

SAMUEL C. McDONALD

Athens, Georgia – samuel.mcdonald@uga.edu

Education:

University of Georgia Athens, Georgia

Doctor of Philosophy in Plant Breeding, Genetics, and Genomics

May 2023

Advisor: Zenglu Li

Dissertation: “Genetic discovery and fine mapping of frogeye leaf spot resistance loci in soybean and selection of favorable recombinants for soybean seed composition using marker-assisted breeding”

Relevant Graduate Coursework:

Advanced Plant Breeding, Statistical Methods for Researchers, Genomic Selection, Genome-Wide Association in Plants, Experimental Design, Communication Seminar, Quantitative Aspects of Plant Breeding, Statistical Analysis of Genetic Data, Biology of Host Plant Resistance, Plant Cytogenetics, Research Seminar

University of Missouri Columbia, Missouri

Bachelor of Science in Plant Science, Cum Laude

May 2017

Emphases: Breeding, Biology, and Biotechnology
Crop Management

Minor: Agriculture Economics

Research Experience:

Graduate Research Assistant University of Georgia, Institute of Plant Breeding, Genetics, and Genomics

August 2018 – Present

PI: Dr. Zenglu Li

- Utilized molecular breeding techniques to stack seed composition traits in soybean, leading to an improved fatty acid composition and increased protein, and validated effects across six environments
- Conducted a genome-wide association study that led to the identification of novel resistance and a selectable marker for the disease frogeye leaf spot in soybean
- Fine mapped resistance loci for frogeye leaf spot and developed molecular assays to increase efficiency and accuracy of soybean breeding selection
- Created a digital image analysis pipeline for high precision phenotyping of frogeye leaf spot disease severity to support genetic mapping efforts
- Developed Kompetitive Allele Specific PCR (KASP) assays to assist in molecular soybean breeding and selection of disease resistance and maturity-related traits

- Designed seed tissue sampling device to support marker-assisted breeding, tested sample purity and seed viability, provided training on use, and implemented in breeding program
- Lead field breeding activities: planting yield plots and early generation nursery; cross pollination; plot observation and data collection; yield plot, progeny row, and single plant harvest; and phenotyping seed traits

Research Specialist University of Missouri, Soybean Breeding and Genetics

July 2017 – August 2018

- Led and organized phenotypic field data collection of soybean research plots across multiple locations
- Prioritized and directed tasks to student research assistants
- Cared for soybean research plots, including planting, weed control, and harvest
- Managed field scouting and herbicide application for yield trials and early generation nursery

Research Assistant University of Missouri, Soybean Breeding and Genetics

February 2014 – July 2017

- Supported day-to-day functions of soybean breeding program, including seed preparation and packaging, plot rogueing, and weed control
- Assisted in cross pollination for soybean cultivar development

Research Assistant University of Missouri, Mitchum Nematology Laboratory

August 2016 – December 2016

- Utilized CRISPR/Cas9 to confirm the role of *SHMT* genes in resistance to soybean cyst nematode
- Used tissue culture and *Agrobacterium rhizogenes* transformation to generate soybean hairy roots for soybean cyst nematode infection assays

Maize Trait Discovery Research Intern Pioneer Hi-Bred International, Inc.

Summer 2016

- Led experiment using immature ear photometry to study the effect of drought stress during flowering on corn ear development for QTL discovery
- Managed data collection for early vigor, silk/shed date, and stay green

Undergraduate Research Scholar Missouri Soybean Merchandising Council

September 2014 – August 2015

PI: Dr. Andrew Scaboo

- Conducted experiment to improve near-infrared spectroscopy calibration to predict fatty acid profiles in high oleic acid and low linolenic acid soybeans
- Profiled fatty acids of soybean seed using gas chromatography and near-infrared spectroscopy

Maize Product Development Intern Pioneer Hi-Bred International, Inc.

Summer 2014

- Completed chemical germination delay research project to ensure seed purity and improve productivity in creating corn hybrids
- Collected emergence data and monitored silk/shed dates of plots

Publications

1. Ostezan, Alexandra, Samuel McDonald, Dung Thuy Tran, Renan Silva E Souza, and Zenglu Li. (2021). Target region sequencing and applications in plants. *Journal of Crop Science and Biotechnology*. 24:1-14. doi: [10.1007/s12892-020-00056-3](https://doi.org/10.1007/s12892-020-00056-3)
2. McDonald, Samuel, James Buck, and Zenglu Li. (2022). Automated, image-based disease measurement for phenotyping resistance to soybean frogeye leaf spot. *Plant Methods*. 18:103. doi: [10.1186/s13007-022-00934-7](https://doi.org/10.1186/s13007-022-00934-7)
3. McDonald, Samuel, James Buck, Qijian Song, and Zenglu Li. (2022). Genome-wide association study reveals novel loci and candidate gene for resistance to frogeye leaf spot (*Cercospora sojina*) in soybean. *Molecular Genetics and Genomics* (accepted)
4. Walker, David R., Samuel McDonald, Donna K. Harris, H. Roger Boerma, James W. Buck, Edward J. Sikora, David B. Weaver, David L. Wright, James J. Marois, and Zenglu Li. (2022). Genomic regions associated with resistance to soybean rust (*Phakopsora pachyrhizi*) under field conditions in soybean germplasm accessions from Japan, Indonesia and Vietnam. *Theoretical and Applied Genetics*. doi: [10.1007/s00122-022-04168-y](https://doi.org/10.1007/s00122-022-04168-y)
5. Zhang, Jun, Samuel McDonald, Miles W. Ingwers, Chengjun Wang, Qijian Song, Pengyin Chen, and Zenglu Li. (2022). Quantitative trait loci for flooding tolerance in soybean. *Plant Breeding*. 141:2. doi: [10.1111/pbr.13008](https://doi.org/10.1111/pbr.13008)

Grants

John Ingle Innovation in Plant Breeding Award. (2021). Design and implementation of a seed drilling device to support marker-assisted soybean breeding. \$10,000.

