Katherine A. Frels, Ph.D.

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EDUCATION

University of Nebraska-Lincoln, Institute of Agriculture and Natural Resources, Lincoln, NE
Doctor of Philosophy, Agronomy and Horticulture
Area of Specialization: Plant Breeding and Genetics, G.P.A.: 3.83/4.0
Dissertation title: "Using Canopy Spectral Reflectance to Estimate Nitrogen Use Traits in Hard Winter Wheat"
August 2015

Iowa State University, Ames, IA
Bachelor of Science, Agronomy, summa cum laude
Area of Specialization: Plant Breeding, G.P.A.: 3.91/4.0
May 2011

PROFESSIONAL EXPERIENCE

University of Nebraska-Lincoln Mar 2021-
Department of Agronomy and Horticulture, Lincoln, NE
Assistant Professor- Small Grains Breeding and Genetics
Supervisor: Dr. Martha Mamo
Role: Develop improved varieties for winter wheat, barley, and tricale and investigate genes controlling economically important traits in each crop.
Objectives:

- Plan, develop, and implement research objectives and budgets for the small grains breeding program.
- Collaborate with multi-disciplinary research partners to solve biotic and abiotic stress challenges such as wheat stem sawfly; stem, leaf, and stripe rust; Fusarium head blight; winter hardiness; and drought and heat tolerance.
- Conceptualize, write, and supervise peer-reviewed publications for the small grains breeding program.
- Supervise and train pennycress breeding team including field technician, graduate students, and undergraduate assistants.
- Serve on graduate student oral exam committees.
- Develop and manage grant proposals for state, federal, and private funding agencies to fund small grains breeding.
- Present research and share educational outreach materials with stakeholders at scientific conferences, grower meetings, field days, and webinars.

University of Minnesota 2020-2021
Department of Agronomy and Plant Genetics, St. Paul, MN
Research Assistant Professor- Winter annual oilseed breeding
Supervisor: Dr. Gary Muehlbauer

Role: Develop improved varieties for winter annual oilseed species pennycress and camelina.
Objectives:

- Plan, develop, and implement research objectives and budgets for the winter annual oilseed breeding program.
- Collaborate with multi-disciplinary research partners to solve biotic and abiotic stress challenges in winter annual oilseeds.
- Supervise and train pennycress breeding team including field technician, graduate students, and undergraduate assistants.
- Conceptualize and write peer-reviewed publications for the winter annual oilseeds breeding program.
- Serve on graduate student oral exam committees.
- Develop and manage grant proposals for state, federal, and private funding agencies to fund winter annual oilseeds breeding.
- Present research and share educational outreach materials with stakeholders at scientific conferences, grower meetings, field days, and webinars.
- Specific projects include:
    - Develop resources and analysis for Pennycress Genome V2 including PacBio sequencing, Hi-C analysis, and linkage map development.
    - Assess genotype by environment interaction in winter annual oilseeds through multi-location yield trials.
    - Selection of pennycress and camelina breeding lines to maximize crop response to nitrogen fertilizer inputs and minimize environmental transport and loss.

University of Minnesota 2015-2020
Department of Agronomy and Plant Genetics, St. Paul, MN
Researcher 5 (Research Associate)- Lead pennycress breeding researcher
Supervisor: Dr. James Anderson
Role: Interpret and evaluate pennycress research data to develop pennycress into a domesticated crop species fitting MN cropping systems.
Objectives:

- Plan, develop, and implement research objectives for the field pennycress breeding research program.
- Collaborate with agronomy team to determine best management practices for new cropping systems.
- Collaborate with genomics team to create, identify, and characterize mutagenesis lines including domestication traits such as reduced pod shatter, early maturity, and edible oils.
- Develop grant proposals and prepare all reports for the pennycress breeding program.
- Present research to stakeholders through written and oral presentations.
- Specific projects include:
    - Evaluate genetic diversity in wild field pennycress collection using Genotyping-By-Sequencing and statistical measures of diversity.
    - Collaborate with UMN nematode lab to evaluate pennycress resistance to soybean cyst nematode.
    - Assess genotype by environment interaction in field pennycress through multi-location yield trials.
    - Selection of pennycress lines developed to maximize crop response to nitrogen fertilizer inputs and minimize environmental transport and loss.

