Zachary J. Winn Ph.D.

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Education

North Carolina State University
Doctor of Philosophy in Crop Science
Focus: *Plant Breeding and Genetics*
Dissertation: "Investigation of Fusarium Head Blight and Hessian Fly Resistance QTL and QTL Profiling via Machine Learning in Soft Red Winter Wheat" 2019-2022

University of Arkansas
Master of Science in Crop Science
Focus: *Plant Breeding and Genetics*
Thesis: "An Evaluation of Hybrid Traits, Yield, and Major QTL Effect on Heterosis in Hybrid Soft Red Winter Wheat" 2017-2019

University of Arkansas
Bachelor of Arts
Focus: *General Biology, Molecular Biology, Vocal Music, Music Theory* 2012-2016
Major: Music
Major: Biology

Awards

United States Wheat and Barley Scab Initiative (USWBSI) Grant for Hard Winter Wheat Variety Development	2024 - 2026 (~$140,000.00)
North Carolina State University Research Assistantship - Raleigh, NC	2019 - 2023 (~ $115,000.00)
North Carolina Small Grain Growers Association Scholarship - Raleigh, NC	2020 - 2021 ($2,500.00)
University of Arkansas Sustainability Teaching Assistantship - Fayetteville, AR	2016 - 2019 (~ $50,000.00)
Central United Methodist Choral Scholarship - Fayetteville, AR	2016 - 2019 (~ $10,000.00)
Schola Cantorum Travel Grant - Fayetteville, AR	2016 ($2,500.00)
St. Paul's Choral Scholarship - Fayetteville, AR	2014 - 2016 ($3,500.00)
St. Joseph's Choral Scholarship - Fayetteville, AR	2013 - 2016 (~ $10,000.00)
University of Arkansas Music Department Scholarship - Fayetteville, AR	2012 - 2016 ($4,000.00)
Arkansas Academic Challenge Scholarship - Springdale, AR	2012 - 2015 ($10,000.00)

Research Experience

United States Department of Agriculture – Agricultural Research Service
Postdoctoral Research Geneticist (GS 11 - 02)
Develop novel bioinformatic tools and scripts to increase efficiency of data reporting and data storage. Act as lead administrator of group server. Identify and introgress novel disease and pest resistance for the southeastern United States winter wheat germplasm. Assemble and annotate soft red winter wheat genomes for use in bioinformatics pipelines. 2024-Present

Colorado State University
Postdoctoral Research Scholar - to Richard Esten Mason in Small Grains Breeding
Organize large genomic and phenotypic datasets for use in analysis, perform statistical analysis for publications, improve breeding pipeline through optimization via newly written scripts, participate in field work and site selection, and assist in advising graduate students. 2022-2024

North Carolina State University
Research Assistant - to Paul Murphy in Small Grains Breeding 2019-2022

Organized experiments, oversaw disease nurseries, conducted crossing blocks for wheat and oats, ran PCR based KASP® assays, extracted genomic DNA, oversaw hourly workers, organized harvesting crews, recorded phenotypic data on large panels of diverse genetic material, assisted in planting, and executed experiments with a focus on publication.

University of Arkansas
Research Assistant - to Richard Esten Mason in Small Grains Breeding
Organize experiments, assist in disease nursery maintenance, assist in wheat crossing, performed PCR based assays, extract DNA, oversaw hourly workers, assisted in harvesting, recorded experimental phenotypic data, prepared breeding materials for planting, assisted in planting, designed experiments, and communicated with collaborators. 2017-2019

Teaching Experience

North Carolina State University
Teaching Assistant - to Keith Edmiston in "Seeds, Biotechnology, and Society"
Lectured, provided supplemental instruction to students, provided technological assistance, and administered grades. 2020

North Carolina State University
Teaching Assistant - to Paul Murphy in "Plant Breeding"
Lectured, provided supplemental instruction to students, administered tests, and executed grading. 2019

University of Arkansas
Teaching Assistant - to Tahar Messadi in "Capstone Experience in Sustainability"
Lectured, oversaw student capstone projects, organized student led presentations of thesis work, provide consultation on student thesis work, peer reviewed and edited student theses. 2019

University of Arkansas
Teaching Assistant - to David Hyatt in "Foundations of Sustainability"
Lectured, provided supplemental instruction to students, administered exams, curated online content for students, organized lecture schedule between different instructors, and executed grading. 2018, 2019

University of Arkansas
Teaching Assistant - to David Hyatt in "Applications of Sustainability"
Lectured, provided supplemental instruction to students, functioned as a liaison between multiple instructors, organized online content for student consumption, created quiz and test questions from lecture material, assisted in test design and execution. 2017, 2018

