Sustainable Crop Production for Resilient Canadian Agriculture

Canadian Society for Horticultural Science & Canadian Society of Agronomy 2025 Joint-Society Conference

June 23-26, 2025

UBC Okanagan, Kelowna, British Columbia, Canada

unceded and traditional territory of the Syilx Okanagan peoples

Canadian Society of Agronomy
La Société Canadienne d'Agronomie

Schedule Overview

Monday, June 23, 2025		
Time	*Description*	*Location at UBC – Okanagan*
08:00 AM	**Local Tour of the Okanagan Valley** (8 hours)	Buses from/to Parking Lot F
03:00 PM	Conference Registration | Poster & Exhibitor Setup	EME Mezzanine
05:00 PM	Welcome Reception & Mixer	ADM 121 Sunroom

Tuesday, June 24, 2025		
Time	*Description*	*Location at UBC – Okanagan*
08:00 AM	Conference Registration | Poster & Exhibitor Setup	EME Mezzanine
08:30 AM	**Plenary Session**	COM 201 Lecture Theatre
Keynote Speakers - Dr. Joann Whalen, McGill University & Dr. Steve Shirtliffe, University of Saskatchewan		
10:30 AM	Morning Break	EME Mezzanine
11:00 AM	**Concurrent Sessions**	
1.1: Soil BMPs in agricultural systems		EME 0050 Lecture Theatre
1.2: System resilience in horticultural crops		EME 1121 Classroom
1.3: Sustainable production of high-value berry crops		EME 1202 Classroom
1.4: Mitigating abiotic and biotic stress via novel crop mgmt.		EME 2111 Classroom
12:00 PM	Lunch	ADM 121 Sunroom
12:00 PM	CSA Executive Meeting | Bring Your Lunch	EME 2111 Classroom
01:30 PM	**Concurrent Sessions**	
2.1: Agricultural sustainability		EME 0050 Lecture Theatre
2.2: Genetics and breeding in wheat and cereal crops		EME 1121 Classroom
2.3: Expanding trait innovation from genome to phenome		EME 1202 Classroom
2.4: Soil BMPs in agricultural systems		EME 2111 Classroom
03:00 PM	Afternoon Break	EME Mezzanine
03:30 PM	**Poster Session**	EME Mezzanine
06:00 PM	**Students Only Social Event**	Nechako Residence Common Room

Wednesday, June 25, 2025		
Time	*Description*	*Location at UBC – Okanagan*
08:00 AM	Conference Registration	EME Mezzanine
08:30 AM	**Plenary Session**	COM 201 Lecture Theatre
Keynote Speaker - Dr. Dominique Michaud, Laval University Plenary Speakers - Dr. Marco Todesco, UBC & Dr. Davoud Torkamaneh, Laval University		
10:30 AM	Morning Break	EME Mezzanine
11:00 AM	**Concurrent Sessions**	
3.1: Crop adaptation for system resilience		EME 1101 Classroom
3.2: System Expanding trait innovation from genome to phenome		EME 2111 Classroom
3.3: Overcoming environmental stress in horticulture production		EME 2181 Classroom
3.4: Optimizing nutrient inputs and cycling in crop production		EME 1151 Classroom
12:00 PM	Lunch	ADM 121 Sunroom

Wednesday, June 25, 2025		
Time	*Description*	*Location at UBC – Okanagan*
01:30 PM	**Concurrent Sessions**	
4.1: Expanding trait innovation from genome to phenome		EME 2111 Classroom
4.2: CSA Annual General Meeting		EME 1101 Classroom
4.3: CSHS Annual General Meeting		EME 2181 Classroom
03:00 PM	Afternoon Break	EME Mezzanine
03:30 PM	**Concurrent Sessions**	
5.1: Crop and nutrient management		EME 1101 Classroom
5.2: Horticultural crop resilience to stressors		EME 2111 Classroom
5.3: Genetics and breeding in oilseeds and pulse crops		EME 2181 Classroom
5.4: Digital Agriculture: Tools for Tomorrow's Agriculture		EME 1151 Classroom
06:30 PM	**Gala Dinner & Awards**	Buses from/to Parking Lot F

Thursday, June 26, 2025		
Time	*Description*	*Location at UBC Okanagan*
08:00 AM	Workshop Registration	EME Mezzanine
08:30 AM	**Plenary Session**	COM 201 Lecture Theatre
Panel Discussion - Agricultural Sustainability & Resilience		
10:00 AM	Morning Break	EME Mezzanine
10:30 AM	**Concurrent Sessions**	
6.1: Workshop - BC Living Laboratories		EME 1121 Classroom
6.2: Workshop - Ag Extension Networking		EME 2111 Classroom
6.3: Workshop - Building Organic Science for Impact		EME 1202 Classroom
12:00 PM	Poster & Exhibitor Takedown | End Conference	EME Mezzanine

Welcome

Message from the Conference Chairs

Dear Colleagues,

It is a great pleasure to welcome you to this conference hosted jointly by the Canadian Society for Horticultural Science and Canadian Society of Agronomy.

We are gathered here in Kelowna at the University of British Columbia Okanagan Campus, located on the traditional, ancestral, and unceded territory of the Syilx (Okanagan) Peoples. We are in the heart of the Okanagan Valley—one of the most diverse and dynamic agricultural regions in British Columbia and Canada. This venue is truly fitting for a conference focused on *Sustainable Crop Production for Resilient Canadian Agriculture*.

We are delighted to host more than 200 participants and grateful for the support of over 20 sponsors representing the agricultural, research and development, and education sectors. Your engagement highlights the collective commitment to building a more sustainable and resilient future for Canadian agriculture.

Sustainability is not just the theme of this conference—it is a daily commitment for farmers and researchers alike, particularly here in Canada, where innovation and stewardship are essential for long-term agricultural success.

The program reflects the breadth and depth of Canadian agricultural science, with three plenary sessions, 20 concurrent sessions, and three interactive workshops.

Canada's agricultural sector is foundational to our food systems, economy, and communities. Research and innovation are essential tools to address the growing challenges of climate change, food security, and sustainability.

Thank you for being here—and for your dedication to advancing science in service of Canadian agriculture. I would also like to extend my gratitude to everyone who has volunteered to make this conference a success.

Sincerely,

Dr. Simone Castellarin
Western Representative, Canadian Society for Horticultural Science
Co-Chair, CSHS &CSA 2025 Joint-Society Conference

Dear Colleagues,

On behalf of the Canadian Society of Agronomy (CSA), and as Co-Chair of the CSHS & CSA 2025 Joint-Society Conference, it is my great pleasure to welcome you to this year's conference, held in Kelowna, BC, Canada, June 23-26, 2025.

This joint meeting provides a unique platform to foster interdisciplinary collaboration among agronomists, horticulturists, and agricultural stakeholders. The conference theme, "Sustainable crop production for resilient Canadian agriculture", reflects our shared commitment to advancing sustainable and resilient food systems across Canada. We are proud to offer a diverse and engaging program featuring keynote speakers, panel discussions, and workshops designed to facilitate knowledge exchange and inspire innovation. I encourage all participants to take full advantage of the program, connect with colleagues, and explore new avenues for collaboration.

I extend my sincere appreciations to all presenters, organizers, and volunteers for their contributions. I am especially grateful to our colleagues at CSHS for their partnership and dedication. I also gratefully acknowledge our sponsors for their generous support in helping deliver an enriching and memorable conference experience.

Thank you for being part of the 2025 CSHS-CSA joint meeting. I wish you a productive and rewarding experience and hope you enjoy your time in beautiful Kelowna.

Sincerely,

Dr. Kui Liu
President, Canadian Society of Agronomy
Co-Chair, CSHS & CSA 2025 Joint-Society Conference

CSHS & CSA 2025 Joint-Society Conference Committee

Simone Castellarin	Conference Co-Chair, Coordinating Committee, Local Committee, Panel Chair
Kui Liu	Conference Co-Chair, Coordinating Committee, Scientific Committee, Session Chair
Beatrice Amyotte	Coordinating Committee, Scientific Committee, Session Chair
Harpinder Randhawa	Coordinating Committee, Scientific Committee, Awards Committee, Session Chair
Bourlaye Fofana	Coordinating Committee, Scientific Committee
Kathleen Glover	Coordinating Committee
Melanie Kalischuk	Sponsorship Committee, Scientific Committee, Session Chair
Jagroop Gill Kahlon	Sponsorship Committee, Workshop Chair
Lauren Erland	Sponsorship Committee
Kirsten Hannam	Local Committee, Tour Host, Workshop Chair, Session Chair
Letitia Da Ros	Local Committee, Tour Host, Session Chair
Mehdi Sharifi	Local Committee, Tour Host, Session Chair
Hao Xu	Local Committee, Session Chair
Louise Nelson	Local Committee
Susan Murch	Local Committee
Ruth King	Local Committee
Jonathan Neilson	Local Committee
Ben Thomas	Local Committee
Gurcharn Singh Brar	Scientific Committee, Session Chair
Ian Willick	Scientific Committee, Session Chair
Jazeem Wahab	Scientific Committee, Session Chair
Joshua Nasielski	Scientific Committee, Session Chair
Laura Van Eerd	Scientific Committee, Session Chair
Linda Gorim	Scientific Committee, Session Chair
Lord Abbey	Scientific Committee, Session Chair
Youbin Zheng	Scientific Committee, Session Chair
Champa Wijekoon	Scientific Committee
Andrew Hammermeister	Workshop Chair, Session Chair
Adrian Correndo	Session Chair
Aitazaz Farooque	Session Chair
Bao-Luo Ma	Session Chair
Yunfei Jiang	Session Chair
Vasantha Rupasinghe	Awards Committee
Claudia Baldassi	Student Representative, Local Committee
Jeremy Irvine	Student Representative
John Hubensky	Student Representative
Shahrokh Khanizadeh	Webmaster

Sponsors

GOLD SPONSORS

GOLD SPONSORS

TerraLink®

SILVER SPONSORS

ACCELERATE OKANAGAN

SFU B.C. CENTRE FOR Agritech Innovation

UNIVERSITY OF GUELPH | Department of Plant Agriculture, Ontario Agricultural College

Canadian Journal of Plant Science

Genome BritishColumbia

Genomics positively impacts life, every day.

SILVER SPONSORS

SILVER SPONSORS

elementar
EXCELLENCE IN ELEMENTS

BRONZE SPONSORS

UNIVERSITY OF THE FRASER VALLEY
RESEARCH AND GRADUATE STUDIES

ESBE Scientific

IN-KIND SPONSORS

TOURISM KELOWNA

CROP DEVELOPMENT CENTRE
USASK

THE UNIVERSITY OF BRITISH COLUMBIA
Irving K. Barber Faculty of Science
Okanagan Campus

UNIVERSITY OF THE FRASER VALLEY
RESEARCH AND GRADUATE STUDIES

THE UNIVERSITY OF BRITISH COLUMBIA
Faculty of Land and Food Systems

DALHOUSIE UNIVERSITY

Nutrien®
Feeding the Future™

CSA GRADUATE STUDENT PRESENTATION AWARD SPONSORS

Detailed Schedule

Monday, June 23, 2025		
Time	***Description***	***Location at UBC – Okanagan***
08:00 AM- 05:00 PM	**Local Tour of the Okanagan Valley** -Jealous Fruits Packing Facility Tour -Kalala Vineyards Lunch & Learn -AAFC Summerland Open House	Buses depart from and return to Parking Lot F| Hosts Drs. Letitia Da Ros, Kirsten Hannam, Mehdi Sharifi
03:00 PM	Conference Registration | Poster & Exhibitor Setup	EME Mezzanine
05:00 PM	Welcome Reception & Mixer	ADM 121 Sunroom

Tuesday, June 24, 2025		
Time	***Description***	***Location at UBC – Okanagan***
08:00 AM	Conference Registration | Poster & Exhibitor Setup	EME Mezzanine
Plenary Session		COM 201 Lecture Theatre
08:30 AM	Opening Remarks - Drs. Simone Castellarin & Kui Liu, Conference Chairs	
08:40 AM	Welcome Address - Dr. Rehan Sadiq, UBC Provost and Vice-President Academic	
08:50 AM	Welcome Address - Dr. Rachid El Hafid, AAFC Director & Horticulture Portfolio Lead	
09:00 AM	**Keynote Speaker - Dr. Joann Whalen, McGill University** A soil-centric approach to sustaining resilient agriculture in Canada	
09:45 AM	**Keynote Speaker - Dr. Steve Shirtliffe, University of Saskatchewan** Digital agriculture tools for agronomy and crop science	
10:30 AM- 11:00 AM	Morning Break *Sponsored by UBC Irving K Barber Faculty of Science*	EME Mezzanine
Concurrent Session 1.1 **Soil BMPs in agricultural systems | Chair Dr. L. Van Eerd**		EME 0050 Lecture Theatre
11:00 AM	CSA Invited Speaker - Kimberley Schneider, U Guelph| The role of grazing livestock in supporting sustainable soil management: Examples from Ontario	
11:30 AM	CSA Speaker - Thierry Fonville, Farming Smarter| Saving Soils: Improving soils through fall-seeded cash and cover cropping	
11:45 AM	CSA Speaker - Wendy Allan, Elementar Americas| Advancing agricultural testing with combustion analysis: Enhancing precision in soil and plant nutrient measurement	
Concurrent Session 1.2 **System resilience in horticultural crops | Chairs Drs. K. Hannam & A. Hammermeister**		EME 1121 Classroom
11:00 AM	CSHS Chair - Andrew Hammermeister, Dalhousie U| The Organic Science Cluster: Exploring the outcomes of organic crop production science	
11:10 AM	CSHS Invited Speaker - Lauren Erland, U Fraser Valley| Predicted impacts of future climate scenarios on commercial cranberry (*Vaccinium macrocarpon* Ait.) production systems	
11:30 AM	CSHS Chair - Kirsten Hannam, AAFC| Irrigation for climate resilience in tree fruit: lessons from the Summerland RDC	
11:40 AM	**CSHS Student* - Jared Brown, UBC| Prioritizing beneficial management practices in tree fruit horticulture for detailed life cycle assessment	
11:50 AM	Pest Management Award Talk - Hannah Friesen, AAFC| The effects of management and vegetation complexity on ground-dwelling spiders in vineyards	

