TENNESSEE COTTON YIELD MEASUREMENT SYSTEM - FIELD EVALUATION OF COMMERCIAL IMPLEMENTATION

J. B. Wilkerson and F. H. Moody
The University of Tennessee
Agricultural Experiment Station
Knoxville, TN

Abstract

An optical-based volumetric flow rate sensor has be developed at The University of Tennessee to monitor flow rates of seed cotton conveyed in an air duct. This technology has been patented and licensed by The University of Tennessee for commercialization on cotton harvesting equipment. The results reported herein are based on the commercial implementation of this technology by AgLeader Technology.

A yield monitoring system provided by AgLeader was installed on a 4-row Case-IH 2155 cotton picker prior to the 1999 harvest season. Sensors were mounted on both the front and rear conveyer pipes of each row. A sensor consist of two parts, a light-emitting unit and an optical detection unit. Light beams are projected normal to the direction of cotton flow. Data from each detector unit is transmitted over an RS485 bus back to a display/data storage unit mounted in the cab. The in-cab unit is based on the AgLeader PF3000 universal display. A Trimble Ag132 GPS receiver was connected to the PF3000 so spatially-varying yield maps could be made.

Field evaluation was conducted on The University of Tennessee Milan Experiment Station. The yield sensor was evaluated using 100 acres of cotton with an average yield of 1.6 bales/ac. Cotton varieties Paymaster 1220 BG/RR, Stoneville 474, and DeltaPine 5111 were used for field testing. One hundred test runs were conducted over the duration of the 1999 harvest season. Basket test weights ranging from 605 to 2820 lbs. Ground speed during harvest was varied to extend the dynamic range of mass flow rates. The field test protocol involved no cleaning of the optics at any time during the test procedure, no data files were eliminated for any reason from the data set, and no special adjustments were made to the data after harvest. The yield monitor was calibrated three times. The first calibration was after the initial installation of the cotton yield monitoring system, the second calibration was performed after a firmware upgrade early in the season, and the third calibration was performed after one variety change. Each calibration consisted of four consecutive loads.

The mean absolute error for the 100 tests was 3.83%. The maximum error for under prediction was 8.35% and 16.71% for over prediction. The median error was 2.7% and 90% of the test runs had errors less than 7.5%. A statistical correlation analysis was conducted to see how the measurement error relates to variety, mass load rate, moisture content, time-of-day, days-since-calibration, and loads-since-calibration. Results indicate that cotton variety, or properties related to variety, statistically affect sensor performance. However, no statistical correlation was found between measurement error any of the remaining variables.

The test results obtained using the AgLeader implementation of the UT cotton flow sensor were found to be as good as or better than test results obtained in previous years using prototype sensors developed at The University of Tennessee.

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