Workshop Summary Report

USDA Pecan Project Updates

Boundary, Goals and Objectives Setting Workshop

August 8th, 2022

University of Georgia, Athens, GA

Workshop Report Author:

Niloofar Rezaei

Table of Contents

Workshop Participants

Delia Murphy	National Pecan Shellers Association
Jonathan Cooper	Sunnyland Farms
Hannah Perkins	National Pecan Shellers Association
Staten Oliver	Modern Electronics and Equipment
John Hutchens	Navarro Pecan Company, Inc.
Ralph Steger	Pecan Pro, LLC
Victoria Henley	Vicki Lynn Pecans
Jeff Worn	South Georgia Pecan Company
Adi Jovovic	South Georgia Pecan Company
William Brown	Savage Equipment
Samantha McLeod	Georgia Pecan Growers Association
Frank N Fleming	The Grove
Ajit K. Mahapatra	Fort Valley State University
Patrick J Feely	National Pecan LLC
Ralph Henley	Vicki Lynn Pecans
Lynn Henley	Vicki Lynn Pecans
Arren Moses	Moses Pecan
David Shapiro-Ilan	USDA-ARS
Nathan T Smith	South Georgia Pecan Company
Jeff Nielsen	Key Technology
Daniel Zedan	Pecan Grove

Presenters:

Niloofar Rezaei	UGA Ph.D. student
Mark Jackson	UGA Ph.D. student
Logan Smith	UGA Master student
Dr. Rui Xu	UGA
Dr. Ajit Mahapatra	Fort Valley State University
Dr. Cameron Bradsley	USDA Agricultural Research Service

Workshop Agenda

Goal, Boundary and Objectives Setting Workshop

Pecan Research Workshop
Hosted by University of Georgia College of Engineering

Time	Event	Location
	Sunday, August 7th	
6:00p	Welcome Dinner at DePalma's Italian Cafe	401 E Broad St, Athens, GA 30601
	Monday, August 8th	
8:00a – 8:30a	Breakfast	
8:30a – 9:00a	Welcome Presentation and Overview *Dr. Beshoy Morkos, University of Georgia*	
9:00a – 10:30a	Low Impact Precision Cracking Analysis *Niloofar Rezaei, University of Georgia* High Impact Cracker *Mark Jackson, University of Georgia* Shelling Analysis and Studies *Logan Smith, University of Georgia* Moisture Analysis *Dr. Rui Xu, University of Georgia*	Delta Innovation Hub 210 Spring St, Athens
10:30a – 10:45a	Pecan Research Progress at Fort Valley State University *Dr. Ajit Mahapatra, Fort Valley State University*	
10:45a – 11:00a	USDA Research Entomologist *Dr. David I. Shapiro-Ilan, USDA-ARS*	
11:00a – 12:30p	Pecan Equipment and Experiment Demonstration	Pecan Research Lab 2036 iSTEM 1 302 East Campus Road (transportation provided)
12:30p – 1:30p	Lunch and Group Discussions	
	Community Feedback and Updates *Logan Smith, University of Georgia*	
1:30p – 2:00p	Background on Krak-N-Blo Cracking and Shelling Machine *Jimmie Steger,* Krak-N-Blo	Delta Innovation Hub 210 Spring St, Athens
2:00p – 2:30p	Role of Social Media in the Pecan Industry *Victoria and Lynn Henley, Vicki Lynn Pecan Co.*	
2:30p - 3:30p	Open Discussion and Break Out Groups	
3:30p – 4:00p	Closing Comments	

Executive Summary

On August 8th, 2022, the College of Engineering at the University of Georgia convened a workshop about the USDA pecan project in Athens, GA. The purpose of the workshop was to give an update on different parts of the project, which included moisture, cracking, and shelling processes. The other important goal of this project was to improve communication and coordination among the groups involved in the pecan industry and get feedback and comments from the industry community.

Some of the challenges that need to be addressed in this project are to reduce the number of defective kernels. In other words, researchers need to work on decreasing the percentage of the meat that is damaged, depreciated, or lost during the shelling process and at the same time increase the half kernel in the shelling process. Next steps would be to propose new technologies to this industry, including using Industry 4.0, AI, and image processing in both cracking and shelling steps.