Tuesday, June 24, 2025 – cont'd		
Time	***Description***	***Location at UBC – Okanagan***
Concurrent Session 1.3		EME 1202 Classroom
Sustainable production of high-value berry crops | Chairs Drs. I. Willick & Y. Zheng		
11:00 AM	CSHS Chair - Youbin Zheng, U Guelph| Controlled environment strawberry production: Current status, challenges and opportunities	
11:15 AM	CSHS Chair - Ian Willick, AAFC| Silicon amendments may improve wine grape tolerance to dehydration and insect damage through physio-chemical modifications to leaves	
11:30 AM	CSHS Speaker - Laila Benkrima, Simon Fraser U| Can vertical farming contribute to climate-resilient agriculture in BC? Insights from BC Centre for Agritech Innovation (BCCAI) industry projects	
11:45 AM	CSHS Speaker - Eric M. Gerbrandt, BC Berries Research| Collaborative research initiatives for the Canadian berry sector	
Concurrent Session 1.4		EME 2111 Classroom
Mitigating abiotic and biotic stress via novel crop management | Chair Dr. Hao Xu		
11:00 AM	CSA Speaker - Tarlok Sahota, Lakehead U| Effect of fungicides on disease incidence and yield of spring cereals at Thunder Bay	
11:15 AM	**CSA Student* - Terence Simbo, U Alberta| Interaction of drought and plant growth regulators in oat varieties	
11:25 AM	**CSA Student* - Kalhari Manawasinghe, USASK| Assessing the role of canopy architecture of wheat (*Triticum aestivum* L.) for drought and heat avoidance	
11:35 AM	**CSA Student* - Will Short, USASK| Developing artificial and natural coatings for freezing avoidance in canola	
11:45 AM	**CSA Student* - Sonika Pariyar, U Alberta| Zeolite-based seed coating as a management tool against Aphanomyces root rot in field pea	
12:00 PM-01:30 PM	Lunch	ADM 121 Sunroom
12:00 PM-01:30 PM	CSA Executive Meeting – Bring Your Lunch	EME 2111 Classroom
Concurrent Session 2.1		EME 0050 Lecture Theatre
Agricultural sustainability | Chair Dr. K. Liu		
01:30 PM	CSA Invited Speaker - Maryse Bourgault, USASK| Agricultural Sustainability: What does it mean for Western Canadian agricultural producers and researchers?	
01:50 PM	CSA Chair - Kui Liu, AAFC | Diversifying rotations enhances the resilience of cropping systems	
02:00 PM	CSA Speaker - Tiequan Zhang, AAFC| Agronomic performance of long-term integrated conservation management practices under a corn-soybean rotation in Lake Erie Basin	
02:10 PM	CSA Speaker - Mohammad Khakbazan, AAFC| Profitability of specialty crops in diversified crop rotations in the semi-arid Canadian Prairies	
02:20 PM	CSA Speaker - Jamie Larsen, AAFC| Prospects for double cropping soybeans in Ontario: The impact of maturity genotype on soybean agronomic traits	
02:30 PM	**CSA Student* - Prerana Upretee, USASK| Assessing seed characteristics of lentils for successful late fall seeding	
02:40 PM	**CSA Student* - Jeremiah Odiketa, USASK| Effect of cover cropping on subsequent wheat and canola production in semi-arid Western Canada	
02:50 PM	**CSA Student* - Shaily Tandekar, USASK| Compatibility of cicer milkvetch with alfalfa: germination response, establishment success, and yield across Western Canada	

Tuesday, June 24, 2025 – cont'd		
Time	***Description***	***Location at UBC – Okanagan***
Concurrent Session 2.2		EME 1121 Classroom
Genetics and breeding in wheat and cereal crops | Chairs Drs. G. Singh Brar & H. Randhawa		
01:30 PM	CSA Invited Speaker - Daniel Rodriguez, U Queensland | The plasticity of root traits and their effects on crop yield and yield stability	
01:50 PM	CSA Chair - Gurcharn Singh Brar, U Alberta| Utilizing Watkins wheat landrace diversity in Canadian hard red spring wheat breeding	
02:00 PM	CSA Chair - Harpinder Randhawa, AAFC| Integrating statistical and machine learning models to uncover genetic architecture of leaf spot resistance in wheat	
02:10 PM	CSA Speaker - Andrew Burt, AAFC| Dissecting wheat yield stability: QTL mapping and G×E Interaction in spring wheat across diverse Canadian environments	
02:20 PM	CSA Speaker - Douglas Cattani, U Manitoba| Flowering in intermediate wheatgrass: Flowering components and controls, and does flowering limit seed production as stands age?	
02:30 PM	**CSA Student* - Suman Bagale, U Alberta| The impact of breeding selection on cereal root traits over time	
02:40 PM	**CSA Student* - Purnima Kandpal, McGill U| Short Interspersed Nuclear Element: Potential marker for screening wheat germplasm against pre-harvest sprouting	
02:50 PM	**CSA Student* - John Adam Hubensky, U Alberta| High spikelet number gene in wild wheat, *Aegilops tauschii*, delays flowering time and may be controlled by a protein with sucrolytic activity	
Concurrent Session 2.3		EME 1202 Classroom
Expanding trait innovation from genome to phenome | Chair Dr. L. Da Ros		
01:30 PM	CSHS Invited Speaker - Anze Svara, USASK| Malus genomic resources for trait and candidate gene discovery	
01:50 PM	CSHS Chair - Letitia Da Ros, AAFC| Refining of reference genome assemblies in sweet cherry	
02:00 PM	CSHS Speaker - Mathias Schuetz, Kwantlen Polytech| Development a dedicated Hop (*Humulus lupulus*) genotyping platform to accelerate new Hop variety development	
02:10 PM	CSHS Speaker - Marzieh Jafari, U Guelph| Ploidy engineering in *Cannabis sativa*	
02:20 PM	CSHS Speaker - Zoë Migicovsky, Acadia U| Genome-wide association studies identify predictive markers for fruit quality in apple	
02:30 PM	**CSHS Student* - Claudia Baldassi, UBC| Genome-wide association studies to unravel the control of fruit color and anthocyanin content in red raspberry	
02:40 PM	**CSHS Student* - Miriam Z. Fenniri, UBC| Chemically profiling the mysterious colour polymorphism in salmonberries (*Rubus spectabilis* Pursh.)	
02:50 PM	CSHS Speaker - Masoumeh Bejaei, AAFC| Optimizing apple juiciness measurement: Instrumental methods aligned with sensory perception	

Tuesday, June 24, 2025 – cont'd		
Time	***Description***	***Location at UBC – Okanagan***
Concurrent Session 2.4 **Soil BMPs in agricultural systems | Chair Dr. Y. Jiang**		EME 2111 Classroom
01:30 PM	CSA Chair - Yunfei Jiang, Dalhousie U| Effect of enhanced efficiency nitrogen fertilizers on the agronomic and environmental performance of grain corn	
01:40 PM	CSA Speaker - Yajun Peng, U Guelph| Assessing long-term cover cropping effect on in-season nitrogen status of soil and grain corn	
01:50 PM	CSA Speaker - Pramod Rathor, U Alberta| Humalite enhances soil nitrogen supply and promotes plant nutrient uptake and assimilation leading to improved yield and oil content in canola	
02:00 PM	CSA Speaker - Noura Ziadi, AAFC| Impacts of BMPs on crop yield and soil nutrients availability: Results from a long-term site	
02:10 PM	**CSA Student* - Charlotte Potter, U Guelph| Envisioning change for BMP adoption in Ontario's potato sector	
02:20 PM	**CSA Student* - Daphnée Ferland, USASK| Improved nitrogen fertilizer management reduces nitrous oxide emissions in a northern Prairie cropland	
02:30 PM	**CSA Student* - Harini Aiyer, UBC| Mechanistic analysis of microbe-mediated storage of root derived carbon in response to defoliation	
02:40 PM	**CSA Student* - Kathryn Rose Beukeboom, U Guelph| Response to varying phosphorus application in an Ontario perennial forage stand	
02:50 PM	**CSA Student* - Boran Liu U. Alberta| Nitrification inhibitor affects greenhouse gas emissions in Western Canadian barley cropping systems	
03:00 PM- 03:30 PM	Afternoon Break *Sponsored by TerraLink Horticulture*	EME Mezzanine
03:30 PM- 06:00 PM	**Poster Session – All Poster Presenters**	EME Mezzanine
06:00 PM- 07:30 PM	**Students Only Social Event** *Games, Prizes, Cash Bar & Small Bites Served*	Nechako Residence Common Room | Hosts C. Baldassi, J. Irvine, J. Hubensky

Wednesday, June 25, 2025		
Time	***Description***	***Location at UBC – Okanagan***
08:00 AM	Conference Registration	EME Mezzanine
Plenary Session		COM 201 Lecture Theatre
08:30 AM	Welcome & Housekeeping - Drs. Simone Castellarin & Kui Liu, Conference Chairs	
08:45 AM	**Keynote Speaker - Dr. Dominique Michaud, Laval University** Plant cystatins as molecular triggers of drought resilience and tuber yield in potato	
09:30 AM	**Plenary Speaker - Dr. Marco Todesco, UBC** Per Aspera Ad Aster: The promises of using wild relatives (and genomics) to improve cultivated sunflower	
10:00 AM	**Plenary Speaker - Dr. Davoud Torkamaneh, Laval University** Not Just a High—A higher understanding of Cannabis through multi-omics	
10:30 AM- 11:00 AM	Morning Break *Sponsored by Western Grains Research Foundation*	EME Mezzanine

Wednesday, June 25, 2025 – cont'd		
Time	***Description***	***Location at UBC – Okanagan***
Concurrent Session 3.1		EME 1101 Classroom
Crop adaptation for system resilience | Chair Dr. B-L Ma		
11:00 AM	CSA Invited Speaker - Fernanda Dreccer, CISRO Australia | Opportunities for adaptation strategies for wheat and chickpea in Australia	
11:20 AM	CSA Speaker - Kui Liu, AAFC | Early seeding boosts organic wheat production in the semi-arid Canadian prairies	
11:30 AM	CSA Speaker - Momna Farzand, Lakehead Ag Research Assn. | Evaluation of spring seeded winter cereals as a drought mitigation strategy	
11:40 AM	CSA Speaker - Roshan Pudasaini, U Guelph | Potential of short duration millets as a post-winter wheat crop in Ontario, Canada	
11:50 AM	CSA Speaker - Momna Farzand, Lakehead Ag Research Assn. | Performance evaluation of two-row and six-row forage barley mixtures	
Concurrent Session 3.2		EME 2111 Classroom
System Expanding trait innovation from genome to phenome | Chair Dr. B. Amyotte		
11:00 AM	Local Invited Speaker - Chase Mason, UBC | Breeding pool and market class differentiation in leaf functional traits across cultivated sunflower	
11:20 AM	**CSHS Student* - Vincent Fetterley, UBC | Development of an image-based phenotyping pipeline for stem anatomy and fiber characteristics in *Cannabis sativa*	
11:30 AM	**CSHS Student* - Malin Peterson, UBC | Deciphering terpenoid biosynthesis in grapevine: A multi-omics approach	
11:40 AM	CSHS Speaker - H.P. Vasantha Rupasinghe, Dalhousie U | Development of functional food ingredients from wild blueberries for metabolic disease management	
11:50 AM	CSHS Speaker - Bourlaye Fofana, AAFC | Genome-wide association mapping for common scab (*Streptomyces scabies* L.) resistance in diploid potatoes	
Concurrent Session 3.3		EME 2181 Classroom
Overcoming environmental stress in horticulture production | Chairs Drs. J. Wahab & L. Abbey		
11:00 AM	CSHS Chair - Jazeem Wahab, AAFC | Dry onion cultivars for irrigated production in Saskatchewan	
11:10 AM	CSHS Chair - Lord Abbey, Dalhousie U | Mugwort response to growing temperature	
11:20 AM	**CSHS Student* - Nikolas Wilson, UBC | Photosynthetic responses to heat stress by grapevine *(Vitis vinifera* L.) varieties grown in British Columbia	
11:30 AM	**CSHS Student* - Sarah Davis, UBC | Responses of grapevine (*Vitis vinifera* L.) to heat and drought: Vine physiology and grape aroma	
11:40 AM	**CSHS Student* - Steven Tyler Bristow, UBC | From Blight to Bright: Understanding water needs of EFB-resistant hazelnuts in British Columbia	
11:50 AM	**CSHS Student* - Ifesinachi Ezeh, U Guelph | Robot vs. Tractor: Weed management in beet and carrot fields in organic and mineral soils	
Concurrent Session 3.4		EME 1151 Classroom
Optimizing nutrient inputs and cycling in crop production | Chair Dr. J. Nasielski		
11:00 AM	CSA Chair - Joshua Nasielski, U Guelph | Economic vs. Environmental best management practices for in-season nitrogen applications in corn: a multi-environment study	
11:10 AM	CSA Speaker - Mervin St. Luce, AAFC | Impact of minor oilseed crops on productivity and nitrogen use efficiency of cropping sequences	
11:20 AM	CSA Speaker - Tarlok Sahota, Lakehead U | Response of canola to high rates of N application from different sources	
11:30 AM	CSA Speaker - Gursahib Singh, U Guelph | Nitrogen fertilization of irrigated dry bean	
11:40 AM	**CSA Student* - Tyler Cole Peterson, USASK | Identifying sod-seeding rates of legumes for rejuvenating grass pasture	
11:50 AM	**CSA Student* - Nolan Steven Johnson, U Alberta | Impacts of nitrification inhibitor eNtrench on Western Canadian barley cropping systems	

