A STATUS REPORT ON THE STATE OF THE USDA-ARS COTTON GIN RESEARCH UNIT (CGRU) AT STONEVILLE, MISSISSIPPI

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Abstract

An update on the USDA-ARS Cotton Gin Research Unit (CGRU) at Stoneville, Mississippi is being provided to the industry. After several years of funding and staffing issues the research unit is fully funded, actively hiring for research and technical positions, participating with industry, academia and other research entities through various development agreements, and well on its way to meeting NP-306 objectives for the recently implemented five-year plan. The research unit is currently engaged in a variety of research projects with significance to the cotton industry including addressing plastic contamination, energy consumption, process control, and fiber quality issues.

Introduction

The state of the Stoneville Gin Lab is good. After several years of floundering with looming shutdowns on the horizon, the Gin Lab is back to its old self, robust and ready for challenge and opportunity. Our budget is healthy, and we have been investing wisely in both people and capital resources. I want to talk about people first.

Three New Researchers Added to the Stoneville Gin Lab in 2020:
Dr. Cody Blake onboarded in the early part of 2020 just prior to Covid-19 restrictions. Dr. Blake earned his Ph.D. from Mississippi State University where his dissertation was on sustainable agricultural bio-products. Prior to becoming an employee of USDA Dr. Blake was an ORISE (Oak Ridge Institute of Science and Education) postdoctoral contractor to the Gin Lab. ORISE is a program allowing federal agencies such as the USDA to hire contractors through the DOE. Dr. Blake's background in agricultural bioproducts and our National Program 306 (NP-306) Objective 3 "Develop Methods to Enable Use of Commercial Cotton Gin Trash (CGT) and Cottonseeds for Bioproducts and Bioenergy" are an ideal combination.

Dr. Sean Donohoe started at the Gin Lab in November 2020. Dr. Donohoe comes to us from the University of California (UC) Davis where, in 2014, he earned his Ph.D. in Mechanical Engineering. Dr. Donohoe's background is combining design and mechatronics into interdisciplinary research and development. With the Gin Lab's reconstituted emphasis on cotton ginning machinery and systems, Dr. Donohoe is a well-suited addition to our pool of talent.

The third research addition is that of the new Research Leader. As Research Leader my responsibilities include research, as the title implies, but more importantly I am a teacher and mentor for the other researchers. The focus is on building a resilient and viable research team and do so with succession in mind. The ultimate end game is a successful and transparent transfer of Gin Lab leadership when the time comes. To accomplish this takes a strong commitment by the USDA to recruit talented engineers and scientists, challenge them and provide opportunity for leadership to ascend. It is obvious from the actions of 2020 the USDA has a strong commitment to the Stoneville Cotton Gin Lab.

The Stoneville Gin Lab team is made up of more than researchers. We have a wealth of talented individuals starting with Tim Hayes, our Supervisory Engineering Technician. Tim is the leader of the technical team that keeps things running, from the physical plant to the cotton gin(s). His team includes Kim Sabbatini, our experienced Textile Machine Operator. Kim operates the equipment in both of our cotton gins and is a most knowledgeable person with respect to cotton ginning and ginning machinery. Ken Phillips is the Electrician, the person who addresses all our wiring and electrical troubleshooting needs. Rodney Gray is the Sheetmetal Technician. Most of our sheet metal fabrications and duct work are manufactured right there in our own shop. Tony Deerman is the Machinist. The Stoneville Gin Lab includes a versatile machine shop to support our design and fabrication requirements. Tony also handles most of our welding and heavy fabrication needs.

Our research would be nothing without the support of talented Physical Science Technician Rita Styles. Ms. Styles oversees our quality control laboratory where seed cotton and fiber testing are conducted under controlled conditions. Among her tools of the trade are AFIS and HVI units, ovens for moisture determination and fractionators, to name but a few.

Ron Edwards is the Engineering Technician. He is our CAD and solid modeling person as well as keeper of the archives. This year the Stoneville Gin Lab has acquired new engineering software to include the latest versions of AutoCAD and SolidWorks featuring the sheet metal package, FEA analysis and Kinematic utility.

Rounding out our team is the Program Support Assistant (PSA), Ms. Wendy Smith. The PSA is the backbone of the Gin Lab team, keeping us in-line and up to date on all procedural matters.

At latest count there are eleven team members at the Stoneville Gin Lab. We have active on-going recruiting efforts for four additional positions; a Research Scientist/Engineer to bring our research team to four, a PSA to replace Ms. Smith who is going to another research unit, one Electronics Technician to reinforce research efforts and a Physical Science Technician to assist Ms. Styles in the QC laboratory. In addition, we have the ORISE postdoctoral position to fill in support of our research.

