

CURRICULUM VITAE

MICHAEL C. TROSS

Quantitative Life Sciences Initiative
Center for Plant Science Innovation
University of Nebraska-Lincoln

Office: N231 Beadle Center
Phone: (786) 405-4772
Email: mtross2@huskers.unl.edu
GitHub: <https://github.com/mtross2>

Education

PhD Complex Biosystems University of Nebraska - Lincoln (Advisor: James Schnable)	2019-Present
BA Biology Doane University (Advisor: Tessa Durham-Brooks)	2015-2018
AS Environmental Science Clarence Fitzroy Bryant College	2010-2012

Employment

University of Nebraska-Lincoln Graduate Research Assistant Teaching Assistant, Life 120 General Biology	Sept. 2019 - Present Sept. 2019 - Dec. 2019
Doane University Computing Assistant, Center for Computing in the Liberal Arts IT Technician Student Assistant, Tiger Tech/HelpDesk Event Services Student Coordinator, Event Services Student Researcher Mentor, International Programs Office	Oct. 2018 - May 2019 Jan. 2016 - May 2019 Sept. 2018 - May 2019 Jan. 2017 - July 2019 Sept. 2017 - May 2019
Charles E. Mills Secondary School High School Teacher, Woodworking Department	Sept. 2013 - Aug. 2015
St.Kitts Bottling Company Limited Lab Technician	Sept. 2012 - April 2013

Selected Honors and Awards

Corteva DELTA Grant Corteva Agriscience	2022
Conference travel award North American Plant Phenotyping Network	2022
Dean list Doane University	2015-2019
Cosida All-Academic College Sports Information Directors of America	2017, 2018

NAIA Scholar-Athlete National Association of Intercollegiate Athletics	2017, 2018
GPAC Scholar-Athlete Great Plains Athletic Conference	2016, 2017, 2018
Doane Scholar-Athlete Doane University	2016, 2017, 2018
Ridley Guishard Memorial Scholarship Sandy Point Benevolent Society	2017

Publications

Tross MC, Gaillard M, Zweiner M, Miao C, Grove RJ, Li B, Benes B, Schnable JC (2021) 3D reconstruction identifies loci linked to variation in angle of individual sorghum leaves. *PEERJ* doi: [10.7717/peerj.12628](https://doi.org/10.7717/peerj.12628)

Mural RV, Sun G, Grzybowski M, **Tross MC**, Jin H, Smith C, Newton L, Andorf CM, Woodhouse MR, Thompson AM, Sigmon B, Schnable (2022) Association Mapping Across a Multitude of Traits Collected in Diverse Environments Identifies Pleiotropic Loci in Maize. *GIGASCIENCE* doi:[10.1093/gigascience/giaco80](https://doi.org/10.1093/gigascience/giaco80)

Preprints

Tross MC, Grzybowski M, Nishimwe AV, Sun G, Ge Y, Schnable JC (2022) Data driven trait quantification across a maize diversity panel using hyperspectral leaf reflectance. *ESSOAr* doi: [10.1002/essoar.10508826.1](https://doi.org/10.1002/essoar.10508826.1)

Oral Presentations:

External

Machine Learning for Cyber-Agricultural Systems (Presenter) 2022 (Ames, IA)
Tross Michael. "Genetically driven autoencoders for trait quantification using hyperspectral leaf reflectance in a maize panel"

Corteva's DELTA R&D Symposium (Presenter) 2022 (Indianapolis, IN)
Tross Michael. "Data driven trait quantification across a maize diversity panel using hyperspectral leaf reflectance"

Maize Genetics Meeting (Presenter) 2022 (St. Louis, MO)
Tross Michael. "Data driven trait quantification across a maize diversity panel using hyperspectral leaf reflectance"

North American Plant Phenotyping Network Conference (Presenter) 2022 (Athens, GA)
Tross Michael. "Data driven trait quantification across a maize diversity panel using hyperspectral leaf reflectance"

Machine Learning for Cyber-Agricultural Systems (Presenter) 2021 (Remote, COVID)
Tross Michael. "Data driven analysis of nitrogen deficit responses across a sorghum diversity panel using hyperspectral leaf reflectance"

Corn Breeding Research Meeting (Presenter) 2021 (Remote, COVID)
Tross Michael. "Measuring leaf angles and mapping genes using 3D reconstructions of sorghum and maize plants"

North American Plant Phenotyping Network Conference (Presenter) 2021 (*Remote, COVID*)
Tross Michael. "3D Reconstruction of Sorghum Identifies Orthologs of Maize Leaf Angle Genes"

National Academy of Science Meeting (Presenter) 2018 (*Lincoln, NE*)
Tross M, Durham Brooks T "Determining the effects of seed size on the production of amino acids in root exudates of corn"

Internal

AI Institute for Resilient Agriculture Annual Review meeting 2022 (*Remote*)
Tross Michael, Schnable James C. "Leaf, Light and Measurable Traits"

Poster Presentations:

