



PLANT BREEDING CENTER

2023 YEAR IN REVIEW



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WELCOME!

Plant breeding is a three-legged stool that requires good germplasm, adequate resources and skilled people to be successful. Take one leg out, and the breeding work will collapse.

The Plant Breeding Center, as it continues to grow, has focused on the people part of plant breeding. Germplasm and resources have remained the domain of individual breeding programs at the University of Minnesota, and the center has found much success in elevating the people part.

Alison Bentley, who was a Bayer Visiting Scholar at the center in fall 2023, noted that plant breeding “requires people with different skills, ideas and perspectives to come together to propose, develop and apply new ideas and ways of working” (see Alison’s article on page 30). This theme comes across strongly throughout the pages of this 2023 year-end report.

I’m thankful for the engaged community of students, postdoctorates, staff and faculty at the center. We, at the center, thank the College of Food, Agricultural and Natural Resource Sciences, industry donors and private individuals for their financial support and their confidence in what we do.

Please join our mailing list and follow us on [Twitter](#), [LinkedIn](#) and [YouTube](#) if you haven’t done so.

Happy reading!

Rex Bernardo
Director, UMN Plant Breeding Center



MAKING CONNECTIONS

through leafy African vegetables

When seven graduate students embarked on a student-led breeding effort on African vegetables in 2021, their thoughts immediately

went to the science behind breeding these exotic plant species. An expansive list of inquiries crossed their mind. What's the mode of pollination

of these plants? Are they diploids or autopolyploids? How long are their life cycles? How are they grown and consumed? Are any of them potentially invasive? What genomics work, if any, has been done on these species? And, where can the group acquire seeds of accessions so breeding work can start right away?

Little did they know these important questions had to take a back seat — the group quickly realized the importance of first building relationships with local African diaspora who treasure these vegetables from their homelands. This outward focus is evident in the name the group recently chose for themselves: Community Plant Breeding Team, which has grown to 17 graduate students and postdoctoral scientists.

This burgeoning relationship and outward focus were on full display during an open house the team hosted August 8, 2023. On a sunny and beautiful evening, nearly 100 vegetable enthusiasts came to see a plethora of African vegetables growing in a

Members of the Community Plant Breeding Team share produce with immigrant growers.



Chidi Chidozie, a Master Gardener volunteer originally from Nigeria, tends to the plots of African vegetables.



Michael Burns explains the team's research on adapting African vegetables to the Minnesota growing conditions.

community garden on the UMN Saint Paul campus.

Some of the visitors did not know that many of the vegetables from their homelands can grow in Minnesota, so they have been buying produce in specialty markets elsewhere.

"If we can grow our own produce here, it will be cheaper for us," says Umebe Onyejekwe, who immigrated from Nigeria 13 years ago.

Growing leafy African vegetables until harvest is indeed feasible in Minnesota's shorter growing season, as the leaves are typically harvested young.

The challenge is getting seeds to mature before the frost comes so growers can save seeds for planting the next year.

Michael Burns, Kabita Poudel, Lucas Roberts and Hannah Stoll described the team's research on adapting the following four leafy African vegetables to Minnesota growing conditions: amaranth, Ethiopian cabbage (*Brassica abyssinicum*), jute mallow (*Corchorus olitorius*) and spiderwisp (*Cleome gynandra*). Of the four, jute mallow is proving the most challenging for getting mature seeds before the first frost.



Lucas Roberts shows immigrant growers the team's vegetable plots.






During the August open house, members of the Community Plant Breeding Team presented their findings and invited visitors to stay for a dinner to enjoy the fresh produce.



After stopping to smell the veggies, immigrant growers mingled with each other and with graduate students, professors, postdoctoral scientists and University of Minnesota Extension staff over a catered dinner. They also tasted African dishes from a potluck table, and many took home samples of fresh produce, including amaranth, African eggplant, African basil, Ethiopian cabbage, kittley, sourleaf and waterleaf.

The open house was co-sponsored by the Hennepin County Master Gardeners and University of

Minnesota Extension. Chidi Chidozie, a Master Gardener volunteer originally from Nigeria, has been instrumental in helping the Community Plant Breeding Team make connections with local immigrant gardeners and has been a wonderful fount of knowledge regarding African vegetables.

“My dream,” shared Chidi, “is to create a global garden where everyone can share plants from their cultures.” 



GOPHERCORN U-PICK

attracts sweet corn fans

Sweet corn aficionados, young and old alike, got to pick, taste and bring home some maroon-and-gold sweet corn during four *GopherCorn* U-Pick field days last August and September.

GopherCorn is a supersweet (sh2 gene) F1 hybrid developed by UMN Plant Breeding Center Director Rex Bernardo. While it is nothing compared with UMN cultivars of other species, this UMN-proud sweet corn is



One of the littlest *GopherCorn* U-Pick participants, Loretta, bites into an ear of the fresh supersweet corn.

proving to be an effective mascot for telling different audiences about the broader plant improvement work on the UMN Saint Paul campus.

GopherCorn has provided an opportunity to tell former UMN President Joan Gabel (who received a box of *GopherCorn* ears in 2022), three UMN Regents (who took home some *GopherCorn* after a Saint Paul campus tour on September 8,


2023) and the U-Pick participants why continued breeding work at UMN on different plant species is important.

The U-Pick participants learned how plant breeding is akin to the *Survivor* reality television series and saw the puny maroon-kerneled parental line, the puny gold-kerneled parental line and the vigorous hybrid that resulted from crossing the two parental lines.

Most of those who came to the U-Pick events had never tasted a raw ear of sweet corn before, and they marveled at the deliciousness of a freshly picked ear of supersweet corn. They all happily left with a bag of *GopherCorn* that they picked themselves — and, said they’d like to come back in 2024.

Rex started *GopherCorn* as a homeschool science project with his youngest son, David, who has

Autism Spectrum Disorder. David needed a project that was hands-on and easy to understand, and *GopherCorn* fit the bill.