Wednesday, June 25, 2025 – cont'd		
Time	***Description***	***Location at UBC – Okanagan***
12:00 PM- 01:30 PM	Lunch	ADM 121 Sunroom
Concurrent Session 4.1 **Expanding trait innovation from genome to phenome | Chair Dr. L. Da Ros**		EME 2111 Classroom
01:30 PM	CSHS Speaker - Jack O. MacKenzie, Aurora Cannabis| Mapping and characterization of a novel powdery mildew resistance locus (PM2) in *Cannabis sativa* L.	
01:45 PM	CSHS Speaker - Jayasankar Subramanian, U Guelph| Black knot in plums: Addressing resistance using a multi-omic approach	
02:00 PM	CSHS Speaker - Mohsen Hesami, U Guelph| Overcoming recalcitrance in Cannabis somatic embryogenesis: Insights from transcriptomics toward synthetic seeds and genome editing	
02:15 PM	CSHS Speaker - Abueng Innocent Moalafi, South Africa| Preliminary study on pre-breeding and selection of high performing okra mutant population through induced mutation in South Africa	
02:30 PM	******CSHS Student* - Marco Pepe, U Guelph| Revolutionizing the production of psychoactive organisms for research and conservation	
01:30 PM- 03:00 PM	**CSA Annual General Meeting** CSA Executives; Open to current and prospective members *Includes 2024 CJPS Best Paper Award Talk* - Dr. Brian Beres, AAFC Integrating enhanced efficiency fertilizers and nitrogen rates to improve Canada Western Red Spring wheat	EME 1101 Classroom
01:30 PM- 03:00 PM	**CSHS Annual General Meeting** CSHS Executives; Open to current and prospective members	EME 2181 Classroom
03:00 PM- 03:30 PM	Afternoon Break *Sponsored by University of Saskatchewan Crop Development Centre*	EME Mezzanine
Concurrent Session 5.1 **Crop and nutrient management | Chair Dr. L. Gorim**		EME 1101 Classroom
03:30 PM	CSA Invited Speaker - Daniel Rodriguez, U Queensland| Agronomic adaptations to heat stress: Sowing summer crops earlier	
03:50 PM	CSA Chair - Linda Gorim, U Alberta| Soil pH stratification and the need to lime in Western Canada	
04:00 PM	CSA Speaker - Bao-Luo Ma, AAFC| Nitrogen fertilizer replacement values of farm manure for corn in long-term study	
04:10 PM	CSA Speaker - Yajun Peng, U Guelph| Effect of cover crops on nutrient cycling and cash crop yield: exploring the knowns and the unknowns	
04:20 PM	CSA Speaker - Balwinder Kumar, Lakeland College| Enhancing lodging resistance, yield, and quality in feed barley (*Hordeum vulgare* L.) through optimized plant growth regulator strategies	
04:30 PM	CSA Speaker - Roshan Pudasaini, U Guelph| Nodule crushing: a technique to improve symbiotic traits and nitrogen fixation in legumes	
04:40 PM	CSA Speaker - Ali Baghdadi, USASK| Nutritional improvement and fermentation analysis of corn silage made from intercropping corn with legumes	
04:50 PM	CSA Speaker - Amarjit Basra, OCPNA| Triple Super Phosphate (TSP) discovered to enhance drought resilience in maize	
05:00 PM	******CSA Student* - Michael Bilek, UBC| Unravelling the effects of RCA on hydraulic function in hydroponic corn subject to multiple abiotic stressors	

Wednesday, June 25, 2025 – cont'd		
Time	***Description***	***Location at UBC Okanagan***
Concurrent Session 5.2		EME 2111 Classroom
Horticultural crop resilience to stressors | Chairs Drs. M. Sharifi & M. Kalischuk		
03:30 PM	CSHS Publishing Award Talk - Kirsten Hannam, AAFC| Effects of postharvest deficit irrigation on sweet cherry (*Prunus avium*) in five Okanagan Valley, Canada, orchards	
03:40 PM	Local Invited Speaker - Miranda Hart, UBC| Biofertilizers in horticulture: When and where?	
04:00 PM	CSHS Chair - Mehdi Sharifi, AAFC| Soil fertility responses to two years of cover cropping in an irrigated vineyard system	
04:10 PM	CSHS Chair - Melanie Kalischuk, U Guelph| Improved disease and nutrient deficiency scouting in watermelon using multispectral imagery	
04:20 PM	**CSHS Student* - Trista Algar, AAFC| Rapid soil microbiome assessment in vineyards under cover crop management	
04:30 PM	**CSHS Student* - Sachithrani K. Kannangara, Simon Fraser U| Detection of novel viruses/variants in highbush blueberries of British Columbia	
04:40 PM	**CSHS Student* - Portiaa McGonigal, UBC| Organic waste compost improves soil fertility and controls pathogenic dagger and pin nematode populations in a crown gall-diseased vineyard	
04:50 PM	**CSHS Student* - Sarah Drury, AAFC| The mycovirome of hypovirulent *Botrytis cinerea* isolates infecting strawberries and raspberries	
05:00 PM	**CSHS Student* - Laura Carruthers, USASK| Improving nitrogen use efficiency and reducing nitrous oxide emissions in potato production	
Concurrent Session 5.3		EME 2181 Classroom
Genetics and breeding in oilseeds and pulse crops | Chairs Drs. G. Singh Brar & H. Randhawa		
3:30 PM	CSA Speaker - Mohsen Y. Najafabadi, U Guelph| The Pulse of Progress: Canada's role in global crop innovation	
3:40 PM	CSA Speaker - Megan House, USASK| Accelerated Breeding: Flax on fast-forward	
3:50 PM	CSA Speaker - Elroy Cober, AAFC| Long term soybean protein trends in Canada	
4:00 PM	CSA Speaker - Hugh Earl, U Guelph| When is yield determined in Ontario soybean? Environment and management effects	
4:10 PM	CSA Speaker - Fernando Guerrero Zurita, U Alberta| Identifying canola (*Brassica napus* L.) accessions with superior photosynthetic traits and unique resource partitioning strategies	
4:20 PM	CSA Speaker - Robert Duncan, U Manitoba| Genomic selection for oil and fatty acid profile in rapeseed (*Brassica napus* L.)	
4:30 PM	CSA Speaker - Abe Shegro Gerrano, South Africa| Quantification of genetic variation in nutrient compositions in cowpea [*Vigna unguiculata* (L) Walp] genotypes grown in marginal areas of South Africa	
4:40 PM	CSA Speaker - Tamanna Akter Jahan, USASK| Characterizing variation in root architectural traits among chickpea (*Cicer arietinum* L.) interspecific population grown in a hydroponic setup.	
4:50 PM	**CSA Student* - Sophie Anne Duchesne, USASK| Dissecting the genetic basis of heat tolerance in interspecific chickpea population	
5:00 PM	**CSA Student* - Xinjie Yu, USASK| Exploring Pasmo resistance from *Linum bienne* for flax improvement	

Wednesday, June 25, 2025 – cont'd		
Time	***Description***	***Location at UBC Okanagan***
Concurrent Session 5.4		EME 1151 Classroom
Digital Agriculture: Tools for Tomorrow's Agriculture | Chairs Drs. A. Correndo & A. Farooque		
3:30 PM	CSA Co-Chair - Aitazaz Farooque, UPEI| Role of precision agriculture technologies for sustainable farming: Atlantic Canadian perspective	
3:50 PM	CSA Speaker - John Sulik, U Guelph| Optimizing yield data aggregation in on-farm "strip trials"	
4:10 PM	**CSA Student* - Sarah van SteenBergen, USASK| Downscaling in-season yield forecasts across Western Canada using remote sensing and machine learning methods	
4:20 PM	**CSA Student* - Hassan Afzaal, UPEI| Integrating Deep Learning and UAV remote sensing for precision Plant stand counting and spatial fertility analysis in potato crops	
4:30 PM	**CSA Student* - Saad Javed Cheema, UPEI| Enhancing potato crop coefficient estimation using XGBoost optimized with the Chaos Game algorithm and SHAP analysis	
4:40 PM	**CSA Student* - Muhammad J. Khan, UPEI| Eco-friendly hybrid nano-fertilizers from marine waste for enhanced nutrient retention and controlled release	
06:30 PM- 10:00 PM	**Gala Dinner & Awards** – Manteo at Eldorado Hotel *Cocktail hour with cash bar followed by plated dinner with local wine* **Plenary Speaker - Dr. Karen Tanino, U. Saskatchewan** One foot in both worlds: A personal journey and perspectives on the increasing importance of scientific societies to Canada	Buses depart from and return to Nechako Residence | Host Dr. Louise Nelson

Thursday, June 26, 2025		
Time	***Description***	***Location at UBC Okanagan***
08:00 AM	Workshop Registration	EME Mezzanine
Plenary Session		COM 201 Lecture Theatre
08:30 AM	Welcome & Housekeeping - Drs. Simone Castellarin & Kui Liu, Conference Chairs	
08:45 AM	**Panel Discussion - Agricultural Sustainability & Resilience | Moderator Dr. S. Castellarin** *Keynote Speakers* Dr. Joann Whalen, McGill; Dr. Steve Shirtliffe, USASK; Dr. Dominique Michaud, Laval U *Local Invited Speaker* Dr. Mohamed Shehata, UBC | *Science-Industry Reps* Dr. Laila Benkrima, BC Centre for Agritech Innovation at Simon Fraser U; Mr. Matt Gomez, Accelerate Okanagan	
10:00 AM	Thank You & Closing Remarks - Drs. Simone Castellarin & Kui Liu, Conference Chairs	
10:00 AM- 10:30 AM	Morning Break *Sponsored by Feast Farms*	EME Mezzanine
Concurrent Session 6.1		EME 1121 Classroom
10:30 AM- 12:00 PM	**Workshop - BC Living Laboratories | Moderators Dr. K. Hannam & Mr. G. Telford** *Join us to hear about the BC Living Lab from the producers and commodity leads working in the field and on the ground!* Panel Speakers - Ms. Karen Raven & Mr. Thiago Moraes, Cattle and Forages; Dr. Eric Gerbrandt, Berries and Nuts; Gail Nelson, Tree Fruits; Mr. Hans Buchler, Winegrapes; Ms. Angelique Slade-Shantz, Apples	
Concurrent Session 6.2		EME 2111 Classroom
10:30 AM- 12:00 PM	**Workshop - Ag Extension Networking | Chair Dr. J. Gill Kahlon** *Join us to learn about building effective knowledge transfer and technology exchanges between science and industry!* Panel Speakers - Dr. Sheri Strydhorst, RDAR - Results Driven Agriculture Research; Ms. Sherrilyn Phelps, Saskatchewan Pulse Growers; Ms. Lindsay Hainstock, BC Ministry Ag.; Mr. Hank Markgraf, Syngenta	
Concurrent Session 6.3		EME 1202 Classroom
10:30 AM- 12:00 PM	**Workshop - Building Organic Science for Impact | Chair Dr. A. Hammermeister** *Join us to learn about leading impactful organic agricultural research to serve producers and communities!* Panel Speakers - Dr. Andrew Hammermeister (Leading) with participation of all!	
12:00 PM- 01:00 PM	Poster & Exhibitor Takedown – End Conference	EME Mezzanine

Keynote Speakers

Dr. Joann Whalen

James McGill Professor, McGill University

Joann K. Whalen holds a James McGill Professor research chair at McGill University and is an Affiliate Professor at the Chair of Sustainable Soil Sciences of the Mohammed VI Polytechnic University in Morocco. She received her B.Sc. (Agr.) from Dalhousie University, an M.Sc. from McGill University and Ph.D. from Ohio State University (USA). She is a professional agronomist (agronome) in Quebec, Canada. She was President of the American Society of Agronomy in 2023.

Joann's research covers soil biology, soil health and agricultural nutrient management. She has been the supervisor/co-supervisor of 80 graduate students and postdoctoral researchers, with more than 280 peer-reviewed scientific articles. She is an Editor-in-Chief for Soil Biology and Biochemistry, the top scholarly journal in the soil sciences and a Review Editor for PNAS Nexus published by the National Academy of Sciences (USA). Joann is a Fellow of the Soil Science Society of America and of the Canadian Society of Soil Science.

Joann has spent her career working on issues in sustainable and resilient agriculture, through the implementation of integrated soil and fertilizer management planning, conservation tillage, and diverse rotations that include perennial crops and trees. Currently, she is leading research projects on the plant root microbiome, including bioinoculation with microbial and other products to improve crop tolerance to heat, water and salt stress.

Dr. Steve Shirtliffe

Professor, College of Agriculture and Bioresources, University of Saskatchewan

Steve Shirtliffe is the director of the Nutrien Digital and Sustainable Agriculture Centre for Sustainability (NDACS) in the College of Agriculture and Bioresources at the University of Saskatchewan. Shirtliffe is also a Professor in the Dept. Plant Sciences at the University of Saskatchewan. His academic position involves teaching, research, and extension in the areas of crop imaging and agronomy. Past and current research projects have focused on phenotypic and agronomic applications of crop imaging using UAV and satellite imagery. He collaborates widely with computer scientists, plant breeders, geographers, economists soil scientists and engineers to form dynamic research groups to tackle inter-disciplinary problems related to crop production.

Dr. Dominique Michaud

Professeur titulaire, Université Laval

Dominique Michaud is a Professor of Plant Physiology and Molecular Biotechnology at Laval University, Québec City. He started his career at Laval U in the late 1990s, after completing doctoral and postdoctoral studies in Plant Biology at Laval U, CNRS in France and UBC in Vancouver. Over the past 30 years, Dominique has developed a broad expertise in plant physiology, proteomics and molecular biotechnology, notably working on the basic and translational aspects of plant stress physiology and recombinant protein processing in plant systems. He has developed strategies to improve the yield and stability of recombinant proteins in plants, including tools to protect them from degradation and facilitate their maturation in foreign cellular environments. Recent advances in Dominique's lab include the rational engineering of hormonal physiology and plant architecture by different means, including Agrobacterium plasmid design, genetic transformation and CRISPR-Cas9 gene editing. Dominique has published over 150 primary research papers, review articles, book chapters and editorials over the years, also filing several patents related to recombinant protein expression in plant systems. He has shown interest in the societal and regulatory aspects of plant biotechnology in Canada and abroad, conducting impact studies on GM crops for different government bodies and serving on different plant biotechnology panels and committees at the national and international levels. Dominique is currently Head of Plant Research and Innovation Centre at Laval U, Past-President of the Canadian Association for Plant Biotechnology, and Senior Editor for PBJ, Wiley's top-tier journal in plant molecular biology.

Keynote Lectures

A Soil-Centric Approach to Sustaining Resilient Agriculture in Canada

Joann K. Whalen | *Dept. Natural Resource Sciences, McGill University, Ste-Anne-de-Bellevue, Quebec, Canada*

Agriculture is inherently vulnerable to the vagaries of weather and biotic stressors. In the Canadian context, agronomists select for crops that can survive cold spells and heat waves, drought, flooding, hail, rainstorms and windstorms. Crops must also overcome competition from weeds, predators and pathogens. Ideally, crop breeding is sufficient to create genetically superior varieties that can withstand these yield-limiting factors. In reality, the yield potential is still determined by the environmental conditions, emphasizing the importance of the G×E×M interaction. A soil-centric approach begins from the ground up, by creating a suitable environment for the resilient cropping system. Conventionally, this focused on selecting best practice for the tillage, drainage, pH adjustment and soil fertility management. Modern insights about the ecology of the crop roots-rhizobiome system should encourage agronomists to consider promoting soil biology for agricultural resilience. Besides symbiotic interactions with soil-borne mycorrhiza and rhizobia, crop roots are colonized by a tremendous diversity of soil microorganisms. The crosstalk between roots, endophytic and root-associated microorganisms is now understood to determine plant growth, development, resource acquisition and immunity through interactions that manifest at the genetic, cellular, physiological and morphological levels. This allows the root-rhizobiome partners to engineer their shared rhizosphere, for their joint benefit. We will discuss how a soil-centric approach works hand-in-hand with other agronomic interventions for the design of cropping systems with enhanced resilience in Canada.