Publications and Presentations

Original Research Articles – Published

- Winn, Z. J., Acharya, R., Ward, B., Lyerly, J., Griffey, C., Fitzgerald, J., Dong, Y., Cowger, C., Murphy, J. P., & Brown-Guedira, G. (2025). Genetic mapping of resistance to fusarium head blight in soft red winter wheat line NC13-20076. CropScience,e70022. https://doi.org/10.1002/csc2.7002
- Wondifraw, M. A., Winn, Z. J., Haley, S. D., Stromberger, J. A., Hudson-Arns, E. E., & Mason, R. E. (2024). Elucidation of the genetic architecture of water absorption capacity in hard winter wheat through genome wide association study. *The Plant Genome*, 17, e20500. https://doi.org/10.1002/tpg2.20500
- Wondifraw, M., Winn, Z. J., Haley, S. D., Stromberger, J. A., Hudson-Arns, E., & Mason, R. E. (2024). Advancing water absorption capacity in hard winter wheat using a multivariate genomic prediction approach. *Crop Science*, 64, 3086–3098. https://doi.org/10.1002/csc2.21321
- Winn, Z. J., Hudson-Arns, E., Hammers, M. DeWitt, N., Lyerly, J. Bai, G. St. Amand, P. Nachappa, P., Haley, S. & Mason, R. E. (2024). HaploCatcher: an R package for inferring allelic states of large effect loci in early generation material. The Plant Genome, 17, e20412. https://doi.org/10.1002/tpg2.20412

- Hammers, M., Winn, Z. J., Ben-Hur, A., Larkin, D., Murry, J., & Mason, R. E. (2023). Phenotyping and predicting wheat spike characteristics using image analysis and machine learning. The Plant Phenome Journal, 6, e20087. https://doi.org/10.1002/ppj2.20087
- Winn, Z. J., Amsberry, A. L., Haley, S. D., DeWitt, N. D., & Mason, R. E. (2023). Phenomic versus genomic prediction - A comparison of prediction accuracies for grain yield in hard winter wheat lines. The Plant Phenome Journal, 6, e20084. https://doi.org/10.1002/ppj2.20084
- Boyles, R. E., Ballén-Taborda, C., Brown-Guedira, G., Costa, J., Cowger, C., DeWitt, N., Griffey, C. A., Harrison, S. A., Ibrahim, A., Johnson, J., Lyerly, J., Marshall, D. S., Mason, R. E., Mergoum, M., Murphy, J. P., Santantonio, N., Saripalli, G., Sutton, R., Tiwari, V., … Winn, Z. J. (2023). Approaching 25 years of progress towards Fusarium head blight resistance in southern soft red winter wheat (Triticum aestivum L.). Plant Breeding, 1–16. https://doi.org/10.1111/pbr.13137
- Winn, Z. J., Lyerly, J. H., Brown-Guedira, G., Murphy, J. P., & Mason, R. E. (2023). Utilization of a publicly available diversity panel in genomic prediction of Fusarium head blight resistance traits in wheat. The Plant Genome, 00(e20353). https://doi.org/10.1002/tpg2.20353
- Winn, Z. J., Larkin, D. L., Lozada, D. N., DeWitt, N. D., Brown-Guedira, G., & Mason, R. E. (2023). Multivariate genomic selection models improve prediction accuracy of agronomic traits in soft red winter wheat. Crop Science, 00(00), 1–16. https://doi.org/10.1002/csc2.20994
- Winn, Z.J., Reisig D.M. & Murphy J.P. (2023). Yield protection afforded by imidacloprid during Hessian fly infestation in six genotypes. Agronomy Journal 115(3),1059-1068 https://doi.org/10.1002/agj2.21308
- Winn, Z. J, Lyerly, J, B. Ward, G. Brown-Guedira, R. E Boyles, M. Mergoum, J. Johnson, S. Harrison, A. Babar, R. E. Mason, R. Sutton, J. P. Murphy. (2022). Profiling of Fusarium Head Blight Resistance QTL Haplotypes Through Molecular Markers Genotyping-by-Sequencing and Machine Learning. Theoretical and Applied Genetics doi: 10.1007/s00122-022-04178-w.
- Winn, Z. J., Acharya, R., Merrill, K., Lyerly, J., Brown-Guedira, G., Cambron, S., Harrison, S. H., Reisig, D., & Murphy, J. P. (2021). Mapping of a novel major effect Hessian fly field partial-resistance locus in southern soft red winter wheat line LA03136E71. Theoretical and Applied Genetics, 134(12), 3911-3923. https://doi.org/10.1007/s00122-021-03936-6
- Winn, Z. J., Larkin, D. L., Murry, J. T., Moon, D. E., & Mason, R. E. (2021). Phenotyping Anther Extrusion of Wheat Using Image Analysis. Agronomy, 11(6), 1244. https://doi.org/10.3390/agronomy11061244
- Hayat, H., Mason, R. E., Lozada, D. N., Acuna, A., Holder, A., Larkin, D., Winn, Z. J., et al. (2019). Effects of allelic variation at Rht-B1 and Rht-D1 on grain yield and agronomic traits of southern US soft red winter wheat. Euphytica, 215(10), 1-9.