Because *GopherCorn* has not been tested widely under different field conditions, there currently are no plans to commercialize the F1 hybrid and it will remain a vehicle for visibility, promotion, education and outreach in plant breeding. 

Attendees of the GopherCorn U-Pick days picked their own sweet corn and enjoyed tasting the raw ears.



AARON LORENZ

Faculty Profile

What classes do you teach, and what are your research interests?

I currently teach PLSC 3401 (Plant Genetics and Breeding) and APSC 8201 (Advanced Plant Breeding). PLSC 3401 is an undergraduate course on plant genetics and introductory principles in cultivar development. APSC 8201 is an advanced graduate course on techniques in cultivar development, applications of quantitative genetics to plant breeding and analysis of molecular marker data for making selections.

My research focuses on breeding methodology, the genetic basis of economically important traits in crops, and the variation and structure of breeding germplasm. I also manage the UMN soybean breeding program where we strive to apply research findings to cultivar development.

Where are you from, and what was your academic path to the University of Minnesota?

I'm originally from Worthington, a town deep in southwest Minnesota. I grew up on a farm and worked at a farmers' cooperative and grain elevator. I started college by attending the local community college called Minnesota West Community and Technical College where I could wrestle and figure out what I wanted to do in a smaller college setting.

Along with several friends, I transferred to UMN and eventually found the Science in Agriculture-Plant Science major. After completing my B.S. here, I headed out on a journey across several universities — Iowa State University for an M.S., University of Wisconsin for a Ph.D. and Cornell University for a postdoctorate.

What drew you to the University of Minnesota?

I was an assistant professor at the University of Nebraska, working on maize quantitative genetics when the UMN soybean breeding and genetics position opened. Several colleagues here, particularly Jim Anderson and Candy Hirsch, encouraged me to apply, and I was offered the position and accepted it.

For one thing, I am from Minnesota, so working for my home state is rewarding. Professionally, this position was attractive as it historically has had the resources to conduct breeding alongside research, allowing me to put some research ideas into practice and create a feedback loop in which the breeding program generates questions, and the answers from the research program can be applied back to the breeding program.

The program and department have an excellent reputation, allowing us to attract top-notch staff and graduate students. Personally, my family and I enjoy all the things the Twin Cities has to offer — from the many forms of entertainment to restaurants to bike trails and more.

How did you become interested in your field of study?

Because I grew up on a farm, I have this lifelong experience in agriculture, and I cannot think of a time when I imagined doing



anything but agriculture. I've always been interested in science, especially genetics. My enthusiasm in genetics goes back to fifth grade, when I asked my teacher if we could conduct inbreeding on the class gerbils to see what would happen (he said, "no"). And, I remember my sister and I keeping track of our farm cat pedigrees (although I don't recall how I determined the father in each case). I also remember enjoying genetics in high school science class.

Working in plant breeding has been perfect for me because it allows me to combine my interest in the science of genetics with my lifelong experience in agriculture.

How does your work impact the citizens and growers of Minnesota?

Soybean is extremely important in Minnesota, being grown on nearly 8 million acres. Soybean breeding helps to create higher yielding cultivars with superior quality and pest resistance. This allows farmers to produce more food on less land, ensuring a stable food supply while



protecting natural resources. While private programs develop the vast majority of soybean cultivars grown on the landscape, public programs, like ours, contribute to the entire 'ecosystem' of soybean breeding through long-term research projects, publication of information benefiting the community as a whole, creation of new cultivars for markets not currently served well by the private industry, and education of future plant breeders and agricultural professionals.

What professional accomplishments are you most proud of in your career?

I realize this is wishful thinking, but I feel like I'm just getting started and have much of my career ahead of me with so much left to do. I would say I'm most proud of the 13 M.S. and Ph.D. students, and seven postdoctorates, who have gone through my lab. It's rewarding to see them advance in their

careers and make an impact on plant breeding, whether it be in the private or public sector.

On the research front, it's hard to know which parts of what I am doing now will have a lasting impact, forcing me to consider activities earlier in my career. I am most proud of some early genomic prediction work, especially some of the reviews I authored or contributed to early on. I know some of these reviews have been used in classes, and to this day I receive comments from people all across the world saying they read a certain paper and it cleared something up for them, or motivated them to study or apply genomic prediction themselves. It's a good reminder that papers are read and do have an impact, so we need to keep doing high-quality research and reporting the results in high-quality papers to move the whole discipline forward.

What are your priorities for the coming year?

I plan to write a few new grant proposals to ensure funding is steady and finish up a few

papers that have been lingering on my desk for quite some time. Beyond these routine activities, I need to spend some serious time recharting a vision for the program and making sure our activities are aligned with current and potential funding. Finally, I have at least one or two students who will want to graduate in 2024, so I need to make sure to help mentor them through the process.

What is the most significant opportunity you see in your field?

I like to divide this question into opportunities related to methodology, and opportunities related to markets and traits. As for methodology, I think increasing adoption of genomic prediction combined with gene editing is an enormous opportunity. This allows breeders to make gains more quickly. Gene editing technologies allow for the creation of novel variation that we need for many traits in soybean, and I'm particularly

excited about its potential for chromosome engineering through stacking of QTL. For some traits we work with (e.g., high oleic and aphid resistance), we're chasing several major QTL. If chromosome engineering could be used to link them so they are inherited together, we would greatly increase our odds of finding the desirable genotypes. The usefulness of this depends on finding the causative genes. Bob Stupar and I are collaborating to find

genes controlling several traits in soybean and elucidate their function with future biotech applications in mind.

On the trait front, we're starting to breed for high oil, given the demand from the renewable diesel market. We're also thinking about how to breed soybeans for better adaptation to intercropping or simply cover cropping, as there seem to be big differences among cultivars in their relative performance

under intercropping that are not predicted by their performance in monoculture.

What is the most rewarding aspect of your position?