Digital Agriculture Tools for Agronomy and Crop Science

Steve Shirtliffe | *College of Agriculture and Bioresources, University of Saskatchewan, Saskatoon, Saskatchewan, Canada*

Crop imagery from drones and satellites can now provide plant breeders and agronomists useful information to assist in crop breeding and management. This presentation will review some of the recent research at the Crop Imaging Lab at the University of Saskatchewan. We are now at a crossroads where remotely sensed satellite information can be analyzed with machine learning to inform agronomic decisions. Cheap drones can be used to scout canola fields for crop emergence and allow farmers to make informed reseeding decisions. UAV trained machine learning models can now use satellite data to map kochia infestations on farmer's fields and target control measures. These models can also use satellite and environment data to make accurate yield predictions before harvest. Crop classification maps can be used to determine the risk of root rot based on crop rotations for any field in western Canada. And finally, our lab is in the process of wall-to-wall mapping of all western Canada at a 10m resolution to measure and understand the causes of within field spatial variability in crop yield and profitability.

Plant cystatins as molecular triggers of drought resilience and tuber yield in potato

Dominique Michaud | *Centre de recherche et d'innovation sur les végétaux, Université Laval, Québec, Québec, Canada*

Current climate change scenarios predict an increased incidence of drought episodes likely to affect potato crops worldwide. Potato exhibits a low-density, shallow root system that makes it particularly vulnerable to water shortage. In this seminar, I will discuss the potential of plant cystatins to promote drought tolerance in cystatin-expressing potato lines by induction of stress-related pleiotropy. Recent studies revealed a link between abiotic stress tolerance and the presence of these endogenous regulators of proteolysis in leaf tissue. In line with these studies, cystatin-expressing potato plants submitted to water deficit here presented an increased root-to-shoot ratio suggesting a relative root growth-promoting effect for the recombinant protein upon water deficit. Cystatin-potato lines also showed an improved tuber yield compared to the control line under both limiting and non-limiting water regimes, suggesting an improved efficiency of primary metabolic functions and the avoidance of a growth–stress response tradeoff in the engineered lines. Accordingly, cystatin expression in the modified potato lines was associated with a stress response-oriented leaf proteome, likely explained by pleiotropic effects of the recombinant cystatin driving the constitutive expression of usually inducible stress-related proteins and the upregulation of primary metabolism-associated proteins. These data suggest the potential of plant cystatins as molecular triggers of tuber biomass production and drought resilience in potato. Work is underway to identify the protease target(s) of recombinant cystatins in potato leaves, as a first step toward the design of a genome editing alternative to the cystatin transgene, 'GM-based' strategy relying on post-expression protease inhibition.

Plenary Speakers

Dr. Karen Tanino

Professor, College of Agriculture and Bioresources, University of Saskatchewan, Saskatoon, Saskatchewan, Canada

Dr. Karen Tanino is a full Professor at the University of Saskatchewan in the Dept. Plant Sciences, College of Agriculture and Bioresources. Her area of research has focused on plant abiotic stress physiology (frost, drought, heat, salt), publishing over 130 refereed journal articles. Among many conferences, she chaired the 1st and 2nd Saskatchewan Food Summits, co-chaired the 1st northern Greenhouse conference, was the Northern Food Security Thematic Network Lead under the University of the Arctic, initiated and founded the Prairie Horticulture Certificate Program, a home-based study curriculum with an enrolment of thousands of students since its inception. She held the W.J. White Professorship, was the second person to have been designated Global Fellow of Iwate University (Japan), is Adjunct Professor in the Dept. Crop Physiology, University of Agricultural Sciences (GKVK), Bangalore India, was President of the Canadian Society for Horticultural Science 2016 – 2018 and in 2022 she was awarded one of the 7 most influential women in Canadian agriculture.

Dr. Marco Todesco

Assistant Professor, Faculty of Science; Michael Smith Laboratories, Botany Dept., Biology Dept., Biodiversity Research Centre, The University of British Columbia, Vancouver, British Columbia, Canada

Marco Todesco is a plant geneticist and genomicist at the University of British Columbia. He received an MSc in plant biotechnology from the University of Padova in Italy and a PhD in plant genetics at the Max Planck Institute for Developmental Biology in Tuebingen, Germany.

His research aims to understand diversity and adaptation in plants and how this knowledge can be used for crop improvement, using a combination of approaches from molecular biology to genetics, genomics, evolutionary biology and ecology. His research on the genetic basis of adaptation has shown the importance of large chromosomal inversions in maintaining complex adaptations. His work on cannabis focuses on generating genomic resources and using them to characterize traits that can improve cannabis production and sustainability, and in understanding the origins and domestication history of this species.

He is a co-lead of the plant section of the Canada BioGenome Project, which aims to sequence the genomes of hundreds of species representing Canadian biodiversity, and the coordinator of the International Consortium on Sunflower Genomics, a private-public partnership dedicated to generating genomic resources and tools for sunflower improvement.

Dr. Davoud Torkamaneh

Professor, Computational Biology, Université Laval, Québec, Québec, Canada

Dr. Davoud Torkamaneh is an Associate Professor in the Dept. Plant Sciences at Université Laval, a computational biologist by training, with extensive experience in applied plant genomics. A passionate researcher and educator, his expertise lies at the intersection of genomics, artificial intelligence, and biotechnology, driving cutting-edge advancements in plant breeding and genetic research.

As the lead of Canada's largest cannabis research center, Dr. Torkamaneh leads pioneering studies that push the boundaries of precision breeding and genomic innovation. With a strong track record of securing major research funding and publishing in top-tier scientific journals, he is shaping the future of data-driven agriculture and sustainable crop improvement. Through his innovative work, he continues to inspire the next generation of scientists while forging impactful collaborations worldwide.

Plenary Lectures

One foot in both worlds: A personal journey and perspectives on the increasing importance of scientific societies to Canada

Karen Tanino | *College of Agriculture and Bioresources, University of Saskatchewan, Saskatoon, Saskatchewan, Canada*

Join Dr. Tanino in a personal reflection on the role of scientific societies in today's Canadian agricultural landscape as she shares words of wisdom from her eminent career in plant science. Dr. Tanino will deliver her lecture during the Gala Dinner & Awards Night on Wednesday, June 25, 2025.

Per Aspera Ad Aster: the promises of using wild relatives (and genomics) to improve cultivated sunflower

Marco Todesco | *Michael Smith Lab., Dept. Botany, Dept. Biology, The University of British Columbia, Vancouver, BC, Canada*

Sunflower is the third largest oilseed crop globally. While it is tolerant to a wide range of soils and climates, biotic and abiotic stresses are still limiting for sunflower production, a situation that will only be made worst by climate change. However, resistance to many of these stresses is often found in wild relatives of cultivated sunflower, which are promising sources of useful alleles for sunflower improvement.

An international genomics effort is underway to decipher the huge amount of genetic and phenotypic diversity found in wild sunflowers. We have produced high-quality genome assemblies for dozens of wild and cultivated sunflowers, revealing the genetic history of past uses of wild relatives in breeding efforts, as well as extensive variation in the organization of the genome both between and within sunflower species. We found that several of these large (1-100 Mbp) structural variants play fundamental roles in helping wild sunflowers adapt to different environments and hold great promise for sunflower breeding. These efforts are helping to understand the past and future roles of wild relatives in improving and climate-proofing cultivating sunflower.

Not Just a High—A Higher Understanding of Cannabis Through Multi-Omics

Davoud Torkamaneh | *Département de Phytologie, Université Laval, Québec, Québec, Canada*

Cannabis is valued for its diverse applications, including fibre, food, medicine, and psychoactive properties. Since its legalization in Canada, the cannabis industry has rapidly expanded into a multibillion-dollar sector, creating unprecedented employment opportunities. Despite this economic significance, historical prohibition and societal stigma have severely limited comprehensive scientific exploration into cannabis biology, genetics, and trait inheritance, resulting in significant gaps in agricultural innovation compared to other crops.

These historical constraints, however, present unique research opportunities, particularly within Canada's pioneering legal framework. Cannabis, a dioecious species typically propagated clonally due to its highly heterozygous genome and economic reliance on female plants, poses distinct scientific challenges. Our research program addresses these complexities through a multifaceted approach integrating optimized agronomic practices, advanced multi-omics-driven breeding methodologies, and cutting-edge genome editing techniques to accelerate trait development and enhance production efficiency.

In this presentation, I will share the journey of establishing Canada's leading cannabis research program, detailing how we overcame biological, societal, and political challenges. I will highlight our progression from foundational agricultural practices to innovative genomic solutions, emphasizing how these advancements can reshape the future of cannabis.

Local Invited Speakers

Dr. Miranda Hart

Professor, Biology & Biotechnology, Okanagan Institute for Biodiversity, Resilience, and Ecosystem Services, University of British Columbia

Miranda Hart is a Professor in the Dept. Biology at the University of British Columbia-Okanagan with a research focus on microbial ecology of soil microbes in applied systems. She has done extensive work on the use of biofertilizers and cover crops in viticultural systems. She uses molecular approaches to understand how agricultural practices change soil microbial communities, and how these changes are reflected in plant performance.

Dr. Mohamed Shehata

Professor, Computer Science, University of British Columbia

Dr. Mohamed Shehata is an accomplished academic and industry leader with a distinguished career spanning over two decades in both theoretical and applied interdisciplinary research. He earned his B.Sc. with Honours in 1996 and his M.Sc. in Computer Engineering in 2001 from Zagazig University, Egypt. He subsequently completed his Ph.D. in 2005 at the University of Calgary, Canada.

Following his doctoral studies, Dr. Shehata held a Postdoctoral Fellowship at the University of Calgary before transitioning to industry as Vice President of Engineering and Research at Intelliview Technologies Inc., where he led advanced developments in intelligent vision systems.

In 2013, Dr. Shehata joined Memorial University as an Assistant Professor, then as an Associate Professor in 2019. Later that year, he joined the Dept. Computer Science, Mathematics, Physics, and Statistics at the University of British Columbia (UBC), Okanagan campus, where he is currently a full professor, continuing to contribute to research and teaching excellence. His research focuses on interdisciplinary computer vision, with emphasis on video and image processing, intelligent camera systems, and real-time analytics. He is particularly known for applying his research in emerging domains such as precision agriculture, biomedical imaging, and digital health.

Dr. Chase Mason

Assistant Professor, Biology & Biotechnology, University of British Columbia

The Mason laboratory focuses on the intersection of plant physiology, genetics, ecology, and evolution. The lab's research program is focused on understanding adaptive functional trait evolution in wild plants, the consequences of domestication and improvement for crop physiology, the role of plant phytochemistry in ecological interactions, as well as the incorporation of plant secondary metabolism into the plant economics spectrum framework. Current projects include describing the genetic architecture of variation in ecophysiological and phytochemical traits in crop and wild sunflower (Helianthus), as well as determining the consequences of variation in these traits for biotic interactions ranging from pollination, pest and pathogen resistance, and the plant microbiome including symbiosis with arbuscular mycorrhizal fungi. The laboratory also conducts hybrid cultivar development in Capsicum peppers as a means to train undergraduates in plant breeding and applied plant science skills. | Photo and bio sourced from https://biology.ok.ubc.ca/about/contact/chase-mason

Abstracts for invited speakers are posted under their respective sessions.

Invited Speakers

Dr. Maryse Bourgault

Assistant Professor; Western Grains Research Foundation (WGRF) Integrated Agronomy Research Chair, College of Agriculture and Bioresources, University of Saskatchewan

Maryse Bourgault is the WGRF Research Chair in Integrated Agronomy. Maryse was trained as a crop physiologist during her PhD at McGill University. Before coming back to Canada, she worked in Australia and the USA to investigate drought adaptive traits in various crops and their impact on productivity with predicted climate change impacts. In recent years, Maryse's research program aims to take a broad look at how agronomic practices can be developed or adapted to address sustainability and resilience issues. She is particularly interested in testing alternative systems, for example, cover crops, intercropping, re-integrating livestock with grain cropping, and winter broadleaf cultivation, to support soil health, crop productivity and resilience in growing environments that are subject to low and variable rainfall such as the semi-arid Northern Great Plains. She also continues to research root systems in pulse crops. Looking to the future, Maryse is also interested in taking a systems approach that includes economic and quality-of-life considerations as part of the discussion on sustainability and resilience of Western Canadian farms.

Dr. Kimberley Schneider

Assistant Professor, Plant Agriculture, University of Guelph

Kim Schneider is an Assistant Professor in Forage and Service crops in the Dept. Plant Agriculture at the University of Guelph. Her research program takes a systems-based approach to address agronomic questions in forage and cover crop production, and to assess their role in increasing soil fertility and nutrient-use efficiency. The research evaluates best management practices and the impact of pasture management, including rotational grazing, on soil organic carbon sequestration. The goal of her research program is to promote the reintegration of crop and livestock systems, aiming to improve both economic and environmental outcomes for producers.

Dr. Lauren Erland

Canada Research Chair in Berry Horticulture; Assistant Professor, Agriculture; Director, BERRI Centre, University of the Fraser Valley

Dr Lauren Erland is an Assistant Professor in the Agriculture Dept. at UFV and Canada Research Chair Tier II in Berry Horticulture. She is also Director the BERRI Research Centre and her associated lab which have the overall goal of enhancing resilience of berry horticulture systems in the Fraser Valley and beyond.

Dr. Anže Švara

Assistant Professor, College of Agriculture and Bioresources, University of Saskatchewan

Anze Svara is an Assistant Professor in the Dept. Plant Sciences at the College of Agriculture and Bioresources, University of Saskatchewan. He leads a research and breeding program focused on improving horticultural crops for the Northern Prairies. He aims to understand the genetics of important traits to enhance crop quality, increase production efficiency, and support sustainability, all while meeting consumer needs. Anze's research explores both wild relatives and modern varieties of crops such as haskap, saskatoons, apples, and hazelnuts. By developing new fruit varieties, he and his team are helping to shape the future of the global fruit market.