University of Nebraska-Lincoln 2011-2015
Department of Agronomy and Horticulture, Lincoln, NE
Graduate Research Assistant- Senior graduate student; Lead high-throughput phenotyping researcher
Advisor: Dr. P. Stephen Baenziger
Role: Develop high-throughput phenotyping methods using canopy spectral reflectance protocols for non-destructive high-throughput assessment of nitrogen use efficiency (NUE) in winter wheat.
Objectives:

- Implement new research methods for non-destructive assessment of nitrogen use efficiency in hard winter wheat.
- Compare new hyperspectral remote sensing methods with traditional, destructive NUE measurements.
- Evaluate NUE in 299 hard winter wheat lines.
- Present research at national conferences to scientific audiences.

Iowa State University, Department of Agronomy, Ames, IA 2010-2011
Undergraduate Research Assistant
Supervisor: Dr. Thomas Lübberstedt
Phenotyped switchgrass for degree of self-incompatibility. Completed DNA extractions and PCR. Maintained switchgrass genetic stocks in greenhouse.

AgReliant Genetics, Ames, IA Summer 2009
Field and Breeding Intern
Supervisor: Dr. Steven Schuetz
Prepare phenotypic reports on corn inbreds and hybrids for plant patent applications and other regulatory notices. Led team of two-four hourly workers to complete daily pollination quotas.

Iowa State University, Department of Plant Pathology, Ames, IA 2008-2009
Undergraduate Research Assistant
Supervisor: Dr. Leonor Leandro
Maintained disease early warning plots to identify potential infestations of soybean rust in a multi-state collaborative plant disease monitoring network. Cultured tissue samples to identify soybean diseases and causal agents present.

COMMUNICATION

PEER-REVIEWED PUBLICATIONS

Tyl, C., L. DeHann, **K. Frels**, P. Bajgain, M.D. Marks, J.A. Anderson. Emerging crops with enhanced ecosystem services: Progress in breeding and processing for food use. 2020. Cereal Foods World. DOI: https://doi.org/10.1094/CFW-65-2-0016

Chopra, R., E. Johnson, R. Emenecker, E. Cahoon, J. Lyons, D. Kliebenstein, E. Daniels, K. M. Dorn, M. Esfahanian, N. Folstad, **K. Frels**, M. McGinn, M. Ott, C. Gallaher, B. Ismail, J.A. Anderson, D.L. Wyse, T. Ulmasov, J. C. Sedbrook, and M. D Marks. Identification and stacking of crucial traits required for the domestication of pennycress. 2020. Nature Food. DOI: https://doi.org/10.1038/s43016-019-0007-z

Cubins, J., M.S. Wells, **K. Frels,** M. Ott, F. Forcella, G. Johnson, M. Walia, R. Becker, and R. Gesch. Management of pennycress as a winter annual cash cover crop. A review. 2019. Agronomy for Sustainable Development. DOI: https://doi.org/10.1007/s13593-019-0592-0

Frels, K., R. Chopra, K.M. Dorn, D.L. Wyse, M.D. Marks, and J.A. Anderson. 2019. Genetic Diversity of Field Pennycress (Thlaspi arvense) Reveals Untapped Variability and Paths Toward Selection for Domestication. Agronomy, DOI: https://doi.org/10.3390/agronomy9060302

Chopra, R., N. Folstad, J. Lyons, T. Ulmasov, C. Gallaher, L. Sullivan, A. McGovern, R. Mitacek, K. Altendorf, **K. Frels,** A. Killam, B. Ismail, J.A. Anderson, D.L. Wyse, M.D. Marks. 2019. The Adaptable Use of Canola NIRS Calibration Equations to Identify Pennycress Variants to Facilitate the Rapid Domestication of a New Oilseed Crop Species. Industrial Crops and Products, DOI: https://doi.org/10.1016/j.indcrop.2018.10.079.