I can't pick a single aspect, so I'll briefly mention three. It's wonderful to see a student progress from barely knowing the first thing in their chosen discipline to an expert who can independently direct their research and to whom I may often go to for answers.

A second rewarding aspect is making new discoveries that create truly new information, and then seeing these findings cited in the literature as a sign that our work advanced the field, even just by a little.

Finally, it's rewarding to see our soybean lines be grown in a production setting and provide benefit to farmers. For example, we recently released some aphid-resistant soybean cultivars, and I hope to hear someday that they enabled a farmer to avoid spraying while protecting their yield.



How has the formation of the Plant Breeding Center affected your work?

The center has influenced our work by increasing the visibility of plant breeding as a whole at UMN, facilitating connections among plant breeders in different departments and being a recruiting tool for students and postdoctorates. The students and postdoctorates really

appreciate the opportunities the center provides in terms of facilitating connections across campus and educational opportunities in the form of workshops and seminars. Whenever I mention the center when recruiting a new student, it seems to have a positive effect on their desire to come here, and I think it has helped with my recruitments.

What research challenges have you had to overcome?

A university plant breeder, such as myself, needs to wear so many hats. When I talk with my industry counterparts, I get the impression that they have responsibility over one part of the product development enterprise (although I know it's not always this way and they have their own challenges). In my case, I find myself as a research scientist, plant breeder, teacher, academic adviser, editor, staff manager, fundraiser and financial manager. But, that also makes the job fun and rewarding.


I've been fortunate in having a talented and dedicated staff of research associates, students and postdoctorates to keep the variety of development pipeline and research projects moving along. The students and postdoctorates eventually exit the program, and the know-how they built up during the project

needs to be passed to the next person if the research area is to continue.

Can you share with us a little-known fact about yourself?

One of my favorite outdoor activities is water skiing, and playing the piano is among my favorite indoor activities. I'm always looking forward to more time to improve my skills.

Another thing about me is I'm prone to getting stuck in the snow for some reason. I actually met my wife just outside the UMN Saint Paul campus after I got stuck in a snowbank. She lent a helping hand by trying to push me out, albeit unsuccessfully.

[Editor's note: She eventually got permanently stuck with Aaron, and that's a good thing!] 



Graduate students tour CIMMYT IN MEXICO

Study abroad programs are common in undergraduate education, but are rarely a part of M.S. and Ph.D. studies. The International Maize and Wheat Improvement Center (CIMMYT, in its Spanish acronym) hosted 11 Plant Breeding Center graduate students during a weeklong educational visit in Mexico from January 8-14, 2023.

Here are the collective impressions of the following M.S. and Ph.D. students, from the Applied Plant Sciences and the Plant and Microbial Sciences graduate programs, who journeyed to Mexico during winter last year:

Isaias Ariza Hernandez
Maybell Banting
Michael Burns
Julian Cooper

Lori Croghan
Amanda Gilbert
Claire Menard
Albert Radloff

Inés Rebollo
Alina Smolskaya
Muyideen Yusuf



Eleven UMN graduate students enjoyed a weeklong educational visit to CIMMYT in Mexico.



It was freezing when the 11 of us left Saint Paul last January for a week on the CIMMYT grounds in Texcoco, Mexico. Most of us had never been exposed to the workings of an international agricultural research center, and we were excited about the opportunity to learn firsthand about CIMMYT.

We were sent the week's program beforehand, and we were humbled that CIMMYT

scientists in plant breeding, plant physiology and agricultural engineering would take time from their busy schedules to tell us about their work.

We, as graduate students, tend to narrowly focus on our own thesis research, and exposure to a nonprofit entity like CIMMYT opened our eyes to how our own work fits in the broader context of global research on food and agriculture.



Michael Burns, a member of our group, said, “I got the opportunity to see the maize nutritional chemistry lab, which was like seeing a globalized version of the research I am doing for my thesis.”



The exchange of information was two-way — we spent an afternoon giving lightning talks to the CIMMYT global breeding team, and, in turn, CIMMYT scientists gave presentations and led thoughtful and engaging discussions about CIMMYT considerations when developing new products for farmers. We visited the CIMMYT gene bank and nutritional quality labs for wheat and maize.



“I was able to reconnect with the wheat nutrition lead, whom I had met at a conference two months prior, and see her work in person,” added Michael.

In addition to meeting daily with scientists in Texcoco, we took a day trip to the CIMMYT station in Toluca, Mexico. This day was a highlight for many of us as we learned about how local farmers



use fireworks to control weather patterns and how CIMMYT improves its land through conservation agriculture.

We toured speed-breeding greenhouses and, in a somewhat impromptu session, we even got to drive a research-plot combine, leading Claire Menard, from our group, to remark that, “not very many people can say they’ve harvested corn in the highlands of Mexico!”

Lunch was tortillas we made ourselves, and the trip back to the CIMMYT headquarters included a sightseeing trip in Mexico City, Mexico.

We were delighted this trip was not just about academic and professional pursuits, but also personal growth. We experienced the culinary culture that Texcoco had to offer, including freshly made elote (corn on the cob) and tacos.



UMN graduate students got the opportunity to drive a research-plot combine while visiting CIMMYT in Mexico.


We visited the Teotihuacan pyramids, took selfies at the Diego Rivera murals at Chapingo Autonomous University and learned how agave is fermented into a local drink known as pulque. Group member Julian Cooper discovered that drinking pulque, “was like drinking a protein smoothie mixed with a Red Bull,” and added, “I was buzzing and energized for hours!”

This weeklong experiential learning visit was transformative for everyone in our group, helping to bridge the gap between theoretical knowledge and practical application while broadening our global perspective. We are grateful to the UMN Plant Breeding Center and to Alison Bentley, Program Director of the CIMMYT Global Wheat Program, for making this trip possible.



“It was a real pleasure to host the group, and we also found it to be an inspiring and motivating start to the year,” said Alison. “At the start of the week, we were all ‘waking up’ after vacation, and the visit certainly helped us to do this: The enthusiasm of all the participants was fantastic, and it was so good to have such

an engaged group who asked questions and were keen to interact with all our scientists.”

