AG2PI SEED GRANT - PROJECT FINAL REPORT

PROJECT NAME	**Developing Education, Research, and Extension Training on Precision Agriculture Phenotyping Tools at HBCU**

PROJECT PRINCIPAL INVESTIGATOR	TODAY'S DATE	PROJECT START DATE	DATE OF COMPLETION
Dr. Jingqiu Chen	10/20/2023	06/01/2022	08/31/2023
TEAM MEMBERS (co-PI, co-I, personnel)		COLLABORATORS	
Dr. Wei-zhen Liang; Dr. Violeta M. Tsolova; Dr. Jian Jin		Ms. Conchita Newman	

ACCOMPLISHMENTS

Please provide a short summary of the conclusions (both successes and failures) made from your project. Include a description of how this project will provide benefits to the agricultural genome to phenome community and, possibly, to a broader audience. You should include both qualitative and quantitative details, as necessary, to support your conclusions. Include a short accomplishment statement in non-technical language and do not include names.

This is not a technical report. Please keep to no more than 6-8 sentences (e.g., 1-2 sentences per point, above).

This project successfully established the education, research, and extension training on precision agriculture phenotyping tools at HBCU and its communities:
(1) Developed educational materials focused on plants phenotyping tools applications, data collection (sensors, cameras, and smart phones), data sharing, and image processing;

(2) Implemented precision agriculture phenotyping course modules for FAMU ABE 4034, Remote Sensing and GIS in Engineering course in collaboration with cross-university experts in Fall 2022 (8 enrolled students, African American student percentage: 100%);

(3) Launched an undergraduate research training program on precision agriculture phenotyping tools and applications for Minorities in Agriculture, Natural Resources, and Related Sciences at HBCU:
Cohort A in Fall 2022: Three undergraduate research trainees, African American student percentage: 100%
Cohort B in Spring 2023: Two undergraduate research trainees, African American student percentage: 100%

(4) Organized two Field Day Project Showcase through FAMU Grape Harvest Festival (08/20/2022 and 08/26/2023) at Center for Viticulture and Small Fruit Research for general public especially for growers, producers to collect and analyze plant phenotyping data (total of ~800+ participants in two years).

(5) Collaborated with FAMU 4-H Youth Development team, provided virtual training for middle school teachers from Jacksonville, FL regarding precision agriculture phenotyping tools and technologies in December 2022.

This project made precision agriculture phenotyping tools and technology more accessible, particularly to those with limited resources, engaged HBCU that are currently underrepresented in AG2PI, and developed precision agriculture phenotyping tools and training activities tailored to multiple scientific communities and different career stages within AG2PI.

(HINT: You can expand sections as necessary by pulling down on the square in the lower right corner of each box)

Products

Please list any products from this project. This may include (but not limited to) publication, concept/white paper, workshop, conference presentation, website, publicly available data or pipelines, etc. Reminder: you are required to make your prodcuts available to the broader stakeholder community using standard USDA practices, open source, FAIR, or other models. Metrics may include number of participants or times accessed, etc. Include links to recordings, DOI, etc. when possible. For presentations and posters, provide authors, date, location and presentation title.