Invited Speakers

Dr. Daniel Rodriguez

Professorial Research Fellow, Queensland Alliance for Agriculture and Food Innovation, University of Queensland Australia

Professor Dr. Rodriguez is a biophysicist trained at Wageningen University, specializing in crop ecophysiology and systems modelling to enhance adaptation in broadacre crops. His recent research focuses on GxExM interactions, trait physiology and high-throughput field phenotyping for drought tolerance in grain crops. He combines empirical research, crop modelling, and data analytics to develop more profitable, sustainable, and resilient crops and cropping systems. Dr. Rodriguez collaborates with institutions in Australia and various countries in the Americas, eastern and southern Africa, Indonesia, Latin America, and China. He served as President of the Australian Society of Agronomy and organized the 2022 Toowoomba Australian Agronomy Conference. He has contributed to the Academic Board of the University of Queensland and its Research and Innovation Committee. Dr. Rodriguez is the founding editor-in-chief of Nature's npj Sustainable Agriculture and serves as an Expert Advisor for the Independent Science for Development Council of CGIAR. He is also a member of the College of Experts at the University of Queensland's Global Change Institute and sits on the Editorial Board of multiple academic journals.

Dr. Fernanda Dreccer

Principal Research Scientist, Commonwealth Scientific and Industrial Research Organisation, Australia

Fernanda Dreccer is a Principal Research Scientist at the Commonwealth Scientific and Industrial Research Organisation (CSIRO, Australia). She has a background in Agronomy and Plant Breeding from University of Buenos Aires and Wageningen University. She leads multidisciplinary teams that investigate adaptation drivers to minimize yield gaps caused by abiotic stress, combining expertise in crop physiology, agronomy, genetics and crop modelling. Her research is focused on untangling complex interactions between crops, environment, and farm practices to deliver new knowledge, germplasm and practical tools to reduce risk and improve productivity in a sustainable manner.

In addition to her role in CSIRO, Fernanda is a member of the Scientific Board at the Wheat Initiative, identifying global strategic priorities for wheat research, a panel member at the Australian Grains Research and Development Corporation, Adjunct Senior Researcher at University of Tasmania, an assistant editor in Field Crops Research, as well as serving on several editorial boards in her field.

Abstracts for invited speakers are posted under their respective sessions.

Oral Presentation Abstracts

**Indicates student presentation*

1.1 Soil BMPs in agricultural systems

Chair: Dr. Laura Van Eerd

The role of grazing livestock in supporting sustainable soil management: Examples from Ontario. K. Schneider | *Dept. Plant Agriculture, University of Guelph, Guelph, ON, Canada* [Invited talk] • Regenerative agriculture and best management practices for supporting soil health promote the integration of livestock on cropland, however challenges exist for producers to do this and relate to training, equipment and infrastructure needs and high land costs. In Ontario, perennial forages and in particular grazed pastures, have been shown to score highly in soil health scores compared to other agricultural land uses, supporting the importance of animal agriculture in the landscape. Among grazed pastures, rotational grazing is often touted for its ability to increase carbon sequestration on pastures, however, little Ontario data is available to support this claim. This presentation will outline the scientific results obtained from an Ontario grazing management study obtained using data from five 'across the fence comparisons' of beef farms managed according to adaptive multi-paddock grazing principles or continuously grazed. Results found changes not only in soil organic carbon quantity, but also in quality, which has suggested implications for soil carbon stability. The integration of livestock on annual cropland is also gaining interest among beef and sheep producers as a way to be more economically viable and also to potentially increase soil health. Preliminary results from soil health testing from grazed vs. ungrazed cover crops in an annual cash crop scenario will be presented with future work and implications discussed.

Saving Soils - Improving soils through fall-seeded cash and cover cropping. T. Fonville, M. Gretzinger, L. Baarda, G.S. Dhillon, K. Coles | *Farming Smarter, Lethbridge, AB, Canada* • Soil erosion is a real threat in the windswept prairies of Canada. The adoption of no-till on the prairies was largely successful at mitigating erosion risk particularly in rainfed areas. Irrigated cropping systems have been slower to adopt these practices due to a reduced need to conserve moisture, higher land costs and the need for maximizing yield. In addition, several high-value irrigated crops, like potatoes, sugar beets and beans, are more disruptive to the soil structure and provide less residue cover. Fall seeded cash and cover crops can have a wide range of soil health benefits. The Saving Soils project started in 2023 in Southern Alberta and has been investigating the agronomy of cover crops, the soil health benefits of cover crops and how fall-seeded crops can positively and negatively impact main season crops. We tested novel techniques such as strip tillage and roller-crimping, together with a range of cover crops like fall rye, winter wheat and winter oats and for main season crops barley, canola, dry beans and corn. Initial results indicate that: 1) the timing and method of cover crop termination can impact main season yield, 2) earlier seeded cover crops have better winter survival, 3) soil carbon and nutrient dynamics are complex across the season, 4) cover crops can provide weather and pest protection for early summer crops. This study shows that cover crop management is dependent on unique regional climate conditions and should be customized to farm operation for optimal yield.

Advancing agricultural testing with combustion analysis: enhancing precision in soil and plant nutrient measurement. W. Allan, K. Poe | *Elementar Americas* • Accurate elemental analysis is essential for improving soil health assessments, guiding crop management strategies, and optimizing fertilizer use. This presentation explores how modern combustion analysis has become the gold standard for measuring carbon and nitrogen in agricultural samples such as soil, plant tissue, biomass, and biochar. The session will highlight the latest advancements in combustion analysis technology and its applications in agricultural testing. Attendees will gain practical insights into improving laboratory workflows through enhanced automation, precision, and efficiency. Topics will also include best practices for instrument maintenance, troubleshooting common issues, and extending equipment lifespan—key strategies for improving data quality and minimizing downtime. Ideal for both research and applied settings, this talk will provide actionable knowledge to support high-performance analytical labs and data-driven agricultural decision-making.

1.2 System resilience in horticultural crops

Chairs: Drs. Kirsten Hannam & Andrew Hammermeister

The Organic Science Cluster: Exploring the outcomes of organic crop production science. A.M. Hammermeister[1], N. Boudreau[2], D. Jans[2], M. Graves | *[1]Organic Agriculture Centre of Canada, Dept. Plant, Food and Environmental Sciences, Dalhousie University, Truro, Nova Scotia, Canada; [2]Organic Federation of Canada* • The Organic Science Cluster has coordinated the national program for organic science in Canada since 2009. Now in its 4th iteration, the OSC is reflecting on key outcomes of the past and research priorities for the future. Organic greenhouse production has evolved tremendously in Quebec using innovations in growing medium design. Organic science has explored whether breeding under organic management is necessary for field crops. Meanwhile participatory plant breeding has demonstrated how meaningful farmer engagement in breeding programs vegetable crops can lead to meaningful contributions to regional genetics. The study of cover crops and recycled nutrients has revealed the potential and challenges of using green manures to support crop nutrient requirements. Organic science has furthered our understanding of the importance of biodiversity and

use of biological controls for management of pests such as wireworm and tarnished plant bug. Here we will evaluate how science has revealed the successes and challenges of organic crop production, and how this knowledge has influenced research priorities, and the evolution of organic standards.

Predicted impacts of future climate scenarios on commercial cranberry (Vaccinium macrocarpon Ait.) production systems. Lauren Erland | *BERRI Centre, University of the Fraser Valley, Abbotsford, BC, Canada* [Invited talk] • Cranberries (*Vaccinium macrocarpon* Ait.) are a specialty fruit crop which represent a $184M farm gate value in 2022. Climate change is impacting our local agricultural systems and is predicted to increase global temperatures by 2°C in the coming years, leading to warming environments and more extreme weather events. At the same time B.C. cranberry growers are currently undertaking major replanting efforts to refurbish underperforming Stevens fields in the province. There is a need for future climate-informed planting recommendations for the region. In response we established a multi-year in-field experimental warming experiment at the BC Cranberry Research Farm in Delta, BC in 2023. This study builds on existing varietal assessment studies to understand how future climate scenarios will impact cranberry growth, physiology, productivity and quality. Overall, this long-term study is integrating field and lab-based studies to holistically understand and inform the impacts of climate change on cranberries from the field to the consumer. Through the use of open top chambers, we have identified significant impacts of warming on four varieties of cranberries being considered for replanting. These passive warming chambers increase air temperatures by ~2°C. Our results have identified significant impacts on yield, potentially driven by a shift in cranberry growth towards runner production. Berry quality parameters including colour, firmness and brix have remained consistent across the treatments, while untargeted metabolomics studies have identified shifts in some anthocyanin contents.

Irrigation for climate resilience in tree fruit: lessons from the Summerland RDC. K.D. Hannam[1], S.Kuchta[1], S. Damin[1], E.A. Houghton[2], D. Neilsen[1], G.H. Neilsen[1], T.A. Forge[1] | *[1]Agriculture and Agri-Food Canada (AAFC) Summerland Research and Development Centre (RDC), Summerland, BC, Canada; [2] Dept. Biology, University of British Columbia – Okanagan, Kelowna, BC, Canada* • The Okanagan Valley, BC, is one of the most important fruit growing regions in Canada. With its warm, dry climate, commercial tree fruit production is not possible here without irrigation. As our climate warms and the population expands, the demand for water is growing at the same time that the irrigation water supply is becoming less certain. Tree fruit producers require tools to help them prepare for and adapt to water shortages, droughts and emergency restrictions in use. The Summerland RDC has a long history of research on efficient water use in tree fruit production. We will revisit some of this work, which has increasing relevance in the face of today's growing challenges. We will also present the results of recent experiments exploring the use of irrigation scheduling, deficit irrigation and soil amendments to save water while protecting orchard health, crop quality and yield. Tree fruit producers in the Okanagan Valley are feeling pressure to 'grow more with less'. Research is available to help farmers prepare for and respond to water emergencies while supporting Canada's food sovereignty, but more work is needed to promote wider adoption of these practices.

***Prioritizing beneficial management practices in tree fruit horticulture for detailed life cycle assessment – A systematic review of environmental impact mitigation potentials, technical feasibility and economic feasibility.** Jared Brown[1,2], Vivek Arulnathan[1], Nicole Bamber[1], Kirsten Hannam[2], Nathan Pelletier[1] | *[1]Food Systems PRISM Lab, University of British Columbia Okanagan, Kelowna, British Columbia, Canada. [2]AAFC Summerland RDC, Summerland, British Columbia, Canada* • Beneficial management practices (BMPs) in tree fruit horticulture can provide environmental and economic benefits. However, few have been studied using life cycle assessment (LCA), and it remains unclear which to prioritize for future LCA research. Given this, a systematic literature review was conducted to develop an interdisciplinary framework for prioritization, using semi-arid and Mediterranean climates to illustrate. LCA studies were reviewed to identify primary resource use and environmental concerns in tree fruit horticulture. BMP studies were reviewed to determine the technological readiness of identified BMPs and quantify percentage differences in environmental impacts, orchard input needs, production costs, and fruit yields compared to control practices. A decision tree was then developed using this information to prioritize BMPs for LCA research. Primary resource concerns included inorganic fertilizers, irrigation, and energy use, though several LCA studies lacked quantitative data on impact contributions. Of the identified BMPs, the most studied were deficit irrigation, cover crops, no-tillage, manures, and organic mulches, all showing positive contributions to environmental impacts and fruit yields, though orchard input need data were almost non-existent. Deficit irrigation, cover crop, and no-tillage practices had lower production costs, and cover crops, manures, and organic mulches were identified as ready for commercial use. Only cover crops fully met the decision tree criteria for future LCA research, though other BMPs may have if more data were available. Recommendations include future LCA studies publishing all quantitative data on impact contributions and future BMP studies accentuating how environmental impacts, orchard input needs, and production costs are affected.

The effects of management and vegetation complexity on ground-dwelling spiders in vineyards. Hannah Friesen[1,2], Lael Parrott[1], Kirsten Hannam[2] | *[1]University of British Columbia Okanagan, Kelowna, BC, Canada [2]Agriculture and Agri-Food Canada, Summerland, BC, Canada* [Invited talk: Pest Management Award 2025] • Vineyard expansion and intensification threaten natural ecosystems and biodiversity. Fortunately, both vineyard operators and wine consumers are becoming increasingly interested in environmentally friendly practices that support biodiversity conservation. Although vineyard biodiversity studies have increased in recent years, the effects of vineyard management on biodiversity vary by region and taxa, limiting the ability to generalize best practices. This project investigates how vineyard management and vegetation complexity impact ground-dwelling spider abundance in vineyards of the Okanagan Valley. Spiders are important generalist predators and are sensitive to environmental change, making them valuable indicators of biodiversity in agroecosystems. Spiders were sampled at 22 vineyards (13 conventional, 9 organic) using pitfall traps placed in both vine rows and inter-rows for 14 days in June. The results provide support for the hypothesis that increased vegetation complexity enhances natural enemy abundance, however, in organic vine rows, spider abundance declined with increasing vegetation complexity. Organic vineyards exhibited more complex vegetation overall, particularly in vine rows, which complicated the ability to isolate vegetation effects independently of management effects. These findings emphasize the importance of within-vineyard habitat variation, which has not been explored yet in vineyard

biodiversity studies. Future work will investigate spider functional traits and the role of landscape heterogeneity, as previous studies suggest that landscape context can mediate local management effects.

1.3 Sustainable production of high-value berry crops

Chairs Drs. Ian Willick & Youbin Zheng

Controlled environment strawberry production: Current status, challenges and opportunities. Youbin Zheng | *School of Environmental Sciences, University of Guelph, Guelph, ON, Canada* • The majority of strawberries have been cultivated in open fields during the warmer months. However, in colder regions such as Canada, strawberries are typically imported from warmer countries during the winter. Long-distance transportation and storage often result in a significant decline in fruit quality, including loss of nutritional value. In recent years, an increasing number of growers have begun producing strawberries under controlled environmental conditions, such as greenhouses and indoor vertical farms. This presentation will explore the advancements made in controlled environment strawberry production, including variety selection, propagation methods, and cultivation techniques. Special attention will be given to key production factors such as growing media, plant nutrition and irrigation, production systems, lighting, and climate control. Additionally, I will examine the current challenges and future opportunities in this field, with a focus on how researchers and industry stakeholders can collaborate to develop sustainable systems for year-round production of high-quality strawberries, particularly in Canada.