The pleasure was ours, and we thank the CIMMYT scientists and staff for their kind hospitality. It was an experience we, as graduate students, will remember for a lifetime. 

The UMN Plant Breeding Center hopes to organize its next CIMMYT trip for graduate students in January 2026.

FROM SOYBEANS TO SUPERCOMPUTERS

In fall 2023, I, Alison Bentley, was fortunate to be a Bayer Visiting Scholar at the Plant Breeding Center. Hosted by Rex Bernardo, during my visit I aimed to learn more about the diverse plant breeding activities at the University of Minnesota, to share perspectives on wheat genetics and research and the wider context for ensuring food security through plant breeding, and to develop collaborative opportunities for the future.

I gave a talk entitled *A Growing Cereal Emergency* describing the impacts of the Ukraine-Russia conflict on global wheat markets and livelihoods, as well as a UMN Plant Breeding Center seminar entitled *Crops on the Edge* highlighting work I've been involved in regarding accelerating adaptation of cereal crops to growing climatic instability.

It was also a highlight of my visit to be able to discuss issues

around diversity, equity and inclusion in plant breeding and crop science.

I gave a talk highlighting some of the key points in a recent *Nature Journal* article I co-authored with Professor Rachael Garrett titled, *Don't get mad, get equal: putting an end to misogyny in science*.

I also attended enriching events and discussions with members of the College of Food, Agricultural and Natural Resource Sciences and the Artemisia Leadership

Initiative network working to support and encourage greater diversity and inclusion.

It was a privilege to interact with a large number of staff and students to learn more about the many different aspects of crop research and plant breeding at UMN. This included an introduction to several programs which were new to me: hazelnut, turfgrass, soybean, perennial grains, pennycress, apple, roses and more. Staff and students

About the Bayer Visiting Scholar Program

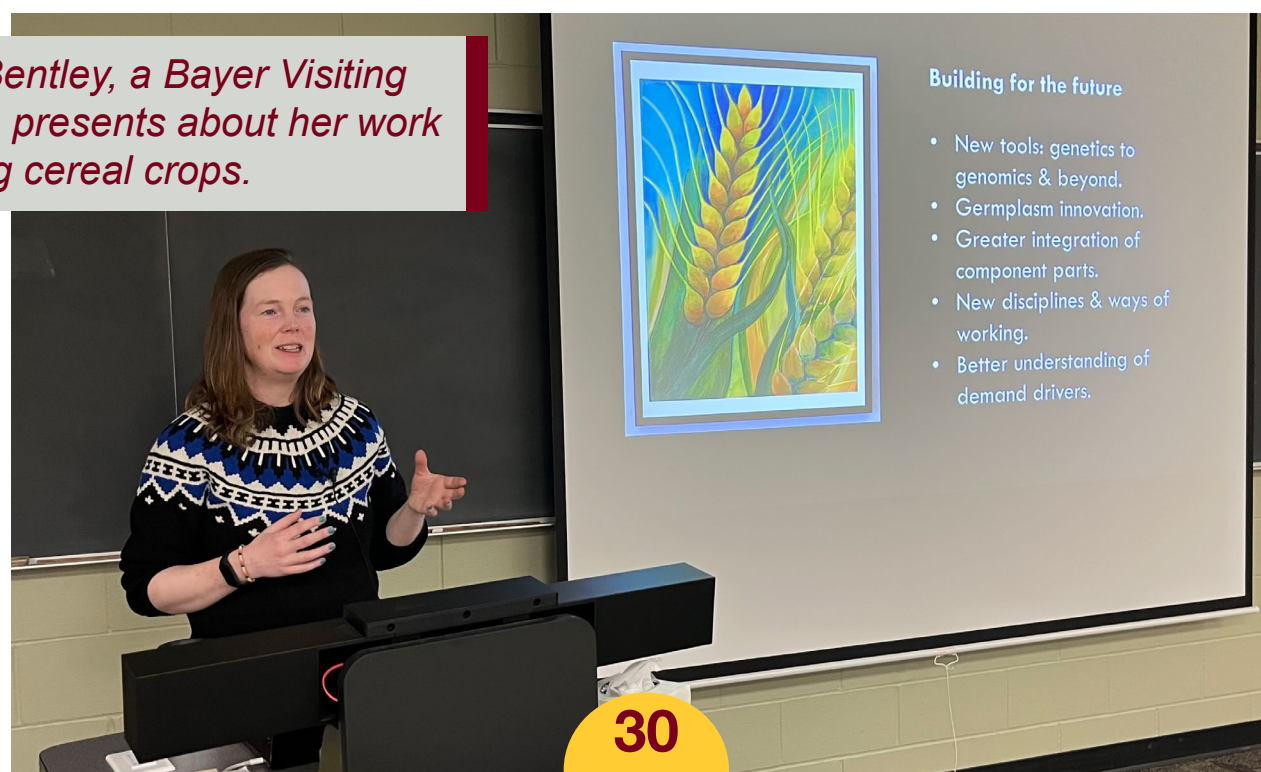
Bayer Visiting Scholars are leaders in plant breeding, or in a related field. They are invited to spend several weeks to a full year at the UMN Plant Breeding Center to:

- Interact in meaningful ways with faculty, postdoctorates, research staff and students;
- Give seminars, teach special courses, offer input to graduate students on their thesis research and develop collaborative research projects or grant proposals with faculty; and
- Develop professional collaborations that will last well beyond the duration of the leave.

Alison Bentley, who spent five weeks at the UMN Plant Breeding Center from October-November 2023, was formerly Program Director for the CIMMYT Global Wheat Program and is currently Deputy Director of the Agrifood Innovation Institute at the Australian National University.

This visiting scientist program has been made possible by a generous gift from Bayer Crop Science.

Alison Bentley, a Bayer Visiting Scholar, presents about her work involving cereal crops.