Chopra, R., E. Johnson, E. Daniels, K. Dorn, N. Folstad, K. Amundson, K. Altendorf, K. Betts, **K. Frels**, J.A. Anderson, D.L. Wyse, J. C. Sedbrook, and M. D Marks. 2018. Translational genomics using Arabidopsis as a model enables the characterization of pennycress genes through forward and reverse genetics. The Plant Journal, DOI: https://doi.org/10.1111/tpj.14147

Hayes, R.C., Wang, S., Newell, M.T., Turner, K., Larsen, J., Gazza, L., Anderson, J.A., Bell, L.W., Cattani, D.J., **Frels, K.** and Galassi, E., 2018. The performance of early-generation perennial winter cereals at 21 sites across four continents. Sustainability, https://doi.org/10.3390/su10041124

Frels, K., M.J. Guttieri, B. Joyce, B. Leavitt, and P.S. Baenziger. 2018. Evaluating canopy spectral reflectance vegetation indices to estimate nitrogen use efficiency in hard winter wheat. Field Crops Research, DOI: 10.1016/j.fcr.2017.12.004

Zhang, X., S.R. Larson, L. Gao, S.L. Teh, L.R. DeHaan, M. Fraser, A. Sallam, T. Kantarski, **K. Frels**, J. Poland, and D.L.Wyse. 2017. Uncovering the Genetic Architecture of Seed Weight and Size in Intermediate Wheatgrass through Linkage and Association Mapping. The Plant Genome, doi:10.3835/plantgenome2017.03.0022

Guttieri, M.J., **K. Frels,** T. Regassa, B. Waters, and P.S. Baenziger. 2017. Variation for nitrogen use efficiency traits in current and historical great plains hard winter wheat. Euphytica, DOI: 10.1007/s10681-017-1869-5

Grogan, S.M., J. Anderson, P.S. Baenziger, **K. Frels**, M.J. Guttieri, S.D. Haley, K. Kim et al. 2016. Phenotypic plasticity of winter wheat heading date and grain yield across the US Great Plains. Crop Sci., doi:10.2135/cropsci2015.06.0357

Guttieri, M.J., P.S. Baenziger, **K. Frels**, B. Carver, B. Arnall, S. Wang, E. Akhunov and B. Waters. 2015. Breeding wheat for increased zinc and Decreased Cadmium Concentration in grain: Insights from a winter wheat association mapping panel. Crop Sci., doi:10.2135/cropsci2014.08.0559

Guttieri, M.J., P.S. Baenziger, **K. Frels**, B. Carver, B. Arnall and B. Waters. 2015. Variation for grain mineral concentration in a diversity panel of current and historical great plains hard winter wheat germplasm. Crop Sci., doi:10.2135/cropsci2014.07.0506

PAPERS IN PREP

Frels, K., R. Chopra et al. 2020. The Pennycress Genome: Tools for a new cash cover crop and model species.

Ott, M.A., **K. Frels**, et al. 2020. The effect of nitrogen fertilizer on pennycress protein and oil content.

Hoerning, C., S. Chen, **K. Frels**, D.L. Wyse, M.S. Wells and R.W. Gesch. Host Suitability of Winter Oilseed Crops Pennycress and Camelina for Heterodera glycines.

GRANTS AND FUNDING

Lead Author (Total Funded: $2,216,418)

"Forever Green Breeding Programs Support- Increasing research plot harvest efficiency through combine harvest". 2020. USDA-NIFA EGP. PI: Katherine Frels and Jim Anderson. Not funded $260,142.

"Expanding the field pennycress breeding program for variety development and rapid response to new challenges". 2019. Forever Green Initiative. PI: Jim Anderson and Katherine Frels. Funded $309,034.

"Closing the agronomic and breeding gaps for commercialization of pennycress and camelina". 2018. Walton Family Foundation. PI: Donald L. Wyse. Funded $460,000.

"Genetic improvement of seed yield and oil content in field pennycress, a non-food oilseed feedstock species". 2018. Plant Feedstock Genomics for Bioenergy: A Joint Research Funding Opportunity Announcement USDA, DOE. PI: Jim Anderson. Funded $1,000,000.

"Enhancing field testing and genomic tools for pennycress breeding and domestication". 2017. MDA Agri Crop Research Grant. PI: Jim Anderson. Funded $199,000.

"Field Pennycress Breeding Project Support". 2017. Forever Green Initiative. PI: Jim Anderson. Funded $137,250.

"Breeding for oil quality in field pennycress (*Thlaspi arvense* L.), a new winter annual cover and oilseed crop". 2016. Forever Green Initiative. PI: Jim Anderson. Funded $111,134.

Co-author

"Developing winter camelina rotations in short-stature corn". 2020. Bayer CropScience. PI: M. Scott Wells. In review $750,000.

"Pennycress - A solution for global food security, renewable energy and ecosystem benefits". 2020. JGI. PI: Ratan Chopra, M.D. Marks, John Sedbrook, Katherine Frels. Funded (In-kind sequencing support).