Teaching

Teaching Assistant and Guest Lecturer. Plant Quantitative Genetics and Molecular Breeding. Instructor: Dr. Zenglu Li. 2022.

Awards and Honors

1. Third Place, Soy2022 Molecular and Cellular Biology of the Soybean Poster Competition, 2022
2. Borlaug Scholar, National Association of Plant Breeders, 2022
3. Second Place, Soybean Breeder's Workshop Poster Competition, 2022
4. Second Place, E. Broadus Browne Award, University of Georgia College of Agriculture and Environmental Sciences, 2021
5. People's Choice Winner, University of Georgia Institute of Plant Breeding, Genetics, and Genomics Poster Competition, 2020.
6. Recipient, University of Georgia Institute of Plant Breeding, Genetics, and Genomics Travel Award, 2020
7. First Place, Soybean Breeder's Workshop Poster Competition, 2020

8. Second Place, National Association of Plant Breeders Poster Competition, 2020
9. Golden Opportunity Scholar, Agronomic Science Foundation, 2016
10. Winner, DuPont Pioneer Internship Grant Award, 2014

Invited Talks

Picture this: Image analysis-enabled discovery of novel frogeye leaf spot resistance in soybean. (2022) University of Georgia Department of Plant Pathology. Athens, GA.

Conference Posters Presentations

1. Sam McDonald, James Buck, Qijian Song, and Zenglu Li. (2022). Discovery and allele mining of novel resistance to frogeye leaf spot in soybean. Soy2022 Molecular and Cellular Biology of the Soybeann. Ames, IA (virtual).
2. Sam McDonald, James Buck, Qijian Song, and Zenglu Li. (2022). Discovery and allele mining of novel resistance to frogeye leaf spot in soybean. National Association of Plant Breeders Annual Meeting. Ames, IA.
3. Sam McDonald, James Buck, Qijian Song, and Zenglu Li. (2022). Discovery and allele mining of novel resistance to frogeye leaf spot in soybean. CROPs Conference. Huntsville, AL.
4. Sam McDonald, Spencer East, S. Carlos Barrow, and Zenglu Li. (2022). Design and implementation of a seed drilling device to support marker-assisted soybean breeding. University of Georgia Institute of Plant Breeding, Genetics, and Genomics Annual Retreat. Athens, GA. Jekyll Island, GA.
5. Sam McDonald, James Buck, Qijian Song, and Zenglu Li. (2022). Discovery and allele mining of novel resistance to frogeye leaf spot in soybean. Soybean Breeders Workshop. St. Louis, MO (virtual).
6. Sam McDonald, James Buck, Qijian Song, and Zenglu Li. (2021). Discovery and allele mining of novel resistance to frogeye leaf spot in soybean. University of Georgia Plant Center Retreat. Young Harris, GA.
7. Sam McDonald, James Buck, Qijian Song, and Zenglu Li. (2021). Dissecting the genetics of soybean resistance to frogeye leaf spot using a genome-wide association study and biparental mapping. University of Georgia Institute of Plant Breeding, Genetics, and Genomics Annual Retreat. Athens, GA (virtual).
8. Sam McDonald, Kristin Bilyeu, Rouf Mian, Blair Buckley, and Zenglu Li. (2021). Identifying recombinants to stack high protein, high oleic, and low linolenic acid in soybean. Soybean Breeders Workshop. St. Louis, MO (virtual).
9. Sam McDonald, James Buck, Qijian Song, and Zenglu Li. (2020). Dissecting the genetics of soybean resistance to frogeye leaf spot using a genome-wide scan of diverse accessions and a bi-parental population. National Association of Plant Breeders Annual Meeting. Lincoln, NE (virtual).

10. Sam McDonald, James Buck, Qijian Song, and Zenglu Li. (2020). Dissecting the genetics of soybean resistance to frogeye leaf spot using a genome-wide scan of diverse accessions and a bi-parental population. University of Georgia Institute of Plant Breeding, Genetics, and Genomics Annual Retreat. Athens, GA (virtual).
11. Sam McDonald, James Buck, Qijian Song, and Zenglu Li. (2020). Dissecting the genetics of soybean resistance to frogeye leaf spot using a genome-wide scan of diverse accessions and a bi-parental population. Soybean Breeders Workshop. St. Louis, MO.
12. Sam McDonald, James Buck, Qijian Song, and Zenglu Li. (2019). Dissecting the genomic regions conferring resistance to frogeye leaf spot of soybean using a genome-wide association analysis. National Association of Plant Breeders Annual Meeting. Pine Mountain, GA.
13. Sam McDonald, James Buck, and Zenglu Li. (2019). Identification of candidate genes conferring resistance to frogeye leaf spot in soybean. University of Georgia Institute of Plant Breeding, Genetics, and Genomics Annual Retreat. Amicalola, GA.

Community/Departmental Service and Outreach

1. President, University of Georgia Plant Breeding, Genetics, and Genomics Graduate Student Association, 2021
 - Led team that organized professional development workshops and social events for graduate students
 - Arranged for external speakers for Institute seminar series
 - Served as liaison between graduate students and faculty
2. Member, University of Georgia Plant Center Spring Symposium Committee, 2020-2021
3. Member, University of Georgia Integrated Plant Sciences Recruitment Committee, 2021
4. Member, University of Georgia Institute of Plant Breeding, Genetics, and Genomics Recruitment Committee, 2021-2022
5. Member, University of Georgia Plant Center Spring Symposium Committee, 2020
6. Instructor, Georgia 4-H Summer Program in STEM, 2019