VALIDATION OF THE COTTON PRODUCTION MODEL ACROSS THE US COTTON BELT

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Abstract

The Cotton Production Model (CPM) is designed specifically as a production tool applicable across the US Cotton Belt to help farmers better manage their cotton crops. The new model predicts cotton yield for any combination of soil, weather, cultivar and sequence of management actions with minimal data input. It can be used to optimize yield or profitability, and to minimize environmental pollution. The Cotton Production Model draws upon the latest scientific knowledge available, is designed to work with all types of cotton, is user-friendly, and easily maintained.

CPM requires input data on weather, soil, cultivar characteristics and management actions at the start of each run. No prior knowledge of cotton growth is required and no soil or plant measurements are required during the season. Weather data should ideally come from a weather station near the field, though use of readily available county weather data is acceptable. Soils data are derived from the database of the Natural Resource Conservation Service and standard soil tests. Data on management actions are entered by the user. The data requirements of CPM are similar to those of other models, and are largely dictated by the information needed to accurately predict crop behavior. While necessary for the current validation effort, mid-season corrections of plant growth are not required. Entry of data has been simplified by adopting the graphical user interface GUICS.

The responsibilities of the validation team are to thoroughly test the performance of the model under the diverse environmental, managerial and cultivar differences experienced across the US Cotton Belt. The validation effort is focusing on utilizing the most current cultivars and management practices to test the model. To this end, a team of ARS, University and Extension scientists has been formed to test and validate the model. Initially, four sites began validation of the model in the Spring of 1998, and have performed an initial evaluation of the model. Through the coordinated efforts of the validation team and the model development team, significant advancement in model performance has been achieved.

The initial examination of model performance tested its ability to respond to different management inputs. The model is able to handle several methods of nitrogen application, including broadcast, banded, and injected. The model responds to sprinkler, flood, furrow and dripper irrigation, as well as fertigation. The model has also been designed to track spray applications, including mepiquat chloride and defoliant. Further testing explored the ability of the model to simulate growth under variable environmental conditions, including temperature, insolation, and rainfall. The model is sensitive to both high and low temperatures. Increases in insolation result in greater plant growth with an increased requirement for nitrogen, as would be expected. Reduction in rainfall limits plant growth and yield. From these tests, we can see that the model responds in a reasonable fashion to alteration of the growth environment. The model is now ready for more extensive testing, and the validation team is expanding to include more sites.

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