"Interrogating pennycress natural and induced variation to improve abiotic stress tolerance and oilseed bioenergy crop resilience." 2020. DOE. PI: John Sedbrook. Funded $12,899,996.

"Monetizing pennycress oilseeds to enhance the substantiality of Midwest farm ecosystems". 2020. MN Futures. PI: M. D. Marks. Not funded $250,000.

"Pennycress and soybean cyst nematode: a solution oriented approach" 2019. Forever Green Initiative. PI: Kathryn Bushley and Senyu Chen. Funded $184,717.

"Oilseed Pennycress - A new cash cover-crop for the Midwest". 2019. USDA-NIFA. PI: Win Phippen. Co-PIs: M. David Marks, John Sedbrook, M. Scott Wells. Funded $10,000,000.

"Development and Deployment of Pennycress and Winter Camelina, Two New Cash Cover Crops". 2017. Walton Family Foundation. PI: Don Wyse, Jim Anderson, Frank Forcella, M. Scott Wells. Funded $400,000.

"Evaluation of pennycress for host resistance to soybean cyst nematode". 2016. Forever Green Initiative. PI: Senyu Chen. Funded $104,763.

"Expanding the Footprint : New Cropping System Opportunities for Forever Green Crops". 2016. Forever Green Initiative. PI: M. Scott Wells. Funded $132,000.

"Launching a Breeding Program for Camelina (Camelina Sativa), a Winter Annual Cover Crop with Potential to Increase Production of Food, Feed, and Fuel". 2016. Forever Green Initiative. PI: M. David Marks. Funded $150,000.

"Agronomic and breeding strategies for improved pennycress grain yield and oil content" 2016. MDA Crop Research Grant. PI: M. Scott Wells, Don Wyse, Jim Anderson, Frank Forcella, M. David Marks. Funded $248,791.

"Evaluation and development of pennycress as a new oilseed feedstock for Western and Southwestern United States". 2018. Plant Feedstock Genomics for Bioenergy: A Joint Research Funding Opportunity Announcement USDA, DOE. PI: M. David Marks. Not funded $1,500,000.

"Protecting rural wellheads, waterways, and farmlands with pennycress and camelina, winter annual cash cover crops." 2017. University of Minnesota Grand Challenges. PI: M. David Marks, Craig Sheaffer, Jeffrey Peterson, Baraem Ismail, M. Scott Wells. Not funded $745,690.

"Enhancing the experience undergraduates helping to advance pennycress, camelina and Kernza® as new FGI crops." 2017. Forever Green Initiative. PI: M. David Marks. Not funded $145,000.

Technical, extension, and outreach documents

Frels, K., R. Chopra, K.M. Rai, J.A. Cubins, M.S. Wells, D.L. Wyse, M.D. Marks, and J.A. Anderson. 2020. Breeding and genetics research update. https://bit.ly/3lFYmly

Rai, K.M., **K. Frels,** R. Chopra, J.A. Cubins, M.S. Wells, D.L. Wyse, J.A. Anderson, and M.D. Marks. 2020. Integration of modern genetic tools to improve winter oilseeds at the University of Minnesota. 2020. https://bit.ly/3jXMYRq

Cubins, J.A., **K. Frels,** R. Chopra, K.M. Rai, D.L. Wyse, M.D. Marks, J.A. Anderson, and M.S. Wells. 2020. How can we ensure pennycress profitability? https://bit.ly/3lJhTBh

Frels, K., R. Chopra, K.M. Rai, J.A. Cubins, M.S. Wells, D.L. Wyse, M.D. Marks, and J.A. Anderson. 2019. Evaluating genetic diversity in field pennycress. https://bit.ly/2uK0nrm

Chopra, R., **K. Frels,** K.M. Rai, J.A. Cubins, J.A. Anderson, M.S. Wells, D.L. Wyse, and M.D. Marks. 2019. Advancements in field pennycress (*Thlaspi arvense*) domestication. https://bit.ly/2xWYbLu

Frels, K., R. Chopra, M.K. Walia, M. Ott, J.A. Anderson, D.L. Wyse, M.D. Marks, and M.S. Wells. Considerations for optimizing planting date in pennycress. 2018. https://bit.ly/2SqGX2D

K. Frels, R. Raymundo, R. Chopra, M.K. Walia, J.A. Anderson, D.L. Wyse, M.D. Marks, and M.S. Wells. Evaluating Phenotypes to Improve Survival in Corn Stover Systems. 2018. https://bit.ly/2JE9wqD