External

Biological Systems Science Division Meeting (Presenter) 2022 (*Remote, COVID*)
Tross Michael. "Data driven analysis of nitrogen deficit responses across a sorghum diversity panel using hyperspectral leaf reflectance"

Plant and Animal Genome Conference (Presenter) 2022 (*Remote, COVID*)
Tross Michael. "Data driven trait quantification across a maize diversity panel using hyperspectral leaf reflectance"

Maize Genetics Meeting (Presenter) 2021 (*Remote, COVID*)
Tross Michael. "3D Reconstruction of Sorghum Identifies Orthologs of Maize Leaf Angle Genes"

Annual American Society of Plant Biologists Meeting (Non-Presenter) Aug 2018 (*Montreal, QB*)
Doan Tu, Doan Truc, Kangas M, Ernest A, Tran D, **Tross M**, Schroeder L, Davis-Alm C, Weber S, Schroeder D, Wilson C, Holmes A, Doyle E and Durham Brooks T. "Temporal and Spatial Colorimetric Detection of free amines on maize roots surfaces"

Internal

UNL PSI Retreat (Presenter) 2022 (*Nebraska City, NE*)
Tross Michael. "Data driven trait quantification across a maize diversity panel using hyperspectral leaf reflectance"

UNL Summer Research Symposium (Non-Presenter) Aug 2018 (*Lincoln, NE*)
Schroeder D, Weber S, **Tross M**, Doyle E, Doan T, and Durham Brooks T. "Determining the effects of seed size and stressed seedlings on the production of amino acids in root exudates of corn."

MindExpo Meeting (Presenter) 2018 (*Crete, NE*)
Tross M, Durham Brooks T "Determining the effects of seed size on the production of amino acids in root exudates of corn"

Research Experience

Graduate Research 2020 - Present (*Lincoln, NE*)

Project: "Data driven trait quantification across a maize diversity panel using hyperspectral leaf reflectance"
Here we explore the potential of data driven approaches for analyzing hyperspectral reflectance data in the absence of ground truth phenotypic measurements. These approaches enable us to quantify both genetic variability and genotype by environment variability in a subset of maize lines drawn from the wisconsin diversity panel. A set of 752 maize inbred lines were grown and hyperspectral reflectance data was collected from the leaves of plants in each replicate using an ASD spectrometer. This produced a high dimensional dataset consisting of the intensities of 2,151 distinct wavelengths measured across 1658 distinct samples. An auto-encoder neural network and principal component analysis were used to reduce the dimensionality of this high dimensional dataset to either 10 principal components or 10 autoencoder latent variables. A subset of both principal components and latent variables exhibited

significant heritability. Both auto-encoder latent variables and principal components were correlated with molecular traits. The most highly correlated trait with either latent variables or principal components was chlorophyll content. Latent variable 6 and principal component 2 were the most correlated with chlorophyll content within the latent variables and principal components respectively. However, the relevant latent variable proved to have a much stronger correlation with chlorophyll content (LV8; $R^2 = 0.59$) than the most correlated principal component (PC2; $R^2 = 0.31$). Genome wide association studies were able to identify specific genetic loci in the maize genome associated with variation in latent variables.

Project: "Identifying shared and unique loci linked to the angle of individual sorghum leaves via 3D reconstruction" In collaboration with computer scientists, calibrated 2D images of sorghum plants were reconstructed in 3D space using a voxel carving based reconstruction algorithm. The reconstructions were automatically segmented and the skeletons derived, enabling quantification of the angle of each leaf for each plant. Leaf angle measurements derived from these skeletons proved to be heritable and were correlated with manual measurements of those same plants. This study employed a population of 366 sorghum plants imaged over three time points. There was a total of 971 successful reconstructions enabling 3,376 leaf angle measurements. A large effect leaf angle gene that has been implicated in previous studies, was identified from a genome wide association study using aggregated leaf angles as a measurement for each plant. In addition, novel signals as well as previously identified leaf angle QTL were detected in the same study. The high throughput nature of this method allowed for separate genome wide association studies of three separate leaves. This revealed signals near the sorghum orthologs of maize genes known to affect leaf angle, shared signals between leaves, as well as signals near the big effect genes that was found using the aggregation of leaf angle measurements.

Other research-related duties:

- Provide training to undergraduate students on quantitative genetics and high-throughput phenotyping tasks.
- Maintain laboratory notebooks and archives.

Undergraduate Research

Jan. 2017 - Aug. 2018 (Crete, NE)

Project: "Determining the effects of seed size on the production of amino acids in root exudates of corn". Image analysis via computer software (ImageJ) and python coding was used to measure the concentration of exudates produced from seedlings that were classed according to the size of their seeds. Data supports that there is no significant correlation between seed size according to mass and concentration of amino acids in exudates. Seed size may play a factor in the roots' ability to adapt to stressors. The roots of bigger seeds may produce higher concentration of exudates in times of stress. Research experience also entailed imbibing, growing and nursing Maize seedlings over a period of 11 days after germination.

