Effects of Climate Variability on Irrigation Water Use in the Southeastern United States

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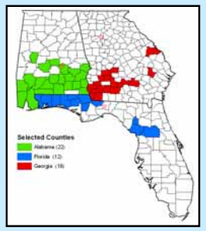
INTRODUCTION

- Water is critical in support of irrigated agriculture in the southeastern United States, and demand for irrigation is expected to increase in the future. There is a need to quantify the impact of El Niño-Southern Oscillation (ENSO) on irrigation water use.
- The goal of this study was to examine the effects of changes in ENSO phases on irrigation water consumption for peanut production.

METHODOLOGY

- The CSM-CROPGRO-Peanut model, which is part of DSSAT v. 4.0 (Hoogenboom et al., 2004) was used to simulate peanut yield response and irrigation water use to different climate, irrigation, and planting date scenarios.

- Long-term historical weather data (1900-2004) were obtained from the National Weather Service (NWS) Cooperative Observer Program (COOP) network and compiled by the Center for Ocean-Atmospheric Prediction Studies (COAPS).
- A solar radiation generator, WGENR (Hodges et al., 1985), with adjustment factors obtained for the southeastern USA was used to generate daily solar radiation data.
- Georgia Green peanut cultivar, a medium maturing runner-type peanut variety, was selected as the representative variety for all counties included in the simulation.
- The soil profile data of three representative soils for each county were obtained from the soil characterization database of the USDA National Resource Conservation Service.
- Eight planting dates were considered in the simulation: April 16, 23; May 1, 8, 15, 22, 29; June 5 and 12.
- Peanut responses were simulated with and without irrigation. Yield and associated variables including irrigated water requirements and number of irrigation events were predicted.
- An irrigation event is triggered when soil moisture at the top 50 cm of the soil profile reaches 60% of the available soil moisture.
- Crop simulations were made for several counties in Alabama (22), Florida (12), and Georgia (18).



RESULTS

- Cumulative precipitation during El Niño was higher during the peanut growing season compared to La Niña years.

Average cumulative precipitation (mm) during the peanut growing season under different ENSO phases.

State	El Niño	Neutral	La Niña
Alabama	1234	1213	1205
Florida	1408	1336	1262
Georgia	1100	1037	1001

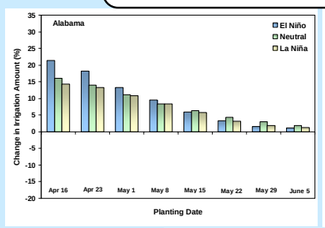
- Under El Niño condition, the average cumulative irrigation used during the peanut growing season was lower compared to La Niña years.

Average cumulative irrigation (mm) during the peanut growing season under different ENSO phases.

State	El Niño	Neutral	La Niña
Alabama	264	286	282
Florida	204	215	212
Georgia	283	296	292

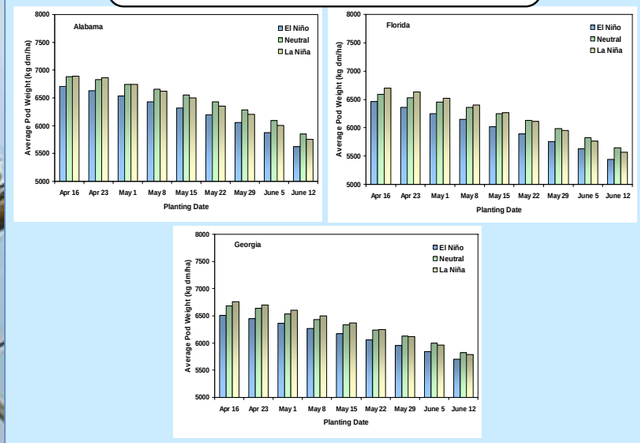
- Average irrigation amount decreased with delayed planting date. The reduction in irrigation water use was higher for El Niño as opposed to La Niña.

Changes in cumulative irrigation consumption (compared to a June 12 planting date) under different ENSO phases.



- In general, average peanut yields under El Niño were lower than in La Niña and Neutral years.
- Pod weight decreased when planting was delayed regardless of ENSO phase.

Pod weight of irrigated peanuts grown at different planting dates under different ENSO conditions.



CONCLUSIONS

- Irrigation water consumption was lower under El Niño. With delayed planting, the reduction in irrigation water use was more pronounced for El Niño compared to La Niña.
- Peanuts tended to produce higher yields under La Niña and Neutral conditions.

REFERENCES

- Hodges T., V. French, and S.K. LeDuc. 1985. Estimating solar radiation for plant simulation models. AgRISTARS Tech. Rep. JSC-20239; YM-15-00403, 21 pp.
- Hoogenboom, G., J.W. Jones, P.W. Wilkens, C.H. Porter, W.D. Batchelor, L.A. Hunt, K.J. Boote, U. Singh, O. Uryasev, W.T. Bowen, A.J. Gijsman, A.S. Du Toit, J.W. White, and G.Y. Tsuji. 2004. Decision Support System for Agrotechnology Transfer Version 4.0. [CD-ROM]. University of Hawaii, Honolulu, HI.

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