Alison Bentley (right) gets a tour from Brian Steffenson (left), a professor with UMN's Department of Plant Pathology.

were generous in giving their time to take me on tours and to explain the importance and relevance of their work.

The experience of visiting each of the programs (along with seeing the more familiar maize, barley and wheat research and breeding) allowed me to learn a great amount, organize ideas on the commonalities and connections that so many research and breeding programs share, and appreciate the incredible breadth of expertise under the umbrella of the UMN

Plant Breeding Center. I also had a glimpse of some of the interesting and diverse teachings underway at UMN, including a literal taste of the origins of coffee from Rex Bernardo, covering highlights of his *Coffee from the Ground Up* freshman seminar course.

Informative visits to the UMN Department of Plant Pathology and the U.S. Department of Agriculture's (USDA) Agricultural Research Service (ARS) Cereal Crops Research laboratory also extended my understanding



of cereal disease research, including the all-important international wheat leaf rust work that both do. Interactions with the GEMS Informatics team and a visit to the humming UMN supercomputer, housed in the spectacular Walter Library, opened further opportunities for future data-driven collaborations.

A standout part of my time at the UMN Plant Breeding Center were the many interactions that I had with early career scientists, including graduate students and postdoctorate

scientists. The beauty of being a Bayer Visiting Scholar was the flexibility of time to spend having coffee, lunch and hallway conversations. This led to many new ideas for building research, as well as ideas for better supporting the crop science community and the next generation of plant breeders. I am immensely grateful to the early career community for welcoming me and for engaging so enthusiastically and openly.

My time as a Bayer Visiting Scholar at the UMN Plant



Breeding Center came at an important time for my family and I. We arrived in unusually warm summer-like temperatures and received an equally warm Minnesota welcome from the plant breeding community, which lifted and enriched us all.

In addition to plant breeding-related activities, we enjoyed cycling across the Stone Arch Bridge, exploring

the Twin Cities, experiencing UMN Gophers soccer and ice hockey, watching Minnesota Timberwolves basketball, enjoying the explosion of fall color, taking in the fun of pumpkin patches and seeing the early snowfall of Halloween.

Plant breeding is incredibly diverse. From hazelnuts to Honeycrisp apples, and soybeans to supercomputers, it covers many species and

a range of interconnected disciplines. It also requires people with different skills, ideas and perspectives to come together to propose, develop and apply new ideas and ways of working. More than anything, my time as a Bayer Visiting Scholar at the UMN Plant Breeding Center cemented in me more understanding and appreciation for the great diversity that plant breeding embraces. 🌱



Alison Bentley poses with UMN students and staff following her final presentation during her time as a Bayer Visiting Scholar.

JULIAN COOPER

Student Profile

Where are you from?

Chicago, Illinois

What has been your academic path, and what degree are you currently seeking?

I did my undergraduate degree in agronomy at the University of Wisconsin-Madison (2016) and then a M.S. in crop science at the University of Illinois Urbana-Champaign (2018) where my research involved quantitative genetics and plant pathology.

I am currently a third-year Ph.D. candidate in Cory Hirsch's lab, studying applications for field-based high throughput phenotyping.

What experiences led you to choose plant breeding at the University of Minnesota?

Prior to the pandemic, I was working as a research technician for USDA-ARS. While everything was shut down for COVID-19, I had a lot of time to think and realized I wanted to learn more about plant breeding and take a more active role in future research projects — which required returning for a Ph.D.

My wife and I both have family in Minneapolis, so it was all very serendipitous that I got into school here. Landing here really lends credence to the idea that everything happens for a reason.

What has been a favorite class to date?

My favorite class so far has been Data Visualization. It was the first class I took when starting my Ph.D. after being out of school for three years, and the core principles I learned have been foundational in all my research since then.

Tell us about your research and how you expect it to be used.

From a plant breeding angle, high throughput phenotyping can affect and improve every facet of the breeder's equation. Being able to screen more plants for further traits more accurately and in less time is fundamental to increasing genetic gain. In addition, as plant science continues to rely on big data generation and analysis, my research gives me practical skills to assist research groups across a wide range of

crops, traits and imaging platforms. Currently, I work with the UMN maize, wheat and barley breeding groups, as well as industry partners, to study different aspects of plant growth and disease resistance using unmanned aerial vehicles, cellphones and terrestrial rovers.

How has the formation of the Plant Breeding Center affected your research or course of study?

As much as I enjoy my research, my experience with the UMN Plant



Breeding Center has been the highlight of my graduate career. I served as the UMN Plant Breeding Center coordinator for 1½ years, from spring 2021 through fall 2023. During that time, I was directly involved with building the UMN plant breeding community.

I planned seminars, lunch and learns, journal clubs and even coordinated a study abroad course to CIMMYT. I believe the interpersonal and communication skills I developed during this time are just as important as any research ability, and I know my experience with the UMN Plant Breeding Center will be instrumental in my success after graduation.

Tell us about a challenge you've faced in your academics and how you overcame it.

The toughest class I ever took was Applied Linear Regression during my first semester at UMN. It got so bad that at one point, while I was asking the professor a question, they

suggested maybe I didn't belong in the class. But, I worked hard. I was lucky to have some smart classmates to help me learn, and I was able to pass the class. Looking back, I'm happy I put in the work and feel proud of the statistical knowledge I gained.

I'm a big proponent of Type II fun — I like things that are miserable at the time, but enjoyable in retrospect. With this mindset, even the toughest obstacle just becomes another challenge to conquer.

What is your career goal, and how did you choose it?

I plan to work in industry after graduation. I like having applied research to focus on and enjoy being given a challenge and working in teams to accomplish goals.

What is your advice to a student interested in studying plant breeding?