Workshop attendees were comprised of USDA members, local stakeholders and researchers from the University of Georgia and Fort Valley State University. In the first part of the workshop, students from UGA gave several presentations about different parts of the project, including Niloofar Rezaei, a Ph.D. student working under Dr. Camelio's supervision, who presented the low impact cracking side with the AUTOGRAPH AGX-V series of the Shimadzu test bed machine. The experimental variables in these parts are temperature, forces, direction, humidity, and different compression plates. She also talked about different attachment designs for the compression plates, which can be printed using the 3D printer the team already has in the lab using different materials, including resin. The next presenter was Mark Jackson, a Ph.D. student working under Dr. Davis's supervision, who presented the high impact cracking side of the project. Using an experimental setup, capturing photos of pecan, and using image processing tools for this part helped to study the halves kernel more effectively. Also, experimental variables include different geometries and materials like durable resin and steel. Results showed advantages for the durable resin material type with an internal angle of 30 degrees. The next presenter was Logan Smith, a master student working under Dr. Morkos's supervision, talking about the shelling process, which includes a sheller obtained from ME&E and modified for research purposes. The team added lexan panels around shellers for better visibility, added dividers to sheller output based on paddle shaft pins, and added the ability to change machine tilt angle. The next step would be adding two motors to independently control drum and paddle shaft rpm; also, add three more independent variables such as drum rpm, sheller tilt angle, and pin materials. The last presenter from UGA was Dr. Xu, who is working on moisture control and uses a moisture sensor to measure the moisture content of the pecan samples, a humidifier to increase the moisture content, a heater to decrease the moisture, and the samples are placed in the enclosed chamber.

Dr. Ajit Mahapatra from Fort Valley State University talked about the pecan research process in his research team. He added that the current sterilization method in pecans is thermal processing (pasteurization). However, they are exploring novel nonthermal processing methods such as ultraviolet and pulsed ultraviolet light in order to reduce pathogens, extend the self-life of pecans, and evaluate the quality of pecans following the application of nonthermal intervention methods.

The next presenter was Dr. Bradsley from USDA, who reviewed the project plan, research drivers, and understanding sheller needs and risks.

The second part of the workshop was about demonstrating experiments and pecan equipment in the STEM1 building in the College of Engineering at UGA. Students ran the equipment and answered questions about the experiments from attendees. Fig. 1, 2, and 3 shows the equipment that researchers are using in different part of the project at college of Engineering.