Walia, M.K., **K. Frels,** R. Chopra, M.S. Wells, J.A. Cubins, D.L. Wyse, F. Forcella, and R. Gesch. Influence of Growing Degrees on Winter Camelina Seed Yield and Quality. 2018. https://bit.ly/2LY0o1G

Frels, K., R. Chopra, M.K. Walia, M.S. Wells, M.D. Marks, D.L. Wyse, and J.A. Anderson. Identifying genotype and environment interactions in pennycress breeding populations. 2018. https://bit.ly/2LY0l60

R. Chopra, **K. Frels,** M.K. Walia, M.S. Wells, D.L. Wyse, J.A. Anderson, and M.D. Marks. Brassica NIRS models for determining pennycress seed contents – Potential tool for the elevator. 2018. https://bit.ly/2LyYaGP

R. Chopra, **K. Frels,** M.K. Walia, M.S. Wells, D.L. Wyse, J.A. Anderson, and M.D. Marks. Mutant resource exhibits the phenotypic variation for pennycress improvement. 2018. https://bit.ly/30DcNw2

Frels, K. and J.A. Anderson. Pennycress Breeding Program 2017 Year End Update. 2017. http://bit.ly/2sl4bOm

R. Chopra, **K. Frels,** M.K. Walia, M.S. Wells, D.L. Wyse, J.A. Anderson, and M.D. Marks. Winter Annual Oilseed Quarterly Report: Pennycress Genomics Update. 2017. http://bit.ly/2nN5cKo

Frels, K., R. Chopra, M.K. Walia, M.S. Wells, M.D. Marks, D.L. Wyse, and J.A. Anderson. Winter Annual Oilseed Quarterly Report: Pennycress Breeding Update. 2017. http://bit.ly/2Bj4Qm8

Frels, K., F. Forcella, R. Gesch, M.S. Wells, M.D. Marks, J.A. Anderson, and D.L. Wyse. Forever Green Initiative: Field Pennycress. 2017. http://bit.ly/2BP6fSM

Ott, M., F. Forcella, R. Gesch, **K. Frels,** M.S. Wells, M.D. Marks, J.A. Anderson, and D.L. Wyse. Forever Green Initiative: Winter Camelina. 2017. http://bit.ly/2sjF6Dn

Technical, extension, and outreach videos

Frels, K. Behind the scenes in a pennycress breeding program. 2020. Links on Twitter @FrelsintheField

Grow with KARE- What's new at the U? Developing camelina as a new cash cover crop. 2019. https://bit.ly/2Nn8RvO

Frels, K., and L. Sandall. Teaching Video: High Throughput Phenotyping in Wheat. 2015. https://vimeo.com/139988799

Presentations

2020

ASA-CSSA-SSSA International Annual Meetings

Field Pennycress Genome Unlocks Genetic Variation and Road Maps for Breeding

Forever Green Winter Annual Oilseeds Virtual Field Days

Winter Annual Oilseed: Breeding and Improvement youtube.com/watch?v=RfCeb-lYtK0

2019

Association for the Advancement of Industrial Crops Annual Meeting

Revealing the genetic diversity of Field Pennycress (Thlaspi arvense L.)

Green Lands Blue Waters 2019 Conference

New cash cover crops in the Forever Green Initiative

Forever Green Initiative

Pennycress Breeding Update and New Projects Initiated

2018

Minnesota Department of Agriculture

Breeding Field Pennycress as a Potential Cash Cover Crop

Forever Green Initiative

Pennycress Breeding Update

2017

ASA-CSSA-SSSA International Annual Meetings

Where's the genetic diversity at? Breeding Thlaspi arvense L., a new cash cover crop

Forever Green Initiative

Pennycress Breeding Update

2016

ASA-CSSA-SSSA International Annual Meetings

Finding Genomic Keys to Breeding Pennycress (Thlaspi arvense L.)