Other research-related duties:

- Supervised and provided training to High Schools on laboratory techniques
- Generated and analysed data for experiments
- Maintained laboratory notebooks and archives.

Mentoring

Undergraduate students:

Ryleigh Grove (University of Nebraska-Lincoln)	Present
Cole Hammett (University of Nebraska-Lincoln)	Present
Aime Nishimwe (University of Nebraska-Lincoln)	2021 - 2022
Olivier Mizero (University of Nebraska-Lincoln)	2020 - 2021

Mentorship of undergraduate students at the University of Nebraska-Lincoln. This entails providing advice on relevant classes and strategies to help students achieve their academic goals, as well as supervising research based projects to aid in their development as scientists and learn new skills. Projects supervised consisted of quantitative genetics and high throughput phenotyping.

Young Nebraska Scientists:

Ryleigh Grove (Lincoln NorthEast High School)	2021
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Danny Schroeder (Crete High School)	2018
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Sami Reese (Crete High School)	2018
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Mentorship of high school students who participated in the Young Nebraska Scientists summer research program. Two students presented research at the University of Nebraska Lincoln Summer research symposium in August 2018 on the topic, "Determining the effects of seed size and stressed seedlings on the production of amino acids in root exudates of corn."

International Students:

Davron Hanley (Doane University)	2017 - 2019
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Mentored an international student whom attended Doane University. This entailed meeting with the student, getting feedback on struggles that they might have in adapting to the American classroom/culture and giving advice or directing them to individuals who might be able to help with their struggles. Students were also directed to resources that they might need to meet their living requirements and pleasures.

Recent Service

Elected social chair, Collective Research Organization of Plant Scientists (CROPS)	2022 - Present
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Co-coordinator, Introduction to Python for Plant Pathologists (APS 2022)	2022
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Co-coordinator, Introduction to R for Plant Pathologists (APS 2022)	2022
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Search Committee, Research Technologist II	2021
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Professional Development:

Introduction to Business Data Analytics with Python	Lincoln, NE
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Participant in two day workshop that taught basic to intermediate concepts in using python for data analytics. Day one covered programming in python which included python fundamentals and handling tabular data, handling multiple files, and custom functions and lastly, robust programming as well as running python scripts from the command line. Day two covered business data analysis with python which included topics such as anaconda environments, working with packages such as numpy, pandas and matplotlib, connecting to and retrieving data from databases.

Nebraska Research and Innovation Conference (NRIC) Microbiomes symposium	Lincoln, NE
"Microbes from different habitats : soil, water and gut". Attendee at Conference	

Digital Imaging and Vision Applications in Science (DIVAS) Boot Camp	Crete, NE
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Participant in one week workshop that taught the basic concepts of coding in the computer language python, then further went into coding concepts that pertains to image analysis. This was followed up with a four week DIVAS seminar, which gave students the opportunity to work on different projects pertaining to image analysis.

Induction course for future teachers	Sandy Point, St.Kitts
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Took part in two-week course for potential future teachers, where classroom management skills, expectations and tools needed to be an effective teacher taught and implemented in a controlled setting. Acquired certificate for successfully completing course and became eligible for selection for to be teacher at any primary to secondary school level in St.Kitts and Nevis.

Community Outreach:

Participant in Crete Backpack Run

2016, 2017, 2018 (*Crete, NE*)

The Crete Backpack Run is a fundraiser in which the proceeds go to packing backpacks with essential stationery for students, different food materials and clothing. These backpacks go to students in need. The fundraiser entails making a donation to the program and participating in a mile run.

Volunteer for Martin Luther King blanket-tying project

2016, 2017, 2018 (*Crete, NE*)

Volunteers would go to the Crete Intermediate School and assist children in making blankets. These blankets would be donated to homeless persons as well as those who are in need of blankets to stay warm during the winter.

Video Technician for Crete Berean Church

2016 - 2019 (*Crete, NE*)

Controlled and coordinated slideshows and videos that would be shown to the church audience. Slides ranged from musical lyrics, announcements, powerpoint presentations and videos.

Student Leader for Fellowship of Christian Athletes

2016 - 2018 (*Crete, NE*)

One of three leaders of the group. FCA is an organization which caters to the building and association of Christian athletes where they would grow in faith and even develop together in sports. Although dubbed as a place just for Christian athletes, it is open to non-athletes and non Christians to come and associate in the aim of personal growth. Fundraisers, tailgating sporting events, bonfires, bible study, playing of games are just some of the main activities done in this group.

Huddle Leader For FCA Weekend Of Champions

2016, 2017 (*Grand Island, NE*)

Weekend of Champions is a weekend long event held by the Fellowship of Christian Athletes association which hosts High School students from all over Nebraska and neighbouring states. It comprises of different assemblies and sporting events that aid in the spiritual and physical upliftment of athletes. Students form groups or huddles of around 10 students and a leader who is assigned the responsibilities of coordinating activities for these athletes, guiding and being mentor for students throughout the weekend.