease survey data are currently being evaluated. Correlations were established between pre-season thrips data provided online at http://www.tomatospottedwiltinfo.org/thrips/preseasonrisk.htm, incidence of TWSV in weeds and derived weather parameters. Degree days accumulation of temperature with 56°F as the based and 84°F as the maximum temperature showed some correlations. Further investigations are been conducted to optimize, tested and possibly adapted the model to TWSV severity in peanuts.

Conclusions

In summary, the "Georgia Green model" (based on 2004-2005 data), will require further development and optimization for better accuracy within Georgia Green and across other peanut varieties. In the next few weeks, Dr. Steve Brown and Dr. Albert Culbreath will be providing multi-year data (probably between 5-8 years) for continue development, testing, and validation of models that we are currently working on. The additional data will also provide us with further details about variation and trends from one year to the next, and possibly some information on the impact of El Niño, Neutral and La-Niña years.

References

Brown, S. L., A. K. Culbreath, J. W. Todd, D. W. Gorbet, J. A., Baldwin, and J. P. Beasley. 2005. Development of a Method of Risk Assessment to Facilitate Integrated Management of Spotted Wilt of Peanut. *Plant Disease* 89(4): 348-356.

Brown, S. L., J. W. Todd and A. K. Culbreath. 1996. Effect of selected cultural practices on incidence of tomato spotted wilt virus and populations of thrips vectors in peanuts. *Acta Horticulturae* 431: 491-498.

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