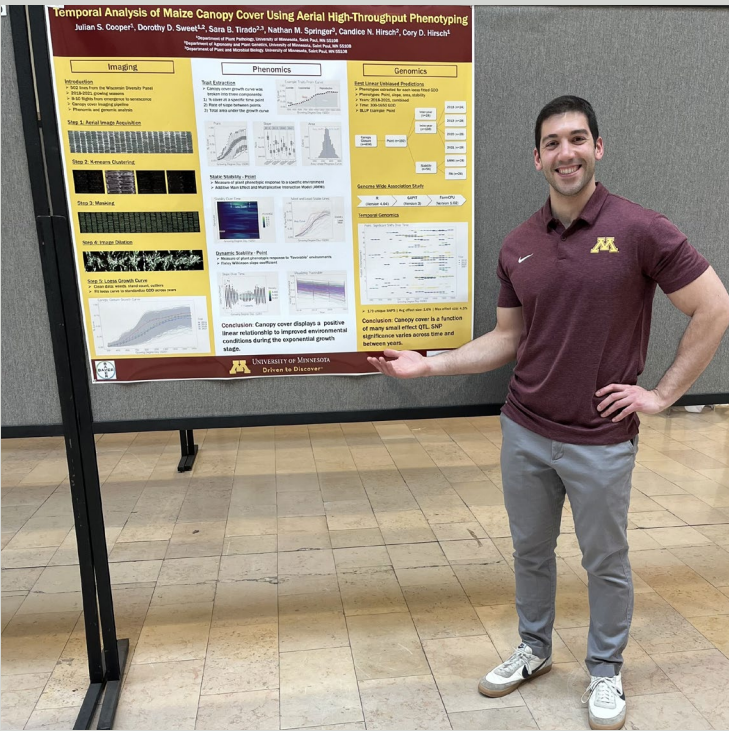
My advice to any student studying plant breeding, or any graduate students in general, is

to treat school like a professional athlete treats training — repetition is key. Just like a wide receiver might catch 10,000 balls, the more mental reps a graduate student has sharing and discussing research, the more they will grow as scientists.

Treat every seminar, visiting scholar or happy hour with colleagues as a chance to learn something new. Graduate school is a unique time when your only job is to learn, so I think students should go to everything and be as involved as possible. You never know who you might meet and what doors that might open. Remember that, "luck is what happens when preparation meets opportunity."

What's a little-known fact about you?

I am a reality television nut. I watch all the Bravo shows, such as Love Island and Bachelor in Paradise. It's the perfect antidote to a long day of work, and I love just turning my brain off and watching other people's drama for an hour. 🌿



Julian Cooper uses a terrestrial rover to study plant growth and disease resistance.

PLANT BREEDING AWARDS:

*Lifetime Award for Jim Luby,
Impact Award for Jim Anderson*

Two UMN Plant Breeding Center faculty were recognized by peers during the 2023 annual meeting of the National Association of Plant Breeders (NAPB) in Greenville, S.C., July 16-20, 2023. Jim Luby received the Lifetime Achievement Award, and Jim Anderson delivered his awardee address after receiving the Plant Breeding Impact Award in 2022.

Jim Luby will deliver his awardee address during the next NAPB annual meeting to be held July 21-25, 2024, in Saint Louis, Mo.).

Congratulations, Jim and Jim!



Jim Luby received the 2023 Lifetime Achievement Award from NAPB for his outstanding contributions in cultivar development, plant breeding research, undergraduate and graduate education and advising, and leadership in the horticultural plant breeding community during his stellar 41-year career.

Since 1982, Jim has led a highly productive breeding and genetics program that has developed 31 cultivars of apple, grape, blueberry, strawberry, raspberry, pear and plum. Jim and his colleague, David Bedford, have introduced several important apple cultivars, including Honeycrisp, SweeTango®, and Rave®/First Kiss®. Honeycrisp apple was designated the Minnesota state fruit in 2006 and

has become the number three apple cultivar in the U.S.

Jim's research contributions are documented in 151 peer-reviewed journal publications, seven book chapters and 34 refereed conference proceedings. He has advised 14 Ph.D. students and 12 M.S. students, supervised six postdoctorate scientists, and served on more than 170 graduate committees. Jim participated in several plant germplasm collecting expeditions, and he is credited as a contributor of 1,725 accessions of fruit and nut species to the National Plant Germplasm System.

Jim's contributions and accomplishments have not gone unnoticed. His previous awards include: International Fruit Tree Association Outstanding Researcher Award, 2023; American Society for Horticultural Science (ASHS) Career Award for Outstanding Graduate Educator, 2020; University of Minnesota Impact Innovation Award (with David Bedford), 2019; ASHS Career Award for Outstanding Researcher, 2014; American Pomological Society Wilder Medal for outstanding contributions to fruit breeding, 2008; ASHS Outstanding Fruit Cultivar Award for Honeycrisp apple, 2007; and ASHS Fellow, 2002.



Jim Anderson received the 2022 Public Plant Breeding Impact Award from NAPB primarily for his work in breeding wheat cultivars resistant to Fusarium head blight (FHB). To date, Jim has developed 19 wheat cultivars, co-developed eight wheat cultivars and bred the world's first Kernza cultivar, 'MN-Clearwater.'

When Jim was hired at Minnesota in 1998, FHB pandemics were reducing the wheat acreage in the state. Acreage decreased from 2.8 million acres in 1992 to 1.7 million acres in 2004, but, thankfully, has stabilized at 1.5 million acres since 2004. This stabilization was due in part to the FHB resistance that Jim has bred into all his new releases, including 'Rollag' and 'Lang-MN' that have the best available resistance of any cultivar in the region. Since 2016, Jim's cultivars have been grown on 43% of the Minnesota wheat acreage. Three of his recent releases, 'Linkert,' 'MN-Washburn,' and 'MN-Torgy,' are the only cultivars in the region known to have resistance to the

highly virulent Ug99 family of stem rust races that have been devastating to wheat in Africa.