Silicon amendments may improve wine grape tolerance to dehydration and insect damage through physio-chemical modifications to leaves. I.R. Willick, E. Rand | *AAFC Kentville RDC, Kentville, NS, Canada* • Silicon (Si) based amendments may improve general stress tolerance in plants. However, the mechanism is not fully understood. Here we assessed how the absorption and polymerization of bioavailable monosilicic acid in *Vitis vinifera* and hybrid wine grape forms physical barriers in vegetative tissues and promotes the accumulation of anti-herbivory and antioxidant compounds to mitigate extrinsic sources of stress. We observed that monosilicic acid applied as a foliar spray or soil amendment enhanced leaf tensile strength, dehydration tolerance and reduced leaf water content (gH_2O per g dry matter) as compared with control vines. Higher accumulation of leaf dry matter and Si per leaf area is likely responsible for the relative reduction in leaf tissue water. Additionally in a preference cage study, grape phylloxera (*Daktulosphaira vitifoliae*) motile counts were higher, and gall formation was lower in Si-treated vines as compared with the control treated vines. We postulate that Si-induced leaf rigidity produces sub-optimal environmental conditions for phylloxera development, resulting in the migration to and the development of galls on non-treated tissues. The Si-induced accumulation of anti-herbivory terpenes will be discussed. The mechanism controlling Si-induced leaf rigidity may result from the accumulation of epidermal Si. While Si incorporation is not the sole solution to dehydration or herbivory stress tolerance, it does appear to play a role in ameliorating different types of stress.

Can vertical farming contribute to climate-resilient agriculture in BC? Insights from BC Centre for Agritech Innovation (BCCAI) industry projects. Laila Benkrima | *BC Centre for Agritech Innovation, Simon Fraser University, BC, Canada* • The talk will explore the role of vertical farming as a one of solutions to the climate challenges facing BC agriculture. Drawing on real-world examples from BCCAI-supported projects, I will highlight how Controlled Environment Agriculture (CEA), automation, and data-driven approaches can enhance agricultural resilience and sustainability, while contributing to food security through year-round production in proximity to urban centers.

Collaborative research initiatives for the Canadian berry sector. Eric Gerbrandt | *British Columbia Blueberry Council; Raspberry Industry Development Council; BC Strawberry Growers' Association, BC, Canada* • Canada's blueberry, raspberry, and strawberry industries are geographically diverse with research needs and ongoing initiatives that are either region-specific or of common national interest. In British Columbia (BC), the industry groups representing commercial growers include the BC Blueberry Council (BCBC), Raspberry Industry Development Council (RIDC), and BC Strawberry Growers' Association (BCSGA). These organizations work collaboratively with a network of academic, government, and private researchers to address a range of applied research questions in support of the long-term sustainability of berry production systems in Canada. Key research initiatives include, but are not limited to, berry germplasm development, breeding, and variety trials; entomology, pathology and virology; horticultural, nutritional, and irrigation management practices; and pollination and pollinator health. Facilitating effective and bi-directional knowledge and technology transfer between the industry and the research community is essential to aligning the practical needs of berry farmers with leading-edge scientific research teams. To make the most of resources available for research, continual development of new synergies between scientific disciplines (e.g., molecular genetics with applied breeding), as well as coordinating across provinces, will help to drive innovation for the sector, maintaining the Canadian berry sector's competitiveness in the global marketplace. An overview of the BC berry sector's research initiatives, and highlights of common research priorities across Canadian provinces, will serve as a starting point for discussions about national collaboration in berry research.

1.4 Mitigating abiotic and biotic stress via novel crop management

Chair Dr. Hao Xu

Effect of fungicides on disease incidence and yield of spring cereals at Thunder Bay. Tarlok Singh Sahota | *Lakehead Univrsity ARS, Thunder Bay, ON, Canada* • Field experiments were conducted during 2020-2024, in RCBD replicated 4 times, to study the effect of fungicides (Stratego, Prosaro and Caramba) on the diseases index and yield of spring cereals (wheat, malting barley and oats). Averaged over 2020-2024, diseases index was low (1-2.42 in all crops). Fungicides sprays lowered the index from 2.42 to 0.20-0.25 in wheat, from 1 to 0.11 in malting barley and from 1.85 to 0.15 in oats as compared to the no fungicides sprays. Lowest disease index was recorded with spray of three fungicides (Stratego at tillering, Prosaro at anthesis and Caramba a week later than anthesis). Though spray of two fungicides (Stratego and Prosaro) was equally effective. Fusarium Head Blight index was low (1-2) even without fungicides spray, because of dry years. Grain (4.29 Mg ha^{-1}) and straw (4.64 Mg ha^{-1}) yields were highest in wheat with the spray of Stratego and Prosaro. Highest grain yield (4.46 Mg ha^{-1}) of malting barley was recorded without fungicides spray, while in oats, highest grain (5.88 Mg ha^{-1}) and straw (5.70 Mg ha^{-1}) yields were obtained with the spray of three fungicides. Averaged over fungicides treatments, grain yields were oats (5.29 Mg ha^{-1}) > malting barley (4.14 Mg ha^{-1}) = wheat (4.05 Mg ha^{-1}).

***Interaction of drought and plant growth regulators in oat varieties.** Terence Simbo, Linda Gorim | *Dept. Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB, Canada* • Oat is an important cereal grain in the Canadian Prairies; its production is impacted by abiotic stresses, such as drought and challenges such as lodging. Lodging reduces nutrient uptake, plant vigor, impedes harvesting, and reduces grain yield/quality. Plant growth regulators (PGRs) such as Moddus and Manipulator have been applied to reduce plant height, thereby minimizing cereal lodging risk. Limited information exists on PGR impacts on oats under drought conditions in Western Canada. Therefore, a greenhouse study was conducted at the Plant Growth Facility, University of Alberta, to evaluate the effects of PGRs on oat agronomic parameters, mimicking the droughts of 1988-89 and 2021. The study was conducted in a randomized design with thirty treatments and ten replications per treatment. Moddus and Manipulator were applied at two application timings (BBCH 31-32 and BBCH 37) in two oat varieties: AC Morgan (tall variety) and CS Camden (short variety). Results indicate that there is a significant interaction between PGR treatments, moisture level, and oat varieties. Under fully watered conditions, Manipulator applied at BBCH 31-32 significantly reduced yield in AC Morgan, whereas Moddus significantly increased CS Camden yields and reduced its height at BBCH 37. Under drought conditions, Moddus and Manipulator significantly reduced plant height for AC Morgan at BBCH 31 - 32 and BBCH 37 compared to the control. Moddus and Manipulator had significant effects on yield, plant height, days to flowering, and days to maturity. Moddus could be recommended for use in oats.

***Assessing the role of canopy architecture of wheat (*Triticum aestivum* L.) for drought and heat avoidance.** K. Manawasinghe[1], R. Richards[2], R. Soolanayakanahally[3], M. Bandara[4], K. Tanino[1] | *[1] Dept. Plant Sciences, University of Saskatchewan, Saskatoon, SK, Canada; [2]Commonwealth Scientific and Industrial Research Organisation, Canberra, Australia; [3]AAFC, Saskatoon, SK, Canada; [4] MCB Agric-Research Consulting, Brooks, AB, Canada* • Wheat (*Triticum aestivum* L.) is one of the key staple crops worldwide. While future demand for wheat is expected to rise by 2050, wheat production may decline due to frequent and severe climate extremes such as droughts and heat waves. Canopy architecture plays a crucial role in stress avoidance as well as being important to achieve high yields, with erectophile canopies generally producing a higher yield than planophile ones. This research aims to identify different wheat canopy architectures and related traits that enhance yield under high temperatures, drought, and combined drought and heat stress conditions. This study was conducted in a unique system of 12 field-established, environmentally controlled high tunnels (9 m x 15m each) in a randomized complete block design. Four selected wheat genotypes with different canopy architectures were grown in each tunnel and subjected to four treatments, including control (ambient air temperature with 90% field capacity), drought (ambient air temperature with 25% field capacity), heat (ambient air temperature +12°C with 90% field capacity), and combined drought and heat stress (ambient air temperature +12°C with 25% field capacity) at the pre-anthesis stage. Canopy architecture was graded using the UPOV visual scoring scale, and grain yield was recorded. The highest yield was observed in two erectophile canopies, under controlled conditions (13.21 to 16.74 g $plant^{-1}$), heat stress (10.95 to 10.59 g $plant^{-1}$) and combined stress conditions (10.45 to 9.59 g $plant^{-1}$). Phenological, physiological and ultrastructural traits of high heritability associated with the erectophile canopy architecture will be presented.

***Developing artificial and natural coatings for freezing avoidance in canola.** William Short[1], Kevin Rozwadowski[2], Mark Smith[2], Karen Tanino[1] | *[1]University of Saskatchewan, Saskatoon, SK, Canada; [2]AAFC, Saskatoon, SK, Canada* • Due to climate change, damage from late-spring frosts is expected to rise in the future. One strategy to protect sensitive herbaceous plants from frost is by applying artificial hydrophobic particle films. Hydrophobic films repel liquid water and form a barrier to developing ice crystals, enabling plant tissues to avoid external ice nucleation and supercool. Similarly, plants with superhydrophobic leaf surfaces coated with 3-dimensional epicuticular wax crystals can be protected from short-term freezing events in the spring. In this project, canola seedlings were used to screen the efficacy of multiple hydrophobic coatings, and the hydrophobicity and wax composition of uncoated canola seedling tissues were also investigated. A superhydrophobic fumed silica spray was developed, which was more durable when compared to a previously created hydrophobic calcined kaolin spray and reduced the nucleation temperature by ~4°C under controlled conditions compared to non-coated plants. The silica spray was also successful in delaying nucleation during a natural outdoor fall freezing event, with further spring testing ongoing. Cotyledon tissue was less hydrophobic than first true leaves with altered concentrations and relative percent compositions of many wax components in both the alkane and primary alcohol wax forming pathways. Cotyledons were lacking in branched primary alcohols and their downstream alkyl-ester components compared to leaves. Currently, we are investigating the impact of overexpressing a *bnCER4* gene on wax composition, crystal structure, hydrophobicity, and freezing avoidance in canola seedlings.

***Zeolite-based seed coating as a management tool against Aphanomyces root rot in field pea.** Sonika Pariyar[1], Patsey Michhetti[3], Lingyun Chen[1], Sabine Banniza[2], Linda Gorim[1] | *[1] Dept. Agriculture, Food and Nutritional Science, University of Alberta , Edmonton, AB, Canada; [2] Dept. Plant Science, University of Saskatchewan, Saskatoon, SK, Canada; [3]Kenobie Inc., Calgary, AB, Canada* • Field pea (*Pisum sativum* L.), is an important pulse in Canadian prairie crop rotations. Field peas play a crucial role in nitrogen fixation, and break disease cycles of major crops such as wheat and canola. Field peas is susceptible to root diseases, especially the Pea Root Rot complex (PRRC). Out of the various pathogens involved in PRRC, *Aphanomyces euteiches* Dreches (AE) is a significant threat that can cause up to 70% yield loss in wet years. Despite management strategies such as resistant varieties, seed treatments, and soil amendments, effective control of AE remains challenging due to the disease's complexity. Therefore, this study aims to explore the potential of zeolite, a natural, biodegradable aluminosilicate mineral with potential antifungal properties, as an emerging seed coating strategy for the management of AE in the Canadian prairies. A greenhouse experiment was conducted to screen 67 different zeolite-based seed coatings for AE suppression The impact of seed coatings was assessed based on honey-brown root discoloration, a key symptom of AE infection. Preliminary results indicate that few zeolite seed coatings have shown promising effects, with lower disease severity compared to control. However, the assessment is still ongoing before any conclusion can be made.

2.1 Agricultural sustainability

Chair Dr. Kui Liu

Agricultural Sustainability: What does it mean for Western Canadian agricultural producers and researchers? Maryse Bourgault | *Plant and Soil Sciences Dept., College of Agriculture and Bioresources, University of Saskatchewan* [Invited talk] • Agricultural sustainability has been criticized for being vague, difficult to implement and therefore somewhat meaningless, especially when used as a "buzz word" for policy. However, when the concept of sustainability is thoughtfully defined with the environmental, social and economic dimensions as a means of improving the resilience of the agricultural sector, it provides a comprehensive framework of analysis in a systems approach. During the COVID-19 pandemic, I interviewed 10 agricultural producers in Saskatchewan and used a qualitative data analysis approach to understand their perspectives on what agricultural sustainability means to them and the barriers they perceive to more sustainable production. One of the challenges in conducting these interviews was that producers were generally uncomfortable talking about the concept of sustainability as they feared it might be used against them, by imposing more regulations, more taxes and/or removing tools they currently have access to. These interviews highlighted how producers have to balance the short-term costs of long-term investments in sustainable practices, the expectations of the Canadian public as a "social license to operate" while contributing to global food security, in the context of increasing misinformation, uncertainties about rates of returns, lack of incentives in markets for sustainable or regenerative products, and unclear expectations in the rest of the food supply chain. As researchers in plant and soil sciences, our natural inclination is to look at the environmental sustainability dimension and evaluate if practices are ecologically sound. I will describe briefly how I am trying, in my research program, to integrate more of the social and economic dimensions of agricultural sustainability, particularly in studies related to intercropping, cover crops and winter crops.

Diversifying rotations enhances the resilience of cropping systems. Kui Liu[1], Yu Jia[1], Erica Prins[2], Pedro Ferrari Machado[1], Hongjie Zhang[1], Henry Chau[2], Brian Beres[2], Roland Kroebel[2], Budong Qian[3], Qi Jing[3], Hiroshi Kubota[4], Breanne Tidemann[4], Greg Semach[5], Jeremy Hodges[5], Ramona Mohr[6], Mohammad Khakbazan[6], Yong Min Kim[6], Aaron Glenn[6], Gary Peng[7], Reynald Lemke[7], Shaun Sharpe[7], Jennifer Town[7], Brent Mollison[8], Prabhath Lokuruge[9], Cindy Gampe[9], Sheri Strydhorst[10], Guillermo Hernandez[11], Maryse Bourgault[12] | *[1]AAFC Swift Current, SK; [2] AAFC Lethbridge, AB; [3]AAFC Ottawa, ON; [4]AAFC Lacombe, AB; [5]AAFC Beaverlodge, AB; [6]AAFC Brandon, MB; [7]AAFC Saskatoon, SK; [8]AAFC Melfort, SK, [9]AAFC Scott, SK; [10]RDAR; [11]Universtiy of Alberta, Edmonton, AB, Canada; [12]University of Saskatchewan, Saskatoon, SK, Canada* • Agriculture faces significant challenges due to climate change, necessitating innovative strategies to enhance the resilience of cropping systems. Crop diversification plays a vital role in improving the ecosystem services that underpin the production function of cropping systems, thereby fostering sustainable agriculture. Despite being recognized as a cornerstone of adaptive agricultural practice, crop diversification encounters challenges in the current canola-wheat dominant cropping systems on the Canadian Prairies. Consequently, exploring pathways for diversifying rotations and conducting comprehensive assessments of diversified rotations deserve further investigation. This presentation explores alternative avenues for diversifying the existing cropping systems across different ecozones of the Canadian Prairies. The findings, based on multiple indicators such as production, resource use efficiency, soil health, economic returns, carbon footprint, and resilience, suggest that diversifying cropping systems, particularly through the integration of pulse crops, is an effective strategy for improving the sustainability of cropping systems.