Original Research Articles - In Preparation

- Hammers, M., Winn, Z. J., Larkin, D., Murry, J., & Mason, R. E. (n.d.). Utilizing Multivariate Genomic Prediction to Predict Wheat Spike Characteristics in Soft Red Winter Wheat. (In external review)
- Winn, Z., DeWitt, N., Lyerly, J., Murphy, J. P., Harrison, S., Boyles, R., Mergoum, M., Babar, A., Mason, R. E., & Brown-Guedira, G. (n.d.). The strengths and weaknesses of QTL analysis and GWAS as demonstrated by simulation. (In preparation)

Grant Proposals - Funded

- Winn, Z. J. & Mason, R., E. (2023) Coordinating Hard Winter Wheat Genomic Assisted Breeding to Develop *Fusarium* Head Blight Resistant Varieties. United States Wheat and Barley Scab Initiative. Submitted September 19th, 2023. (~$140,000.00)

Grant Proposals - Submitted

- Roberts, R., Maston, R. E., Rice, B. & Winn, Z. J. (2023) Mapping and Identifying Climate-Resilient Resistance Traits Against Wheat Virus. National. United States Department of Agriculture - National Institute of Food and Agriculture - Agriculture and Food Research Initiative. Submitted October 13th, 2023 (~$500,000.00)

Thesis and Dissertation

- Winn, Z. J. (2019). An Evaluation of Hybrid Traits, Yield, and Major QTL Effect on Heterosis in Hybrid Soft Red Winter Wheat. University of Arkansas.
- Winn, Z. J. (2022). Investigation of Fusarium Head Blight and Hessian Fly Resistance QTL and QTL Profiling via Machine Learning in Soft Red Winter Wheat. North Carolina State University.

Extension Presentations

- Winn, Z. J., Reisig, D., Marshall, D., Murphy J. P. (2022). Controlling Hessian Fly: The Effect of a Newly Discovered Tolerance Gene on Yield Protection. 32nd Annual NC Commodities Conference, January 12th-14th, Durham, NC.

Oral Presentations

- Winn, Z. J., Hammers, M. (2023). Using Machine Learning to Enhance Wheat Breeding Efforts in Colorado. Colorado Seed Growers Association and Colorado Seed Industry (CSGA-CSIA) Association Annual Meeting.
- Winn, Z. J., Lyerly, J., Ward, B., Brown-Guedira, G., Boyles, R. E., Mergoum, M., Johnson, J., Harrison, S., Babar, A., Mason, R. E., Sutton, R., & Murphy, J. P. (2023). Leveraging Historical Genomic Information to Profile Major Effect QTL in Early Development Germplasm Via Machine Learning. Plant and Animal Genomics (PAG).
- Winn, Z. J. (2022). Applied Genomics Assisted Breeding in Winter Wheat. Colorado State University.
- Winn, Z. J., Acharya, R., Merrill, K., Lyerly, J., Brown-Guedira, G., Cambron, S., Harrison, S. H., Reisig, D., & Murphy, J. P. (2021). Mapping of a novel major effect Hessian fly field partial-resistance locus in southern soft red winter wheat line LA03136E7. ASA, CSSA, SSSA Tri-Society International Meeting.