Jim's research contributions are documented in 180 journal publications and 69 invited presentations. He has mentored more than 40 graduate students, postdoctorates and visiting scientists. His Waldron et al. (1999) publication was the first report worldwide of the association of DNA markers with FHB resistance. Along with the Sub1 QTL for submergence tolerance in rice, the Fhb1 QTL that Jim and his colleagues discovered is probably the most widely introgressed QTL allele in any crop in the world. 🌾



Graduate students receive GDM SEEDS TRAVEL GRANTS

The UMN Plant Breeding Center thanks GDM Seeds for generously providing funds for a new travel grant program for graduate students!

GDM Seeds, which is a soybean market leader in South America and is making inroads into the U.S. market, celebrated its 40th anniversary in 2022. This travel grant program was started as part of the company's anniversary celebration, and it seeks to build and strengthen the relationship between GDM Seeds and the University of Minnesota.

The following M.S. and Ph.D. students each received \$1,000 in travel grant funding in 2023:

- Joshua Havill and Hannah Stoll, Plant and Animal Genome Conference (San Diego, Calif., January 13-18, 2023)
- Alyssa Headley and Emily Moore, American Society of Horticultural Science (ASHS) Annual Conference (Orlando, Fla., July 31-August 4, 2023)
- Kabita Poudel, National Association of Plant Breeders Annual Meeting (Greenville, S.C., July 16-20, 2023)
- Renzo Negrini, Lucas Roberts and Muyideen Yusuf, Crop Science Society of America Annual Meeting (Saint Louis, Mo., October 29-November 1, 2023)

“ The American Society for Horticultural Science conference was a great success in helping build professional connections, as well as being able to present to a group of both academic and industry professionals!

I also enjoyed getting to know the other graduate students in attendance and learning about their research during their presentations. I was able to participate in trivia night with Jesse, Research Site Coordinator at GDM in Hutchinson, Minn., and it was a lot of fun! To finish off the conference, I attended a tour about new trends in the ornamental industry.

Thank you again to GDM Seeds for supporting my academic achievements. ”

—Alyssa Headley



Alyssa Headley presents at the 2023 American Society of Horticultural Science Annual Meeting.

To complement the travel grant program, GDM Seeds hosted a site visit at their Hutchinson, Minn., research station September 18, 2023. The eight travel grant recipients, along with six other graduate students affiliated with the UMN Plant Breeding Center, met with GDM Seeds personnel and learned about the company's soybean breeding work.

As indicated in comments from Alyssa Headley and Emily Moore, who both attended the ASHS conference, presenting research results at scientific meetings is an invaluable part of the graduate student experience.

We're extremely pleased that the GDM Seeds Travel Grant program will continue in 2024. 🌱

“ I really enjoy participating in conferences like ASHS because everyone is there to share their science and collaborate with others. This was my second time presenting at ASHS and I felt so at home surrounded by other plant enthusiasts like myself.

Being able to share my work with others is extremely important so others are aware of the amazing advances we're making in rose breeding. I also love to see what others are doing, especially in crops that I don't have much experience with or exposure to up in Minnesota.

I look forward to building my network of contacts and friends as my career continues! ”

—Emily Moore



Emily Moore attended the 2023 American Society of Horticultural Science Annual Meeting in Orlando, Fla., thanks in part to the GDM Seeds Travel Grant program.

ADDIE THOMPSON

Alumna Profile

What's your current job, and what do you do?

I'm currently an assistant professor at Michigan State University in the department of Plant, Soil and Microbial Sciences. I lead a research lab and advise staff, students and postdoctorates. I also teach courses, including the first semester of graduate plant breeding, and the second semester of a series in computational and plant sciences.

The overarching focus of my program has been improving the efficiency of plant breeding via gene discovery for agronomic traits through quantitative genetics and applications of field phenomics. I work mostly on maize, though we frequently complement that work with sorghum, or even other crop species, when relevant.

Where are you from, what was your academic path to the University of Minnesota, and what's your career path after leaving the Saint Paul campus?

I grew up in Hamburg, Iowa, a tiny town in the far southwest corner of the state.

My undergraduate training was at Iowa State University where I majored in genetics in the liberal arts college to gain broad background knowledge, though my research experiences there were all in plants. I applied to several institutions, including the University of Minnesota, for a Ph.D. in plant breeding. At that time, going straight from a B.S. to a Ph.D. was common in the basic sciences, but less so in applied and agricultural fields — thankfully, UMN was open to the idea.

After obtaining my degree at UMN with Gary Muehlbauer, I had a short postdoctorate stint with Rex

Bernardo before continuing to a longer postdoctorate with Mitch Tuinstra at Purdue University, and then starting my position at Michigan State.

What drew you to the University of Minnesota?

There were several major considerations for me. First, I liked the Applied Plant Sciences (APS) program, as it let me obtain a degree that would cover my interests in plant breeding and molecular genetics, as well as work in a group that spans the range of basic to applied sciences.

Second, I really loved the people and the culture. I now tell prospective students that the most important thing when seeking an advisor (and even potential committee members) is to find someone you feel comfortable around, and that you can easily communicate with. There were multiple potential mentors at UMN that I was excited to work with, and I could tell that different lab groups generally got along

well and worked together.

Third, my spouse (then-fiancé) was applying to graduate schools at the same time I was, so making sure to choose a location that had high-quality programs for him (in musicology) was important.

Finally, although I was initially a little nervous to live in a bigger city, we fell in love with the Saint Paul campus area and Minnesota itself. We both love the cold, to be honest. I was also fortunate to receive an initial fellowship offer that offset the slightly higher cost of living, which helped sway our decision.





Addie Thompson, former student in Applied Plant Sciences, poses with statue of Dr. Norman E. Borlaug.

As early as junior high, I applied to externally sponsored university summer camps in genetics, environmental sciences, biology, geology and so on. In high school, I participated in the World Food Prize Foundation's Global Youth Institute and ended up spending a summer in the Philippines at the International Rice Research Institute conducting research through the Borlaug-Ruan International Internship program. That experience sparked my interest in applying my passion for genetics to plant sciences and international agriculture.

Do you have any fond memories from your days in Saint Paul that you'd like to share?