New Capital Resources:

The Stoneville Gin Lab has invested heavily in new tools to support ongoing research and programs. In addition to the AutoCAD and SolidWorks software, procurements to date include:

- CNC plasma cutter and rollers for the sheet metal shop.
- New trailer tug, forklift and scissors lift to improve material handling and installation.
- Multiple instrument upgrades to the electronics lab.
- New HVI and moisture ovens for the QC lab.
- Equipment for post processing of cotton gin trash (CGT) and cottonseeds for bioproducts and bioenergy research.
- Cherokee Regal Lint Cleaner with rolling feedbar as part of an ongoing fiber quality research effort.
- Several new desktop and laptop computers including two workhorses for our SolidWorks users.
- Three new vehicle replacements for the pool fleet.

Stoneville Gin Lab Commitments for 2021:

The Stoneville Gin Lab has both ongoing and new commitments with stakeholders and partners for the year 2021. I mentioned ORISE, the Department of Energy program providing funding for postdoctoral candidates to participate in research. Our agreement has just recently been renewed for another year and a candidate search is currently underway. If you have post-docs searching for a unique opportunity, please mention the Stoneville Gin Lab prospect.

The Gin Lab has a Cotton Inc. funded agreement to study gin stand energy requirements and UAV detection of plastic contaminants. Dr. Cody Blake is the principal investigator (PI) on this project, one he has been involved in from the time he was our ORISE post-doc.

Three Non-Assistance Cooperative Agreements (NACA) funded by the Stoneville Gin Lab appropriation budget are currently active within our program. Texas A&M University has a NACA with the USDA for university research prefaced on knowledge contamination of U.S. cotton bales can lead to monetary losses for mills and producers, and damage to U.S. cotton's reputation and relationships between cotton suppliers and textile mills. The overall objective of the proposed research is to provide a technology to prevent plastic contamination of U.S. cotton bales that is novel, practical, and unlikely to require large capital outlay. Project sub-objectives are:

- Evaluate UAV remote sensing to map plastic contamination in a cotton field prior to harvest.
- Develop a camera system and image-analysis techniques for identifying contaminants at the module feeder of a gin.

A second research project to evaluate fluid dynamics modeling of seed cotton flow is included in the NACA with Texas A&M. The research is a continuation of work performed by Dr. Bobby Hardin at the Stoneville Gin Lab.

Mississippi State University and the USDA have a NACA for research headed by MAFES scientist Dr. Filip To to develop plastic contaminant detection and handling and a cotton moisture determination control for improved ginned cotton quality. Dr. To's work will bring him to the Stoneville Gin Lab in 2021 to install, test and evaluate the two systems developed at MSU in the Gin Lab Micro Gin.

A more recent NACA between USDA and the University of Georgia-Tifton sites a main objective to develop a system which utilizes spatial information from cotton fields coupled with production and harvest data to develop best management practices for improving cotton fiber quality and quantity. Project sub-objectives are:

- Development of quality maps for cotton fields.
- Evaluate the relationship between production variables and ginning.
- Examine the frequency of bark classing calls as related to field locations.

The main cooperator/researcher for the University of Georgia is Dr. Wesley Porter of UGA Tifton.

Additional potential commitments for 2021 include one cooperative research and development agreement (CRADA) and two material transfer agreements (MTA).

National Program 306 (NP-306)

USDA ARS research is organized into National Programs. All cotton gin lab research falls under National Program 306 (NP-306). NP-306 has three program components, "Food", "Non-Food" and "Biorefining." We are in the Non-Food component of NP-306. Each cotton gin lab has pre-defined objectives related to goals of the NP-306 five-year plan. In the case of the Stoneville Gin Lab there are three major objectives.

Objective 1: Develop methods and devices to enable reduction of plastic contaminants in commercially harvested cotton.
Objective 2: Develop and evaluate tools and methods to enable commercial preservation of cotton fiber quality and increase ginning efficiency.
Objective 3: Develop methods to enable use of commercial cotton gin trash (CGT) and cottonseeds for bioproducts and bioenergy.

Research included under the previous mentioned agreements are aligned with research being conducted at the Stoneville Gin Lab under the three NP-306 objectives. In addition to that mentioned, Stoneville Gin Lab research for 2021 includes roller ginning vs. saw ginning of new mid-south cultivars; dynamics of power usage in breeder saw gins; moisture detection by UAV; and investigation of moisture dynamics in cottonseed.

New design projects related to the three objectives are design, fabrication and evaluation of a mini-module feeder to evaluate round and conventional module related influences such as contamination, energy usage and material dynamics; modification of round hay baler to create mini-round modules for appraisal; installation of 24" wide ginning line for continued lint cleaner research; and design, fabrication and evaluation of a single saw gin stand with single locking feeder to use in conjunction with breeder gin power research.

Summary

The state of the Stoneville Gin Lab is good. We are excited about the possibilities the future may bring. It is a great place to be at a challenging time.

References

Thomasson, A., 2020. Detection and Removal of Plastic Contamination of Cotton and Development of Cotton Gin Process Models – 2020 Mid-Year Report

Porter, W., 2020. Utilizing Precision Technologies to Improve Cotton Fiber Quality During Production, Harvest and Ginning, ARIS/AIMS Extramural/Outgoing Agreement Template, Objective Field