Abstracts

- Winn, Z. J., Brown-Guedira, G., & DeWitt, N. (2025). Validation of molecular markers linked to the novel Hessian fly tolerance locus *Qhft.nc-7D*. Plant and Animal Genomics (PAG).
- Winn, Z. J., Amsberry, A., & Mason, R. E. (2023). Genomics Assisted Phenomic Prediction - Leveraging High Throughput Spectral and Genomic Information to Estimate Phenotypes in Early Development Germplasm. Plant and Animal Genomics (PAG).
- Winn, Z. J., Lyerly, J., Brown-Guedira, G., & Murphy, J. P. (2022). Utilization of a Historical Diversity Panel in Genomic Prediction of Fusarium Head Blight of Wheat. National Fusarium Head Blight Forum.
- Winn, Z. J., Lyerly, J., Ward, B., Brown-Guedira, G., Boyles, R. E., Mergoum, M., Johnson, J., Harrison, S. H., Babar, A., Mason, R. E., Sutton, R., & Murphy, J. P. (2021). Profiling of Fusarium Head Blight Resistance QTL Haplotypes Through Molecular Markers, Genotyping-by-Sequencing, and Machine Learning. National Fusarium Head Blight Forum.
- Winn, Z. J., Acharya, R., Merrill, K., Lyerly, J., Brown-Guedira, G., Cambron, S., Harrison, S. H., Reisig, D., & Murphy, J. P. (2021). Mapping of a novel major effect Hessian fly field tolerance locus in southern soft red winter wheat line LA03136E71. ASA, CSSA, SSSA Tri-Society International Meeting.
- Winn, Z. J., Acharya, R., Lyerly, J., Brown-Guedira, G., Cowger, C., Griffey, C., Fitzgerald, J., Mason, R. E., & Murphy, J. P. (2020). Mapping of Fusarium Head Blight Resistance in NC13-20076 Soft Red Winter Wheat. National Fusarium Head Blight Forum.
- Winn, Z. J., Acharya, R., Merrill, K., Lyerly, J., Brown-Guedira, G., Harrison, S. H., & Murphy, J. P. (2020). Preliminary Mapping of a Large Effect Hessian Fly Field Resistance Locus. ASA, CSSA, SSSA Tri-Society International Meeting.
- Winn, Z. J., Acharya, R., Lyerly, J., Brown-Guedira, G., Cowger, C., Griffey, C., Fitzgerald, J., & Murphy, J.P. (2019). Preliminary Mapping of Fusarium Head Blight Resistance in NC13-20076 Soft Red Winter Wheat. National Fusarium Head Blight Forum.
- Winn, Z. J., Mason, R. E., Murphy, P., Brown-Guedira, G., Johnson, J. W., Mergoum, M., Harrison, S. A., Babar, M. A., Ibrahim, A. M. H., & Sutton, R. (2019). Evaluation of Yield and Major QTL Effects on Heterosis in Hybrid Southern Soft Red Winter Wheat. In The Eastern Wheat Workers / Southern Small Grain Workers Conference.
- Winn, Z. J., Mason, R. E., Murphy, P., Brown-Guedira, G., Johnson, J. W., Mergoum, M., Harrison, S. A., Babar, M. A., Ibrahim, A. M. H., & Sutton, R. (2019). Evaluation of Hybrid Vigor in Southern Soft Winter Wheat. In Plant and Animal Genomics Conference.
- Winn, Z. J., Mason, R. E., Murphy, P., Brown-Guedira, G., Johnson, J. W., Mergoum, M., Harrison, S. A., Babar, M. A., & Sutton, R. (2018). Hybrid Vigor in Southern Soft Winter Wheat. In ASA, CSSA, SSSA Tri-Society Meeting.

Transferable Skills

Coding and Data Management

- SAS - Fluent in base
- R - Fluent in base, able to design advanced scripts and packages for pipeline automation.
- Python – Familiar with syntax, able to write and execute code in visual studio code IDE.
- SQL - Familiar with syntax, able to write and execute code in MySQL Workbench Community.
- ASREML - Proficient in base, able to implement complex covariance structures in ASREML-R.
- Bash and Shell Script Coding - Able to write shell script codes in Linux based systems to create pipelines.
- Linux Server Interface - Familiar with Linux coding and server management.

Software Experience

- Microsoft software - Highly familiar with Word, Excel, and PowerPoint.
- ImageJ - Highly familiar with interface and able to produce macros for batch image analysis.
- R Studio - Familiar with interface, able to create markdowns for efficient communication of information.
- Visual Studio Code - Familiar with interface and used to interpret Python and SQL code.
- TASSEL 5.0 - Familiar with the stand along GUI based interface and the command line interface.
- Microsoft Windows Operating Systems - Highly familiar with Windows interface.
- Linux Operating Systems - Highly familiar with Ubuntu desktop and server interface.
- Unix Operating Systems - Familiar with Mac interfaces.
- PyTorch - Familiar with implementation in machine learning problems.
- SAS 9.4 - Familiar with interface.

Mentoring, Teaching, and Breeding Experience

- Quantitative Genetic Analysis - Deep understanding of quantitative genetic analysis and ability to execute genomic selection, QTL mapping, and genome wide association studies.
- Breeding Pipeline Optimization - Deep understanding of production-based breeding programs with a focus on increasing genetic gain and producing cultivars for public and private use.
- Coordination and execution of day-to-day breeding task - Assisted in planting, DNA extraction, library prep, bioinformatic pipeline, PCR based haplotyping, genomic prediction, selection, harvest crew coordination (undergraduate, graduate, and research associates), harvest, post-harvest processing in a wheat breeding program.
- Graduate student advising - Assisted in advising graduate students at Colorado State University from 2022 to 2024.
- Written communication expertise - Expertise in lecture development, peer reviewed publication, grant writing, and extension writing.