Fig. 1. Low Impact Cracker Part

Fig.2. High Impact Cracker Setup

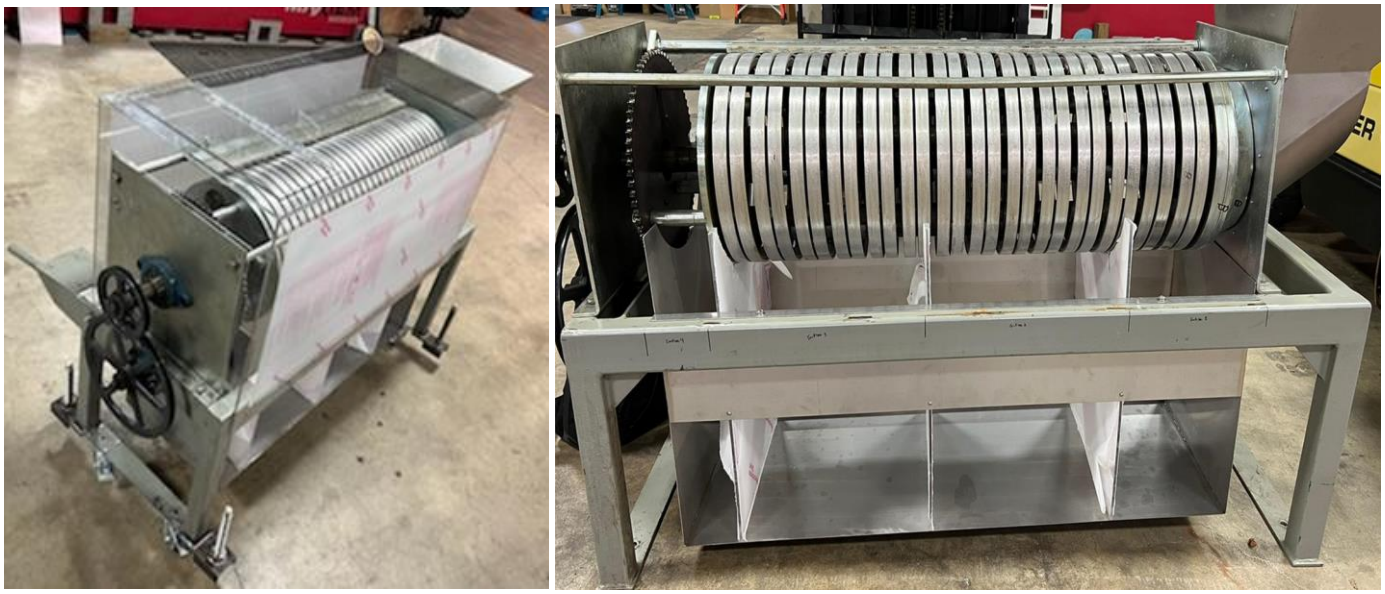

Fig.3. Sheller

After lunch, there was community feedback and an update about the project. Also, Jimmie Steger from Krak-N-Blo talked about the background of his cracking and shelling machine. Victoria and Lynn Henley from Vicki Lynn Pecan Company mentioned the role of social media in the pecan industry. Last but not the least, was the open discussion part, which included different groups led by UGA researchers. Different groups discussed the feedback and suggestions that the industry community had about future steps of the project. There were a lot of questions and ideas that researchers will work on, such as having a survey of the top five largest shellers nationally plus the top ten shellers in industry and asking them about how many of them are using pre-soak. How long? Would it be cold or hot? For How long and at what temperature? Do shellers use different pasteurization processes? How many nuts per minute are all the shellers selling out? What size pieces are coming out of both the cracking and shelling? The other important ideas were to determine the half yields after shelling with sizer, blower, and short (removing defects), having an optical sorter (lasers, cameras), and sorting color using blasts of air. The industry community talked about the importance of moisture and how it affects the half-yield percentage. Also, they mentioned that tempering before cracking step and how the difference between the weight of dry volume and moisture would be a good way to determine the moisture. Table. 1. Shows a summery of the discussion panel.

Group Discussion Name	Details
What Data from Industry can help UGA?	▪ Do shellers have different pasteurization process? ▪ What kind of crackers are the industry uses the most? ▪ Note that the amount of pecan which are put in the machine per minute is about 800 nuts ▪ What size pieces coming out from cracking and shelling process?
Determining Half-Yield	▪ Current way to analyze the input defects are visually by an expert on the line. ▪ Experts says that the moisture is the key to increase the halves-yield. ▪ Using 1Lb samples before and after shelling ▪ Using camera in the shelling process ▪ Come with some ideas about real-time tracking while being shelled ▪ Forced- air moisture analyzer to measure the moisture
Tempering before Cracking	▪ What is the difference between kernel moisture and shell? ▪ The industry is working with approximately 6-8% kernel moisture ▪ In order to check the moisture before cracking, consider having a bath and select sample of pecans to measure the moisture and then crack the rest which are in the same condition ▪ Experiment variables include water temperature, time in the water, moisture percentage, and variety of pecans. ▪ Remember that when you put pecan into the water there is going to be less room between kernel and shells, so is less pressure needed or not. ▪ Another way to calculate the moisture is the difference between weight of dry volumes and moisture one.

Table. 1. Discussion panel output

It's worth mentioning that the most important outcome of the workshop was the communication between industry and research groups. Feedbacks about the moisture side of the project would help us to improve the current system and make sure to determine the force and every other aspect about cracking and shelling with the pecans which are moisture enough. Using different material and angles for holding and cracking the pecan is an affective way to determine which kind of material works better and at the same time decrease the maintenance cost for the industry. It is important to consider that the amount of pecan which goes to the cracking and shelling machine is about 800 per minute. Improving the current machine is the other way to help the industry to increase the amount of half-yield pecans, designing compression plates with teeth is one of these ways to be able to crack the pecans with thicker shells and at the same time avoid having stick tight ones.