Agronomic performance of long-term integrated conservation management practices under a corn-soybean rotation in Lake Erie Basin. T.Q. Zhang[1] , Y.T. Wang[1], C.S. Tan[1], S.W. Xu[2] | [1]AAFC Harrow Research and Development Center, Harrow, ON, Canada; [2]AAFC Morden Research and Development Center, Morden, MB, Canada • Phosphorus (P) loss from agricultural land has been identified as one of the major causes of harmful algal bloom recurrence in Lake Erie. Three innovative conservation management practices, including P-based manure application, soil legacy P drawdown (i.e. no additional P addition), and controlled drainage with sub-irrigation system (CDS), have shown to be able to reduce runoff P losses from agricultural lands. However, their impacts on crops must be clarified using long-term field experiments for production sustainability, particularly when multiple management practices are integrated. Our study aimed to quantify the long-term integrated effects of these three innovative practices on crop yields and N and P uptake and removal, in comparison with current regular practices. We conducted a 16-yr field experiment in a clay loam

soil with a corn (*Zea mays* L.)-soybean [*Glycine max* (L.) Merr.] rotation. In terms of crop yields and nutrient uptake and removal, the interaction between drainage and soil P management was insignificant. Compared with inorganic fertilizer, solid cattle manure application to meet crop P requirement produced similar corn and soybean yields over 16 years; liquid cattle manure application tended to cause lower corn yields presumably due to low N use efficiency, which, however, did not occur to soybean. From 2008 to 2023, both soil legacy P drawdown and CDS consistently produced similar corn and soybean yields and nutrient uptake and removal, compared with P additions and regular free drainage, respectively. Our results help to develop best management practices to reduce P losses without compromising crop yields.

Profitability of specialty crops in diversified crop rotations in the semi-arid Canadian Prairies. M. Khakbazan[1], M. St. Luce[2], D. Biswas[1], M. Bandara[3], C.M. Geddes[4], K. Liu[2], P. Lokuruge[5], B. McConkey[6] | *[1]AAFC Brandon RDC, Brandon, MB, Canada; [2]AAFC Swift Current RDC, SK, Canada; [3]Alberta Agriculture and Irrigation, Crop Diversification Centre South, Brooks, AB Canada; [4]AAFC Lethbridge RDC, AB, Canada; [5]AAFC Scott Research Farm, SK, Canada; [6]Viresco Solutions, Edmonton, AB, Canada* • The agronomic and environmental benefits of diversified cropping systems have been well documented in the Canadian prairies. However, little is known about the profitability of diversified rotations with oilseeds, cereals, legumes, and specialty crops. This study consisted of two 5-year (2018-2022) experiments carried out at four sites in Saskatchewan and Alberta. Treatments were arranged in a randomized complete block design with four replicates. Net return (NR) was defined as total revenue minus total costs. The results showed that rotations benefited from adding legumes and specialty crops, and more frequencies of specialty crops in rotations enhanced NRs in each individual and across experimental sites. Results showed diversified rotations with Oriental mustard, red lentil, yellow field pea and yellow mustard had higher NR than continuous wheat and wheat with chemical fallow rotations. Moreover, rotations diversified with quinoa, yellow mustard, field pea and wheat showed high NR across all sites. Wheat after chemical fallow in the wheat with chemical fallow rotation (wheat-wheat-chemical fallow-wheat-wheat) had high NR; however, this did not compensate for the loss of NR in the chemical fallow phase, resulting in the lowest NR. The inclusion of industrial, oriental, and yellow mustard in rotations with wheat and field pea decreased nitrogen cost by 30% compared to a continuous wheat rotation, concluding that such rotations not only improved NRs but also showed a significant reduction in nitrogen requirement costs.

Prospects for double cropping soybeans in Ontario: The impact of maturity genotype on soybean agronomic traits. J. Larsen[1], B. Samanfar[2], E. Page[1], C. Drury[1], R. Kroebel[3], E. Cober[2] | *[1]AAFC Harrow RDC, Harrow, Ontario, Canada; [2]AAFC Ottawa RDC, Ottawa, Ontario, Canada; [3]AAFC Lethbridge RDC, Lethbridge, Alberta, Canada* • Double cropping soybeans involves planting soybeans after harvesting a previous crop—typically winter wheat or barley—within the same growing season. While uncommon in Canada, climate models suggest a high potential for successful double cropping in the southern Great Lakes Region in the near future. A panel of 23 soybean near-isogenic lines, containing six maturity genes and one growth habit gene, was previously developed at AAFC-Ottawa. For this experiment, the panel was evaluated along with maturity group adapted check varieties under normal and late (post-winter cereal harvest) planting dates at Harrow, London, and Ottawa, ON, to assess the effects of genotype and planting date on agronomic traits. Early planted trials yielded significantly more than late-planted ones. Growing season length impacted late planted trials leading to an inverse ordering of near isogenic line yield performance between Harrow and the other sites. When dissected further, growth habit influenced yield outcomes with determinate lines yielding less than indeterminate ones at Harrow, performed similarly at London, and outyielded them at Ottawa. Late planting increased protein content but reduced seed size. Relationships with specific maturity genes will be discussed and related to future double crop soybean cultivar development goals.

***Assessing seed characteristics of lentils for successful late fall seeding.** Prerana Upretee[1], Manjula Bandara[2], Lawrence V Gusta[1], Kenneth J. Kirkland[3], Maryse Bourgault[1], Yongfeng Ai[4], Randy W. Purves[5], Jarvis A. Stobbs[6], Karen K. Tanino[1] | *[1] Dept. Plant Sciences, University of Saskatchewan; [2]MCB Agric-Research Consulting, Brooks, AB, Canada; [3](Retired) AAFC, Scott, SK, Canada; [4] Dept. Food and Bioproduct Sciences, University of Saskatchewan, Saskatoon, SK, Canada; [5]Centre for Veterinary Drug Residues, Canadian Food Inspection Agency, Saskatoon, SK, Canada; [6]Canadian Light Source Inc., Saskatoon, SK, Canada* • Fall-dormant seeding (seeding before the soil freeze-up) can offer prominent benefits over spring seeding, including early crop maturity, increased grain yield, and reduced frost-damaged risk. However, this practice has not yet been adopted due to the failure of the crop establishment in the following spring. This study aims to identify the key factors affecting the loss of freezing tolerance of seeds. Several experiments were conducted considering lentil (*Lens culinaris* Medik.) as a model system due to its inherent variation in seed characteristics such as seed size, cotyledon and seed coat colour. Water uptake rate under cool (+2°C) temperatures were assessed for 38 lentil genotypes. Seed characteristics such as Thousand Seed Weight (TSW), surface area, volume, seed coat thickness, starch content, protein content and phenolic compounds in the seed coat were assessed. Water uptake rate was positively and linearly related to TSW, seed surface area, volume and starch content, whereas it was negatively correlated with protein content. Freezing tests were conducted to determine seed freezing tolerance (LT_{50} and LD_{50}). Imbibed seeds had lower germination rates than non-imbibed seeds, indicating water uptake is a significant factor in the loss of freezing tolerance of seeds. While the link between water uptake and freezing tolerance is related to seed surface area, volume, and biochemical composition in lentils, we are further investigating how water uptake is regulated at anatomical levels. In the long term, this research may help shift the spring planting to fall, potentially transforming crop production on the Canadian prairies.

***Effect of cover cropping on subsequent wheat and canola production in semi-arid Western Canada.** J.K Odiketa[1], M. Bourgault[1], L. Gorim[2], M. Hailu[2], Y. Lawley[3], J. Gawiak[3] | *[1] Dept. Plant Science, University of Saskatchewan, Saskatoon, SK, Canada, [2] Dept. Agricultural, Food and Nutritional Sciences, University of Alberta, Edmonton, AB, Canada; [3] Dept. Plant Science, University of Manitoba, Winnipeg, MB, Canada* • The integration of cover crops is gaining attention as a sustainable way of diversifying cropping systems in semi-arid Western Canada. In theory, cover crops can suppress weeds, control erosion, increase water infiltration and fix nitrogen when legumes are introduced. However, the wide adoption of cover crops in Western Canada is hampered by producers' lack of knowledge about appropriate species and their agronomic management with major cash crops. In particular, given that the region is water-limited, there are concerns that cover crops may reduce the subsequent cash crop yield. To ascertain the impact of cover

cropping in semi-arid Western Canada, two experiments were set up in two-year sequences of wheat-canola and canola-wheat in Saskatchewan, Alberta, and Manitoba to assess the effect of previous cover crop establishment methods and species on the following cash crops. The experiment was performed in 2022-2023 and repeated in 2023-2024. The experimental design is a split-plot design with 4 establishment methods (broadcast pre-plant, drilled with main crop, broadcast mid-season, and drilled after harvest) as the main plot, and 5 cover crop treatments (alfalfa, overwintering clovers, annual clovers, phacelia (in wheat)/Italian ryegrass (in canola), and control plots without cover crops) as the subplot treatments. Previous annual clovers, Italian ryegrass and phacelia did not affect or reduce the following wheat or canola yield in both sequences. Alfalfa broadcast before previous cash crop consistently reduced the following cash crop yield. Overwintering clovers seeded after previous canola harvest hold a high potential in benefitting the following crop yield.

***Compatibility of cicer milkvetch with alfalfa: germination response, establishment success, and yield across Western Canada.** S. Tandekar[1], B. Biligetu[1], A. Alemu[2], B.M. Kelln[1], H. Poudel[3] | *[1] Dept. Plant Sciences, University of Saskatchewan, Saskatoon, SK, Canada; [2]AAFC Swift Current RDC, Swift Current, SK, Canada; [3]AAFC Lethbridge RDC, Lethbridge, AB, Canada* • Cicer milkvetch (CMV, *Astragalus cicer* L.) is a resilient forage legume known for its abiotic stress tolerance and excellent fall growth in temperate regions. However, its use is limited due to lower dry matter yield (DMY) compared to alfalfa (*Medicago sativa* L.) and establishment challenges due to seed dormancy. In addition, alfalfa has been reported to exhibit allelopathic effects on CMV. Therefore, this study aimed to explore the compatibility of CMV with alfalfa through germination tests, greenhouse and multi-location field experiments. Twenty diverse CMV population were screened for germination and seedling morphology after treating with alfalfa root extracts (ARE) in the greenhouse. ARE treatment significantly reduced germination and biomass yield across all CMV populations, with minimal genetic variability. In field experiment across three western Canadian ecological zones, 2 alfalfa and 5 CMV populations were mixed at 50% recommended seeding rate using same, alternate, and cross-row seeding methods. The plant count of CMV ranged from 37 to 49% in the establishment year across all locations and seeding methods. However, in the first cut of the first production year, CMV composition declined significantly to below 20%, on average. CMV populations had higher composition with alfalfa cv. AC Yellowhead compared to AC Blue J which compromised the DMY. Alternate-row seeding increased CMV composition in most mixture combinations at Clavet and Swift Current, while cross-row seeding performed better at Lethbridge. Notably, the two new experimental CMV populations, LRC04-4051 and LRC06-3973 had higher proportion and comparable DMY in mixtures, suggesting their potential in breeding programs.

2.2 Genetics and breeding in wheat and cereal crops

Chairs Drs. G. Singh Brar & H. Randhawa

The plasticity of root traits and their effects on crop yield and yield stability. Rodriguez D., Zhao D., de Voil P | *Centre for Crop Sciences, Queensland Alliance for Agriculture and Food Innovation (QAAFI) The University of Queensland, Gatton, Australia* [Invited talk] • Given that globally food production is mainly limited by water availability, it is somewhat perplexing how little we know about the rooting system, the most critical plant organ to access soil water and nutrients. Root phenotypic plasticity can be a valuable adaptation strategy for coping with environmental heterogeneity [1]. With a perspective of phenotypic plasticity, we focus on functional root traits associated to water uptake in field-grown crops to answer: (i) How do genetic (G), environmental (E) and management (M) factors and their interactions affect the root traits? and (ii) How do root traits and their plasticity affect yield and yield stability? We developed and applied a new high-throughput functional root phenotyping approach to quantify two root traits, maximum rooting depth and a root activity index in GxExM trials. There was a hierarchy of plasticities for the different traits studied i.e., grain number traits > root traits > grain weight traits. The plasticity of root traits was associated with the stability of grain yield traits. Hybrids with high root plasticity tend to have more stable grain numbers and grain weights. There is valuable genetic diversity in the mean value and plasticity of root traits that could be used to match root phenotypes to target production environments. Our root phenotyping approach can be a valuable tool for understanding the dynamic interactions between root function, root architecture and yield traits in the field under variable environments. Reference: Zhao et al. https://doi.org/10.1007/s11104-024-07185-6

Utilizing Watkins wheat landrace diversity in Canadian hard red spring wheat breeding. Gurcharn Singh Brar | *University of Alberta, Edmonton, AB, Canada* • [No abstract available]

Integrating statistical and machine learning models to uncover genetic architecture of leaf spot resistance in wheat. R. Dhariwal[1], I. Ciechanowska[2], M. Zid[1], G. S. Brar[2], R. Aboukhaddour[1], H. S. Randhawa[1] | *[1]AAFC Lethbridge RDC, Lethbridge, Alberta, Canada; [2]Faculty of Agricultural, Life and Environmental Sci - Ag, Food & Nutri Sci Dept, Edmonton, Alberta, Canada* • Leaf spot diseases, including tan spot and Septoria blotch complex, significantly threaten wheat production in western Canada, causing significant yield losses. To enhance resistance breeding, a genome-wide association study (GWAS) was conducted on a large diverse germplasm panel of hexaploid spring wheat accessions from AAFC-Lethbridge, University of Alberta, and CIMMYT. Phenotyping for disease severity was performed in replicated trials (2022–2024) under artificial inoculation in field and greenhouse settings. The panel was genotyped using the Illumina 90K Infinium iSelect assay to obtain genome-wide single-nucleotide polymorphism (SNP) marker coverage, with data analyzed using Genome Studio and R, incorporating imputation and population structure control. Multiple multi-locus GWAS models (MLM, CMLM, ECMLM, MLMM, FarmCPU, GLM, BLINK, SUPER) and machine learning models (Ridge, LASSO, Elastic Net, Random Forest and XGboost) identified several important marker-trait associations across wheat chromosomes. The findings provide robust SNPs for conversion

to breeder-friendly KASP markers, facilitating marker-assisted selection in resistance breeding. This integrated approach enhances the identification of resistance genes, supporting sustainable wheat production.

