A BELTWIDE EVALUATION OF COTTON SEED QUALITY PARAMETERS

Lori Unruh Snyder
Guy D. Collins
Keith L. Edmisten
North Carolina State University
Raleigh, NC
Steven M Brown
Auburn University
Auburn, AL
Seth A. Byrd
Oklahoma State University
Stillwater, OK
Kent D. Chapman
University of North Texas
Denton, TX
Michael K. Dowd
USDA-ARS Southern Regional Research Center
New Orleans, LA
Hunter Frame
Virginia Polytechnic Institute & State University
Blacksburg, VA
Michael A. Jones
Clemson University
Florence, SC
Murilo Maeda
Texas A&M AgriLife Extension
Lubbock, TX
Ben McKnight
Texas A&M University
College Station, TX
Calvin D Meeks
University of Missouri
Portageville, MO
Gaylon Morgan
Cotton Incorporated
Cary, NC
Randy Norton
University of Arizona
Safford, AZ
Brian K. Pieralisi
Mississippi State University
Starkville, MS
Tyson B. Raper
University of Tennessee
Jackson, TN
Bill Robertson
University of Arkansas
Newport, AR
Tyler Sandlin
Auburn University
Belle Mina, AL
John L. Snider
University of Georgia
Tifton, GA
David L. Wright
University of Florida, Quincy, FL

Abstract

Cottonseed quality is an important criteria in grower planting decisions as seed costs have drastically increased over the past several years. Additionally, environmental conditions during the typical planting season can be erratic in many regions of the cotton belt. Therefore, cottonseed quality is used as a predictor for stand establishment and early season vigor. Collaborative lab analysis and field experiments were implemented in 2020 to investigate the range of seed quality associated with commonly planted cultivars. Lab analysis and field experiments were conducted across 15 locations within the cotton belt during 2020. Lab analysis included parameters such as cottonseed protein and oil by percent weight and cottonseed index and density by volumetric displacement, warm and cool germination, and visual mechanical damage.

Introduction

Cottonseed quality is an important criteria in grower planting decisions as seed costs have drastically increased over the past several years. Cottonseed quality is used as a predictor for stand establishment and early season vigor. Common laboratory analyses used for determining seed quality are warm and cool season germination tests. In addition, it is often common to determine the percentage of protein and oil, as well as, seed density and the percentage of visual mechanical damage. All of these attributes assist growers with making informed decisions on their seed quality.

Materials and Methods

Collaborative lab analysis and field experiments were implemented in 2020 to investigate the range of seed quality associated with commonly planted cultivars. Lab analysis and field experiments were conducted across 15 locations within the cotton belt during 2020. The lab analysis included parameters such as cottonseed protein and oil by percent weight and cottonseed index and density by volumetric displacement, warm and cool germination, and visual mechanical damage.

Protein and Oil

For the determination of the protein and oil analyses the cottonseeds were delinted, treated cottonseed samples received from 11 sites and labeled for easy identification. The samples were placed in a desiccation chamber then allowed to lyophilize for a minimum of 12 hours to ensure all moisture was removed. Representative aliquots of cottonseed were then taken from each sample (three aliquots; approximately 3.0 g each) and placed in 18-mm-diameter glass NMR tubes. Three aliquots per original tube were measured and the average was considered the average of three biological replicates. At a rate of 1H-NMR signals were recorded on a Bruker minispec mq20 NMR instrument per Horn et al., 2011. The pulse-field, time-domain signals obtained for the protein and oil parts of the 1H-NMR spectra were utilized in a chemo metric algorithm specifically developed for cottonseed to calculate the amount of total protein and oil in the seed sample, and they were reported as % by weight. The instrument was calibrated to known standards daily. Data were compiled using sample averages. The seed treatment had negligible effect on protein/oil readings calculated by the NMR, so there was no need to remove the treatment from all samples.

Seed Index and Seed Density

For the analyses of the seed index and seed density, delinted and treated cottonseed samples were counted out into 25 seed aliquots and weighed in order to determine total mass. Determined mass was then multiplied by 4 in order to determine seed index in g/100 seeds. A 25mL graduated cylinder was filled with between ~10mL and ~20mL of 80% Isopropanol mixed with 0.1mL of polysorbate 80 to reduce surface tension. Seed aliquots were then added to the cylinder and the volumetric displacement was used to calculate seed density. Seed density classification results in selection of high protein in the high-density classes.

Visual Mechanical Damage

For the visual mechanical damage evaluation, 300 seeds were randomly selected and organized into four classes. Class (1): no damage (normal), where the seeds were completely intact with no damage to the seed coat; Class (2): pinhole, where the seeds were with only one or two small pinholes, punctures in the seed coats); Class (3): minor damage, where the damaged seeds were with seed coats cracked or cut, but not severely cracked such as the damage primarily to the chalazal end or on side; and Class (4): major damage (very damaged), where the seeds are with large cuts or ruptures in the seed coat and/or part of the seed coat was missing and the cotyledons were exposed and/or damage to the radical end of the seeds. Each visually mechanically damaged seed was photographed and germinated under 30 C conditions and photographed at days 4, 8 and 12. On Day 12 the seeds were measured for length of root and counted as germinated with 4 cm as well as categorized into three seedling categories: strong, weak and abnormal.

Results and Discussion

The protein and oil analyses for the cottonseeds were within normal limits of expected percentage of protein and oil. The range for protein was from 18.73% to 27.81% and the range for oil was from 15.02% to 23%. The seed index range was as low as 5.92 to as high as 12.08, and the seed density range was from 0.818 to 1.14. Both the seed index and seed density ranges were within normal limits of expected calculations. The results for the visual mechanical damage was noted as preliminary data, however, for the three varieties reviewed, the range in visual mechanical damage was as low as average of 9% and as high as 23%. The data provided was limited due to the preliminary results; however, this data established accurate methods to be utilized for data collection in 2021. The amount of information provided for the visual mechanical damaged included a reading for warm germination and a seedling vigor evaluation of number of weak, abnormal and strong seedlings that germinated. Therefore, the goal for 2021 was to repeat the methods for the visual mechanical damage protocol in order to correlate with potential stand count readings to determine germination within a field setting with plantings in Spring 2021.

Summary

In summary, this data was the first year it was collected and analyzed across multiple locations and will be repeated for accuracy in 2021. The primary data proved to be useful as a baseline moving forward into a second year of data collection. It was very important to collect and to collaborate across states to help determine the parameters needed with indicating seed quality data. Thus, these procedures will hopefully ensure the best accuracy for planting and establishment in the future.

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