ACTIVITY / PRODUCT	**DESCRIPTION (include URL, if applicable)**	**OUTCOME / METRICS**
Course module	Module 1 Develop image processing algorithm to estimate grapevine canopy using RGB images	Educational lectures were developed and a course project on image processing algorithms using RGB images was developed.
Course module and website	Module 2 Website development for users to upload images from digital camera/smart phone and calculate canopy cover automatically (https://phrec-irrigation.com/)	Built a website platform and mySQL database for students and users to easily take photos and estimate percentage of grape and green leaves, which provides a simple, fast, inexpensive, and non-destructive method for image acquisition as only a standard camera or a smart phone, is needed.
Course module	Module 3 Introducing hyperspectral imaging technologies for plant phenotyping	Educational lectures were developed and a quiz on hyperspectral imaging technologies for plant phenotyping was developed.
Course module	Module 4 Introducing Florida viticulture	Educational lectures were developed with a focused lecture on "A taste of Florida Viticulture".
Course modules implementation	In person class	We delivered four course modules to FAMU BSE ABE 4034 Remote Sensing and GIS in Engineering course during Fall 2022 semester. There were eight undergraduate students enrolled in the class (two juniors and six seniors). The course contributed to the FAMU Biological Systems Engineering curriculum as an engineering elective and add values to fill the blank of sensing technology field at FAMU BSE.
Workshop	Virtual training for middle school teachers from Jacksonville, FL	Collaborated with FAMU 4-H Youth Development team, contributed a chapter regarding precision agriculture phenotyping tools and technologies to AgriSTEM for Middle Schools Multidisciplinary Curriculum. Provided virtual training for middle school teachers from Jacksonville, FL regarding precision agriculture phenotyping tools and technologies in December 2022.
Undergraduate research training program	Launched an undergraduate research training program on precision agriculture phenotyping tools and applications for Minorities in Agriculture, Natural Resources, and Related Sciences at HBCU	Five African American undergraduate students (3 seniors in 2022 cohort A and 2 seniors in 2023 cohort B). They had experiential learning on precision agriculture phenotyping tools (our image processing and analysis website, muscadine grape image acquisition, leaf area index measurements, muscadine grape physiological parameters measurements, etc.,) at the FAMU CAFS Center for Viticulture and Small Fruit Research.

Field Day/Workshop	Organized two Field Days for project demonstration through FAMU Grape Harvest Festival on August 20th, 2022 and August 26th, 2023 for general public especially for growers, producers to collect and analyze plant phenotyping data.	During two events, more than 800 field day attendees viewed our website and learned how to use the website to conduct Muscadine grape image analysis. In 2022, about 50 participated in the "grape image collection competition" and tried our grape canopy and berry automatic detection function. Our server can process the uploaded images simultaneously. More than 300 images were obtained from the field day uploading by the general public, and these images were used to refine the image processing algorithm. In 2023, we developed a new portal for participants to try out the RGB image analysis tool.
Poster Presentation	Undergraduate research trainee poster presentation (* denotes undergraduate sponsored by this project)	Jayden C. Burnett*, Lauren A. Hawkins*, Katie B. Light*, Violeta M. Tsolova, Wei-zhen Liang, Jingqiu Chen. Experiential Learning on Precision Agriculture Phenotyping Tool in Muscadine Vineyards and Data Analytics. 2022 FAMU Student Research Forum. October 26th, 2022 (**2nd Place** of Undergraduate Poster Presentation, Life Science Research Discipline).
Poster Presentation	Undergraduate research trainee poster presentation (* denotes undergraduate sponsored by this project)	Shomar Bullen*; Wei-zhen Liang; Jingqiu Chen. Image Processing of Plants for Defoliation & Disease Tracking. The 2023 FAMU Undergraduate Research Symposium. April 14th, 2023, Tallahassee, FL.
Poster Presentation	Undergraduate research trainee poster presentation (* denotes undergraduate sponsored by this project)	Lauren A. Hawkins*; Violeta M. Tsolova; Wei-zhen Liang; Jingqiu Chen. Cultivating Learning Material Regrading Precision Agriculture for Grades K- 12th. The 2023 FAMU Undergraduate Research Symposium. April 14th, 2023, Tallahassee, FL.
Invited Poster Presentation	PI Chen was invited to attend AG2PI's 2-day conference, cohosted with USDA NIFA	Jingqiu Chen, Violeta Tsolova, Wei-zhen Liang, Jian Jin. Developing Education, Research, and Extension Training on Precision Agriculture Phenotyping Tools at HBCU Communities. 2023 AG2PI conference. Kansas City, Missouri. June 15-16, 2023.
Educational videos and crossword activity	Educational videos and crossword activity were produced by undergraduate research trainees sponsored by this project https://drive.google.com/file/d/19xWfZsrO9ePgyEdQ0qecJX3i-B7YnxqX/view?usp=sharing https://drive.google.com/file/d/1MOdTBmJ-Zt-dA-p8z25TaE7kCfRRL9Rr/view?usp=sharing https://drive.google.com/file/d/1OZCHc50NTWcDXbZceuh_vAw9otdr28Yp/view?usp=sharing	
Publication	Conference Proceeding https://doi.org/10.13031/aim.202301190	Jingqiu Chen, Wei-zhen Liang, Jian Jin, & Violeta M. Tsolova. (2023). Developing Education, Research, and Extension Training on Precision Agriculture Phenotyping Tools at HBCU Communities. Proceedings of the 2023 ASABE Annual International Meeting. Omaha, Nebraska. July 9-12.
Invited talk	PI Chen was invited by Pacific Northwest National Laboratory HBCU/MSI Climate Research Network to give a virtual seminar.	Jingqiu Chen, Wei-zhen Liang, Violeta Tsolova, Jian Jin. Developing Education, Research, and Extension Training on Precision Agriculture Phenotyping Tools at Muscadine vineyards. Pacific Northwest National Laboratory HBCU/MSI Climate Research Network seminar, June 23, 2023.

