

Use of Climate Indices in Cotton Yield Risk Assessment for the Southeastern USA

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Cotton is one of the most important crops in the Southeastern USA economically, accounting for the major share of total cotton production of the United States. At the same time, cotton in the Southeast deals with the yield/production risk factor. Generally agricultural yield/production risk is categorized by high amount of variability induced by many unknown and uncontrollable factors. Climate is one of the most influencing factors in cotton but sometimes its control is beyond the reach of growers. Knowing cotton yield risk well in advance based on climate information would aid the grower in making alternative decisions to manage risk. From previous studies it is known that large scale climate indices can be used as an early indicator of temperature and rainfall variables with temporal lags. The rationale of this study was that climate indices can be used as early indicators of cotton yield due to the fact that it has lagged correlation with weather conditions during the cropping season. The main objective was to use climate indices to assess yield risk in cotton before the season in order to aid growers in managing risk. We were also interested in investigating if climate indices show statistically significant correlation with weather variables and cotton yield in Southeastern USA.

Several Pacific and Atlantic SST climate indices were selected for this analysis. As a first step, monthly indices from January through April were correlated with monthly (May-Oct) precipitation, and maximum temperature for the selected counties in Georgia, and Alabama. The same climate indices were also correlated with historic cotton yield residuals. Principal component (PC) analysis was first performed on Jan-Feb climate indices selected from the initial analysis. Multiple linear regressions of significant PCs of climate indices with historic cotton yield residuals were carried out to predict cotton yield. Cross validation was used to evaluate the regression models. Predicted cotton yield residuals were re-categorized in to different groups to obtain the first yield risk prediction by the end of February. This forecast can be useful to growers when deciding about crop insurance coverage. After that the Jan through Apr climate indices were used to make another yield risk forecast by the end of April. This forecast can be useful to growers for marketing decisions.

Initial results from this study showed that the pre-season climate indices showed statistically significant correlation with monthly temperature and rainfall, as well as with the historic cotton yield residuals for selected counties in Georgia and Alabama. The principal component regression models also showed significant agreement with the observed yields. Principal component analysis was found to be a promising tool in cotton yield risk assessment and this tool could be useful to growers in managing their risk.

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