Forever Green Initiative

Pennycress Breeding Update

2015

TCAP Meetings at PAG XXIII

Evaluating Vegetation Indices for Nitrogen Use Efficiency Phenotyping in Winter Wheat

ASA-CSSA-SSSA International Annual Meetings

2014

Plant and Animal Genome XXII

Canopy Spectral Reflectance Methods and Management in the Triticeae Coordinated Agriculture Project, co-presenter

TCAP Meetings at PAG XXII

TCAP Wheat Phenotyping, co-presenter

Public outreach presentations

2020

Winter Camelina Fall Field Day

Breeding objectives for winter camelina and systems breeding with applied agronomy researchers

2019

Public Testimony at MN House Ag Finance and MN Senate Agriculture Committees

New perennial and winter annual crops: the key to improved water quality and sustainable cropping systems in Minnesota

2019 Winter Camelina Field Day

Breeding winter camelina and pennycress for value added winter cover

Democratic-Farmer-Labor Senate District 58 Meeting

Developing High-Efficiency Agricultural and Food Systems: A Forever Green Agriculture Initiative

Minnesota State Fair

Protecting Minnesota's soil and water with pennycress and camelina

2018

Public Testimony at MN House Ag Finance Committee

New perennial and winter annual crops: the key to improved water quality and sustainable cropping systems in Minnesota

Grass Seed Institute, Producer Meeting

Breeding Field Pennycress as a potential cash cover crop

One Water Conference-Forever Green Tour

Domesticating new cover crops for Minnesota Farmers

Minnesota State Fair

Protecting Minnesota's soil from water erosion with perennials and cover crops

2017

Sustainable Farming Association Annual Conference

Converting Field Pennycress into the Next Cash Cover Crop: A Weed No More

Crow River Sustainable Farming Association Chapter Spring Social

It's not a weed, It's a crop! Converting Field Pennycress into the Next Cash Cover Crop.

Minnesota State Fair

Protecting Minnesota's soil from water erosion with perennials and cover crops

College of Food, Agricultural and Natural Resource Sciences Legislative Visit Day

Domesticating new cover crops for Minnesota Farmers

2016

Minnesota Legislative and Governor's Forever Green Field Day

Domesticating new cover crops for Minnesota Farmers

Minnesota State Fair

Protecting Minnesota's soil from water erosion with perennials and cover crops

Posters

2019

Association for the Advancement of Industrial Crops; Kansas State Plant Breeding and Genetics Symposium:*Unlocking Pennycress Potential: Rapid Domestication through Bioinformatics and Super Computing*

2017

ASA-CSSA-SSSA International Annual Meetings: *Estimating Genetic Diversity and Population Structure of Founder Lines in a Pennycress Breeding Program.*

2016

ASA-CSSA-SSSA International Annual Meetings: *Developing a Genome Informed Breeding Program for Field Pennycress (Thlaspi arvense L.)*; *Validating the Use of Vegetation Indices to Select Nitrogen Use Efficient Wheat.*

2015

Plant and Animal Genome XXII: *Breeding for Nitrogen Use Efficiency in Hard Winter Wheat Using Canopy Spectral Reflectance and Genomic Selection*

2014

Plant and Animal Genome XXII: *Genomic Selection for Nitrogen Use Efficiency Using Canopy Spectral Reflectance in Hard Winter Wheat*

ASA-CSSA-SSSA International Annual Meetings: *Choosing the Best Vegetation Index for Use in Nitrogen Use Efficiency Selection in Winter Wheat*

PROFESSIONAL AND INTERPERSONAL SKILLS

Leadership and Teamwork

Team leader for the pennycress breeding program at the University of Minnesota. Coordinate a multi-disciplinary team dedicated to the domestication and advancement of field pennycress as a new cover crop species. Administer Walton Family Foundation research grant and prepare biannual reports that summarize research from all teams. Facilitate small group team meetings to improve communication between breeding, genomics, agronomy, and end-user research team. Lead large group team meetings with all pennycress and camelina researchers to encourage networking and new research collaborations.

Diversity and Inclusion

Completed nine of ten 3-hour workshops in the Equity and Diversity Certificate Program delivered by the University of Minnesota Office for Equity and Diversity. Topics included “My Role in Equity and Diversity Work”; Leadership and Communication in Equity and Diversity, Addressing Implicit Bias and Microaggressions; LGBTQIA Identities and Communities; Ableism & Disability Justice; Gender Equity, Race, Racism, and Privilege, and Facilitating Challenging Conversations.

Teaching

Laboratory teaching experience:

Agro 315 Genetics (UNL, 2 semesters)- guided students through weekly lab activities problem sets by teaching undergraduate level genetics concepts including principles of inheritance in plants and animals, introduction to population genetics, chromosome biology, and gene expression.