Invited talk	PI Chen was invited by Florida Wine & Grape Growers Association (FWGGA) to give an in person oral presentation.	Jingqiu Chen, Wei-zhen Liang, Violeta Tsolova, Jian Jin. Developing Education, Research, and Extension Training on Precision Agriculture Phenotyping Tools at HBCU Communities. 2023 Florida Wine & Grape Growers Association (FWGGA) Annual Conference, Deland, FL, Jan. 13-14, 2023.
Conference presentation	Oral presentation	Qiao, X., W.-Z. Liang, J. Chen, and G. Stone. Peer-Learning Agricultural Network (PLAN). ASA, CSSA, SSSA (The American Society of Agronomy, the Crop Science Society of America, and the Soil Science Society of America) International Annual Meeting. Baltimore, MD. November 6-9, 2022.
Conference presentation	Oral presentation	Jingqiu Chen, Wei-zhen Liang, Jian Jin, Violeta Tsolova. Enhancing Precision Agriculture Phenotyping Tools' Education, Research, and Extension Training at Muscadine Vineyards. 2023 Florida Section American Society of Agricultural and Biological Engineers (ASABE) Annual Conference, Duck Key, FL, Jun. 4-6, 2023.
Conference presentation	Oral presentation	Jingqiu Chen, Wei-zhen Liang, Violeta Tsolova, Jian Jin. Developing Education, Research, and Extension Training on Precision Agriculture Phenotyping Tools at HBCU Communities. 2023 American Society of Agricultural and Biological Engineers (ASABE) Annual International Meeting, Omaha, NE, Jul. 9-12, 2023.

Audience

With whom has this work been targeted to and shared? Please describe how this project and its products have been disseminated to a community of interest. Include any outreach activity or information sharing as well as training or professional development opportunities provided in this project.

As detailed in each product, this project has targeted HBCU undergraduate students, researchers, underrepresented groups, growers, and producers. The deliverables have reached other scientific communities such as the American Society of Agricultural and Biological Engineers, the American Society of Agronomy, the Crop Science Society of America, the Soil Science Society of America, Pacific Northwest National Laboratory HBCU/MSI Climate Research Network, and the Florida Wine & Grape Growers Association.

CONTINUATION OF WORK

Next steps

How do you/your team plan to continue moving this project forward? Include how AG2PI can assist in your forward momentum.

We collaborated on several proposals based on the successful collaboration built upon this project.

Outreach

In what ways are you able to stay engaged with AG2PI? (check boxes as appropriate)

- ☐ Will present at a field day
- ☐ Will lead a training workshop
- ☒ Would like to participate in any future AG2PI conference
- ☒ Work with AG2PI on a news release on project conclusions
- ☒ Will continue attending AG2PI events
- ☐ Other (please explain)