One valuable and memorable aspect of my graduate experience that I didn't know to seek out in advance was the level of engagement and closeness of the cohort of graduate students at the time in the APS club. I made many lifelong friends and forged a solid network of connections that persist today.

Unexpectedly, my time in graduate school was perhaps the most socially active part of my life so far. I attribute at least part of this to the large, shared office spaces we worked in daily next to students from multiple diverse labs. One of my favorite social activities in the shared office was "grilled cheese Tuesdays," when we would use one of the club's electric griddles to make grilled cheese sandwiches for lunch for anyone who stopped by. Sometimes people would even bring unique ingredients or side dishes, like a mini-potluck, so it was a great way to get to know everyone beyond their science.

Which people, courses or experiences most influenced you while you were at the University of Minnesota? How?

My advisor and committee arguably influenced me the most during my time there, along with my fellow graduate student cohort.

Beyond that, as someone working on maize in a lab primarily focused on barley, I appreciated having field space adjacent to Nathan Springer's program, as he and his group helped with field management and taught me how to do pollinations. My research project was part of a national-scale collaboration, and I benefited tremendously from interacting with all the other leaders and participants outside of our institution. Similarly, I met some incredibly smart and friendly people by attending the Maize Genetics Meeting each year.

Ultimately, it was those experiences that made me want to stay in the maize genetics

research community for life, despite initially joining Gary Muehlbauer's lab to avoid corn!

What are some of the things you enjoy most about your current job?

My research is exciting, and I love it when I get to analyze data (or teach others to do so), but my very favorite part of my job is definitely the people: mentoring and advising graduate students; working with undergraduate student researchers; reaching out to farmers, teachers and youth; and engaging with diverse collaborators. I say diverse collaborators because I have many interdisciplinary projects that let me work with people like engineers and computer scientists, and I love the feeling of thinking about complex problems from new perspectives.

Having good leadership in your unit is also important. You want to feel a sense of belonging, and to feel supported and appreciated in what you do. I also keep a drawer in my

desk for letters and cards from mentees, to remind myself of the impact I'm having!

What are some things you find difficult in your current job?

We don't explicitly train people to do many of the aspects of an academic position, and a significant portion of the job is akin to running a small business. That includes juggling financial accounts, doing paperwork, navigating frustrating bureaucracy at times and managing personnel.

Because my position comes with no hard funding other than nine months of my salary, I've had to adjust to the low-level persistent dread of what would happen if I'm ever unable to fund my staff if grant money runs out, since that would impact multiple peoples' livelihoods. I've gotten used to this, and I enjoy writing grants.

I also appreciate that I have the power to decide what to work on, what grants to apply for and what collaborators to work with, so that I still feel somewhat in control

and am not beholden to any overarching directions, priorities or funding limits.

The other challenge is that my to-do list is never done — there is always more work that could be done and not enough time to complete it all, so you really have to implement your own balance.

Any suggestions for maintaining a good work-life balance?

This is going to be different and have a unique solution for everyone, so there is no magic answer I can give other than to say that YOU DO HAVE the power to set this — you can, and should, decide what this looks





like for you, and not let anyone tell you that your way is wrong.

It is particularly important in academia, where you are welcome (if not encouraged) to dedicate your whole life to work, and you are largely your own boss, so no one else at your job is going to enforce this for you.

For me, what helps is to have something tugging in the other direction. In other words, what

aspects of your life are as important to you as your work? Family? Friends? Hobbies? Faith? If you have other people, activities or responsibilities that you are passionate about, it becomes easier to prioritize your time more evenly between these different aspects.

Time is your most valuable resource, so you should spend

it in ways that will ultimately make you happy.

What advice would you give to our current M.S. and Ph.D. students?

I will pass along one of the pieces of advice that my committee gave me as a graduate student, and that was to practice “talking science.” I, like many other students, struggled with how to have

casual conversations about research. I had practiced both formal presentations on my work, as well as public-level non-scientist communication skills; however, partway through my Ph.D., it became apparent that I was not good at communicating informally with other scientists.

Attending conferences can help, but only if you push yourself to engage in conversations outside of the talks. Departmental social events can also help, because you can practice this by telling other professors about the research going on in your lab and ask about theirs. And, ask lots of questions! As an introvert, I know this is very hard. For me, it helped most to develop close scientist friendships, both within and outside of the university, and to start with one-on-one or small group discussions to become more comfortable and confident with these skills. This is also one of the reasons that journal discussion/seminar courses are important for graduate students.

Can you share with us a little-known fact about yourself?

I have always been very musically and artistically inclined, or at least highly involved. I play piano and flute, sing, and have conducted multiple church choirs over the past couple decades, including handbells during my time in Minnesota. In fact, Rex Bernardo once played acoustic guitar with one of the handbell pieces, which was particularly memorable (he’s incredible!).

I recently had the privilege of returning to Minnesota for a visit, and I dropped in on a service when the bell choir was playing. The feeling of seeing some of the people I had trained as children, now already playing challenging parts as adults, was indescribably rewarding. I cannot wait to witness that same type of growth and success with my former, current and future research mentees as well! 🎵

Announcing the **2024 SUMMER INSTITUTE IN PLANT BREEDING**

The 2024 Summer Institute in Plant Breeding will be held June 10-14, 2024, at the University of Minnesota. This continuing education event, which will be held in person, will offer the following six 2½-day modules (instructors in parentheses):

- Plant Breeding 101 (Jim Anderson, UMN)
- Mixed-Model Analysis in Plant Breeding (Lucia Gutierrez, University of Wisconsin-Madison)
- Professional Skills for Scientists (Rex Bernardo, UMN)
- Polyploid Genomics (Laura Shannon, UMN)
- Participatory Plant Breeding (Julie Dawson, University of Wisconsin-Madison)
- Data Bootcamp for Genomic Prediction in Plant Breeding (Aaron Lorenz, UMN)

Visit the [event webpage](#) for information on costs, course details and registration.



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