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7. Title

Improving Soybean Profitability through Explanation of Yield Improvement in New vs. Old Culitvars and Genetic Selection for Yield Compensation at Low

12. Investigator Name(s) (Last Name and Initials)

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20. Termination Date 01/31/2013	40. Period Covered (mo/da/year): 07/01/2009 TO 01/31/2013

Outputs:

Publications discussing light interception as a yield-loss prediction tool and use of dry matter levels for stress analysis and yield prediction have appeared in Crop Management in the July, 2011 and July, 2012 issues, respectively. The use of dry matter levels for stress analysis and yield prediction have also been discussed in a book chapter on soybean yield formation. A poster paper on genotypic differences for morphological responses to low plant population was presented at the Annual Meeting of the American Society of Agronomy in November, 2011; and an article on this subject is currently in press with Crop Science. A related LAES bulletin discussing minimal optimal plant populations for Louisiana has been accepted for publication. Publications related to yield improvement in new vs. old soybean cultivars have been published in Agronomy Journal (2011) and the Journal of Crop Improvement (2012). A poster paper on this subject was also presented at the Annual Meeting of the American Society of Agronomy, November, 2009 in San Antonio, TX.

Outcomes/Impacts:

Activities over the three-year period of this project have mainly involved analysis of soybean field experiments on the following subjects: development of light interception as a yield-loss prediction tool for defoliation-induced yield loss; use of dry matter levels for stress analysis and yield prediction; analyses of genotypic differences for morphological responses to low plant population; and elucidation of yield components and growth dynamic factors related to yield improvement in new vs. old soybean cultivars. Regression models related relative yield loss to reduced light interception during the flowering/pod formation period, and for the early, mid, and late seed filling periods. Highly correlated (R^2= 0.74 to 0.95) linear and quadratic regressions were generated relating relative yield to relative light interception reduction. Validation of these models was done using independent studies from Iowa, Alabama, and Louisiana. Observed and predicted relative yields were highly linearly correlated (R^2=0.93; $P<0.0001$) in a 1:1 linear relationship having a zero y-intercept, thus demonstrating that the models were robust yield-loss prediction tools for defoliation-induced yield loss. Simple regression models based on light interception and developmental timing are accurate predictors of seasonal dry matter levels. This provides a simple, rapid, easy, and cheap method for growers to analyze stress problems and predict yield. The R^2 values between predicted and observed dry matter (at first flower) and predicted and observed dry matter (at seed initiation) were 0.84 ($P<0.0001$) and 0.94 ($P<0.0001$). Predicted and observed yields were highly correlated, although R^2 values were lower when several cultivars were used (R^2=0.63, $P<0.0001$) vs. a single cultivar (R^2=0.84, $p<0.0001$). Analyses of plant population studies done throughout Louisiana indicated that optimal yields can be obtained at plant populations as low as 220,000 plants per ha. A survey of the Southern Public Soybean germplasm collection indicated major differences for how genotypes maintain optimal yield at subnormal plant populations. Genotypic performance for this character can be assessed by branch dry matter per plant when grown at a sparse plant population (10,000 plants per ha). Yield differences between new vs. old soybean cultivars were shown to be regulated by node, pod, and seed production. Among these three yield components, reproductive node number per area (node bearing at least one fertile pod) was identified as the most efficient selection criterion for yield during cultivar development. Yield and yield component differences between new and old cultivars were not related to greater vegetative dry matter accumulation, but to more efficient production of nodes, reproductive nodes, pods, and seeds per unit dry matter (i.e. yield component production efficiency).

Publications:

Board, J.E., Kahlon, C.S., Harrell, D. Udeigwe, T., Stapp, J. and Talbot, T. 2012. Can soybean seeding rates be reduced without affecting yield in Louisiana? Louisiana Agricultural Experiment Station Bulletin. In press.

Board, J.E, and Kahlon, C.S. 2012. Morphological responses to low plant population differ between soybean genotypes. Crop Science. In press.

Board, J.E, and Kahlon, C.S. 2012. Contribution of remobilized total dry matter to soybean yield. Journal of Crop Improvement 26(5):641-654.

Board, J.E., and Kahlon, C.S. 2012. A proposed method for stress analysis and yield prediction in soybean using light interception and developmental timing. Online. Crop Management doi: 10.1094/CM-2012-02-RS.

Kahlon, C.S., and Board, J.E. 2012. Growth dynamic factors explaining yield improvement in new versus old soybean cultivars. Journal of Crop Improvement 26:282-299.

Participants:

Jim Board, (PI), Charanjit Kahlon, Theophilus Udeigwe, John Stapp, Timothy Talbot, LSU AgCenter; Saratha Kumudini, Joe Omielan, University of Kentucky.

Target Audiences:

Target audiences are the state, national, and international soybean industries and research/extension personnel working on soybean.

Project Modifications:

Nothing significant to report during this reporting period.

Approved (Signature)	Title	Date