Classroom teaching experience:

Agro 815A Self-Pollinated Crop Breeding; 815B Germplasm and Genes; 815C Cross-Pollinated Crop Breeding (UNL, 1 semester)- classroom TA and lead online instructor for graduate level plant breeding

and genetics course. Designed, monitored, and graded online discussion forums, problem sets, and quizzes.

Guest Lecture experience:

First year writing intensive seminar "To eat or not eat GMOs" (Rice University, 2 lectures)- discussed methods of plant breeding, benefits and challenges of GMO technology, and new crop development with freshmen liberal arts students at Rice University.

Agro 5021 Plant Breeding Principles (UMN, 2 lectures)- discussed methods of and challenges with plant phenotyping and introduced concepts of experimental design for plant breeding research trials.

FDSY 2101 Plant Production Systems (UMN, 1 lecture)- introduced students to the Forever Green Initiative and the goals of new crop development.

Agro 1103 Crops, Environment, and Society (UMN, 1 lecture)- introduced students to the goals and methods of plant breeders

Digital teaching tool development:

Collaborated with UNL Agronomy distance education coordinator to develop a short video on the importance of breeding for nitrogen use efficiency and the opportunity that remote sensing tools can provide. https://vimeo.com/139988799

Developed introduction to winter annual oilseed breeding seminar for virtual field days. https://www.youtube.com/watch?v=RfCeb-lYtK0 (start-31:51)

Public Outreach and Extension Communication
Lead speaker representing pennycress breeding and genomics research program at Forever Green Initiative outreach events. Present research at field days targeted to growers, extension agents, crop consultants, and state governing agencies annually. Develop quarterly pennycress research documents to be distributed to the public. Interact with industry representatives to develop relationships and collaborations to further pennycress research.

Mentoring and Personnel Management
Mentored two undergraduate students in guided research projects for honors thesis and Undergraduate Research Opportunity Program (UROP). Trained undergraduate summer employees in breeding program tasks such as DNA extraction, marker assisted selection, accurate phenotype scoring, off-type plant removal, harvest and sample processing methods and appropriate safety procedures. Coordinate field trial management with technical support staff. Organize and assign daily tasks for hourly employees.

Software proficiency
Advanced knowledge of Microsoft Office products, including proficiency in Word, Excel, PowerPoint, and Publisher. Advanced knowledge of Google Docs, Sheets, and Drive. Proficient in R, SAS, and ASReml statistical programming languages. Knowledge of MySql and Linux commands.

Data Management
Facilitated UMN and UNL wheat program transition from pen and paper to digital note taking. Developed automatic backup system to prevent data loss. Trained 10+ students, technicians, and faculty on digital note taking system. Managed breeding program data in Agrobase Generation II®. Developed and maintain MySQL database for managing large (15 GB) phenotypic data set.

HONORS AND AWARDS

University of Nebraska:

UNL Dept. of Agronomy and Horticulture Gerald O. Mott Award	2015
Henry M. Beachell Fellowship	2014-2015
Widaman Trust Distinguished Graduate Assistant Award	2013-2014
National Council of Commercial Plant Breeders Graduate Student Award	2013

Iowa State University:

Dean's List Scholar, College of Agriculture and Life Sciences, Iowa State University	2007-2011
Raymond and Mary Baker Excellence Scholarship	2007-2011
President's Award for Competitive Excellence	2007-2011
Pioneer Agronomy Scholarship	2010
College of Agriculture and Life Sciences Honors Program	2008-2011
ICIA Seed Scholarship	2008 & 2009
ASA-CSSA-SSSA Golden Opportunity Scholar	2009
Gamma Sigma Delta Honor Society of Agriculture, initiated	
Kalton Scholarship in Agronomy	
Alpha Zeta, Professional society for agriculture and natural resources, initiated	2008
Scholtes Scholarship in Agronomy	

ACTIVITIES AND MEMBERSHIPS

Philanthropic Education Organization (P.E.O.)	2018-present
Member ASA-CSSA-SSSA	2013-present
Member National Association of Plant Breeders	2013-present
Agronomy and Horticulture Graduate Student Association, UNL	2011-present
President	2012-2014
Social Committee Co-Chair	2014-2015
Agronomy Club, ISU	2007-2011
Responding Secretary	2008-2009
Iowa State University Honors Program	2008-2011
Alpha Zeta, Academic honor society	2008-2011
Initiation committee	2009-2011