Dissecting wheat yield stability: QTL mapping and G×E Interaction in spring wheat across diverse Canadian environments. Anjan Neupane, Xuelian Wang, Richard Cuthbert, Ron Knox, Santosh Kumar, Colin Hiebert, Andrew Burt | *AAFC, Ottawa, ON, Canada* • A spring wheat double haploid population was evaluated in yield trials across three Canadian locations over three growing seasons. Agronomic data were analyzed to investigate genotype-by-environment (G × E) interactions and assess yield stability. Stability analyses revealed strong correlations among multiple stability indices, while advanced visualization tools—such as AMMI and GGE biplots—provided detailed insights into the complexity of G × E interactions. Simultaneously, SNP-based genotypic data were employed to identify quantitative trait loci (QTL) associated with key agronomic traits and yield stability. Several major QTL were consistently detected across multiple environments. These findings enhance our understanding of the genetic and environmental factors influencing grain yield and stability, offering valuable insights for the continued advancement of wheat breeding under diverse growing conditions.

Flowering in intermediate wheatgrass: Flowering components and controls, and does flowering limit seed production as stands age? D.J. Cattani, A. Slama | *Dept. Plant Science, University of Manitoba, Winnipeg, MB, Canada* • The ability of intermediate wheatgrass to perform as a long-term perennial grain has been noted, in general, to be limited by decreased yields after the second production year, although some recent reports offer more encouraging results. What controls flowering? Is flowering restricting grain yield as stands age? Flowering is the result of the interaction of plant growth and development with the growth environment. Post-harvest regrowth coupled with plant growth and development the following spring provides the yield potential of the crop. This talk will explore potential relationships between the growth environment and the realization of reproductive potential.

***The impact of breeding selection on cereal root traits over time.** Suman Bagale, Linda Gorim | *Dept. Agricultural, Food and Nutritional Sciences, University of Alberta, Edmonton, AB, Canada* • Canadian Prairie cereal breeding programs annually release superior and highly adaptive varieties with good grain yield, plant standability, nitrogen use efficiency, and drought tolerance. Most new varieties released incorporate favorable traits from either old varieties or their wild relatives. However, information on how breeding selection impacts root traits over time is still lacking. We conducted a greenhouse experiment at the Plant Growth Facility, University of Alberta, aimed at evaluating the root traits of current and old barley and winter wheat cultivars/genotypes. Plants were grown in transparent Rhizoboxes laid out in a completely randomized design, replicated four times, and the experiment was repeated twice. Destructive sampling of roots was done at 28 days at the stem elongation stage. Roots were scanned and analyzed using WinRHIZOTM Pro software for root traits, and the proportion of root length in different root diameter classes. All current barley cultivars (AB Standswell, AB Advantage, and AAC Synergy) sharing a pedigree with Bonanza, had similar root traits except for AAC Synergy which had total root length that was significantly lower. This implies that breeding selection had a limited effect on the root traits of current barley cultivars. However, Bonanza had a significantly higher proportion of roots in the small diameter class, a trait important for foraging moisture and nutrients. On the other hand, the old and current winter wheat genotypes had similar root traits and root diameter class distribution.

***Short Interspersed Nuclear Element: Potential marker for screening wheat germplasm against pre-harvest sprouting.** Purnima Kandpal[1], Karminderbir Kaur[1], Raman Dhariwal[2], Harpinder Randhawa[2], Jaswinder Singh[1] | *[1]Plant Science Dept., McGill University, Montreal, QC, Canada; [2]AAFC Lethbridge RDC, Lethbridge, AB, Canada* • Pre-harvest sprouting (PHS) causes substantial losses to yield and quality of wheat due to unwarranted rains during harvest season. The changing climate scenario predicts intensified PHS events. Limited success of extensive breeding and genetic interventions, coupled with emerging evidence supporting the role of epigenetic pathways—particularly RNA-directed DNA methylation (RdDM) mediated by Argonaute (AGO) proteins—in regulating seed dormancy and PHS tolerance, underscores the necessity of investigating alternative regulatory mechanisms in wheat. In the present study, we investigated the role of the *TaAGO802*B gene in PHS tolerance, focusing on the presence of a short interspersed nuclear element (SINE) retrotransposon insertion within its 3'UTR. The study of 41 wheat cultivars indicated a strong association between SINE and PHS tolerance. SINE-insertion was present in 73.2% of the total panel and 92.6% of the PHS-tolerant cultivars. The presence of the insertion reduced the *TaAGO802* expression by 73.3% and lowered the global DNA methylation levels by 54.7% than insertion-absent cultivars. Further, a significant positive correlation was observed between methylation levels and PHS score. This suggests a possible silencing effect of SINE-insertion. The SINE element might be functioning as a cis-regulatory sequence disrupting RdDM-mediated methylation, thereby modulating *AGO802B* expression and contributing to dormancy regulation. Further, the genotypic analysis of a DH population (Sadash × P2711) supported the hypothesis that the SINE insertion co-segregates with PHS resistance. Thus, our findings identify the SINE insertion in *TaAGO802B* as both a putative epigenetic regulator and a potential marker for screening wheat germplasm and developing PHS-tolerant cultivars.

***High spikelet number gene in wild wheat, *Aegilops tauschii*, delays flowering time and may be controlled by a protein with sucrolytic activity.** J.A. Hubensky, S. Holden., M. Li, G.S. Brar | *Cereal Breeding Lab, Dept. Agriculture, Food and Nutritional Sciences, University of Alberta, Edmonton, Alberta, Canada* • Rising populations demand increased crop yields, while environmental challenges demand improved drought resilience. A spikelet number-enhancing trait identified in *Aegilops tauschii* through a previous GWAS offers potential for wheat yield improvement. This trait was initially linked to a trehalose-6-phosphate phosphatase (TPP), a protein involved in sucrose signaling, plant development and abiotic stress responses. Using RNA-Seq, we examined TPP expression across spike development and in maturing spikes under drought and well-watered conditions. TPP showed significantly higher expression in spikes than in leaves, suggesting a sink-oriented role. Under drought, TPP levels changed up to 16-fold compared to well-watered controls. The genotype carrying the high-spikelet trait exhibited a >40% increase in spikelet count, along with

~30 days of delayed flowering and, under drought, fewer emerged spikes. Notably, a poorly characterized gene with sucrolytic activity, located adjacent to TPP on chromosome 1D, is now suspected to underlie the trait. This gene carries a glutamate-to-lysine (E→K) substitution in a putative kinase domain, while TPP showed no clear genetic or expressional changes. However, the sucrolytic gene may interact with TPP to regulate spikelet development. TPP and associated genes' role in plant development continues to emerge. The spikelet trait is one that can be used by breeders to provide yield benefits, for researchers to understand yield component compensation, and flexibility for producers in selecting for high potential yields or for flowering time and expected water availability during late-season maturation.

2.3 Expanding trait innovation from genome to phenome

Chair Dr. Letitia Da Ros

***Malus* genomic resources for trait and candidate gene discovery.** Anze Svara | *College of Agriculture and Bioresources, University of Saskatchewan, Saskatoon, SK, Canada* [Invited talk] • The development of genomic resources for apple (*Malus domestica*) and its wild relatives has advanced association studies linking specific traits with genetic loci and alleles. Chromosome-level assemblies have enabled the discovery of novel candidate genes for quality traits and evolutionary adaptation, and the construction of pangenomes to capture genetic diversity among different Malus species. However, genomes of accessions demonstrating disease resistance and environmental adaptation remain limited. We have sequenced and assembled the genomes of scab-resistant accessions such as 'Antonovka' 172670B and 'Honeycrisp', along with the native North American species *M. coronaria* and *M. ioensis*. These assemblies allowed us to identify novel candidate genes for scab resistance and develop a family-based pangenome of North American species. Specifically, two candidate genes in 'Antonovka' homologous to the scab resistance genes HcrVf2 and HcrVf1 were discovered on linkage group 1 of haplome 1. These homologs exhibit over 95% identity and coverage with HcrVf, possess minor changes in protein motifs, and are not identical by state with HcrVf. Importantly, they show enhanced expression upon inoculation with the *Venturia inaequalis* pathogen. The gene family-based pangenome of North American *Malus* identified 60,211 orthogroups containing 340,087 genes. Core genes, involved in basic cellular and metabolic processes, growth, and development, are essential for the existence of these species. In contrast, accessory genes, involved in secondary metabolism, stress response, and interactions with other organisms, are likely associated with adaptation to specific environments. These studies provide novel genomic resources for different *Malus* species, which can be utilized to identify and validate genes for apple breeding and to understand their roles in disease resistance, environmental adaptation, and evolution during domestication.

Refining of reference genome assemblies in sweet cherry. L. Da Ros, P. Wiersma, A. Singh | *AAFC Summerland RDC, Summerland, BC, Canada* • The sweet cherry genome was first sequenced in 2017 and since that time there have been significant advancements in sequencing technologies. This has led to reductions in the cost of sequencing whole genomes in addition to improvements in the quality of assemblies from the resulting data. The caveat being that assembly, particularly of short read data, is highly dependent on the availability of a high-quality reference genome and its associated annotations. Here we present a new reference genome assembly for sweet cherry using the Canadian cultivar 'Staccato'. The combination of PacBio long read sequences, to assemble highly repetitive regions, and Omni-C short read data, for insight into chromatin structure, resulted in newly mapped centromeric and telomeric regions as well as a redistribution of genes across the eight sweet cherry chromosomes. In addition, the high-quality and contiguity of the resulting genome was key to the recent success in protecting Canadian sweet cherry cultivars from infringement in the US. Existing reference genomes were further compared to the Staccato reference to assess differences in structural variants and chromosome organization in order to guide the usage of the various reference genomes in downstream genomic applications.

Development a dedicated Hop (*Humulus lupulus*) genotyping platform to accelerate new Hop variety development. G.C. McCarthy, K.A. Heron, G.J. Samera, K. Saulog, C.J. Grassa, P.J. Adams, M.M. Schuetz | *Kwantlen Polytechnic University, Surrey, BC, Canada* • Hops (*Humulus lupulus*) are dioecious flowering plants that are grown predominantly for use in beer production. Female hop flowers develop glandular trichomes that primarily accumulate the sought-after bitter acids, as well as aromatic essential oils such as terpenoids. The traditional hop production regions (e.g. Germany and USA) are being impacted by climate change and thus new climate change resilient hop varieties are needed. However, hop variety development is slow, and it can take 15-20 years for the development of a new variety. In 2019, the Applied Genomics Center (AGC) at Kwantlen Polytechnic University established a hop variety development program in partnership with the British Columbia Hop Growers Association and their members. To enable a genomics-assisted breeding strategy and expedite hop variety development process, we sequenced 50 hop accessions which served as the parental lines for the breeding population. We identified over 100 million SNPs amongst the 50 sequenced varieties and a final set of 11K SNPs were selected to produce a custom hop genotyping array. Concurrently, a 350-member mapping population was established to associate genetic markers with specific phenotypic traits. Our initial application of the platform successfully identified genetic markers, and likely the causative gene, associated with a chlorophyll deficient (yellow leaf) phenotype segregating in the mapping population. This validates the utility of our custom SNP array to identify genetic markers associated with specific phenotypes. Furthermore, genome-wide association studies (GWAS) are underway to identify additional SNPs linked to key agronomic and hop quality traits.

Ploidy engineering in *Cannabis sativa*. M. Jafari, N. Paul, M. Hesami, A.M. P. Jones | *Dept. Plant Agriculture, University of Guelph, Guelph, ON, Canada* • Ploidy manipulation presents a promising approach for enhancing the morphological and physiological traits of *Cannabis sativa*. In this study, a range of polyploid and aneuploid cytotypes were generated through antimitotic treatments, resulting in the successful establishment of tetraploid and

triploid plants, as well as aneuploid individuals exhibiting either chromosomal loss or chromosomal gains. Comprehensive characterization was carried out during both the vegetative and flowering stages. In the vegetative phase, physiological performance was evaluated using key indicators such as the quantum yield of photosystem II (phiPSII), electron transport rate (ETR), stomatal conductance (gs), and relative chlorophyll content. These traits provided insights into the functional consequences of altered genomic content on photosynthetic efficiency and overall plant physiology. During the flowering stage, morphological evaluation focused on reproductive structures, particularly trichomes, which play a pivotal role in cannabinoid biosynthesis. Distinct trichome morphotypes were documented and characterized across the different ploidy levels, offering valuable information on the relationship between genome dosage and epidermal differentiation. Furthermore, clear variations in plant architecture were observed among the ploidy types. Aneuploid plants with additional chromosomes displayed a compact growth habit characterized by shorter internodes and increased branching. In contrast, triploid individuals and aneuploids with chromosomal deletions exhibited a more elongated phenotype with greater apical dominance. These findings suggest that ploidy alterations can modulate plant form and development in a genotype-dependent manner, providing new opportunities for targeted crop improvement and the study of genome dosage effects in a commercially and medicinally important species.

Genome-wide association studies identify predictive markers for fruit quality in apple. Z. Migicovsky[1], C. Elzinga[1], B. Hewens-Higgins[1], M. Li[2], T. Davies[3], T. Soomro[3], S. Myles[3] | *[1] Dept. Biology, Acadia University, Wolfville, NS, Canada; [2]Donald Danforth Plant Science Center, St. Louis, MO, USA; [3] Dept. Plant, Food, and Environmental Sciences, Faculty of Agriculture, Dalhousie University, Truro, NS, Canada* • Apples are one of the most economically important fruit crops in Canada. The majority of apples are consumed fresh and consumer preferences for appearance and flavour play a critical role in commercial success. As a result, fruit quality is a primary focus in breeding new cultivars. However, due to a lengthy juvenile phase, selecting for apples with desirable fruit quality is a time-consuming and expensive process. Marker-assisted selection (MAS) allows for early selection of traits based on predictive markers and can be used to improve the efficiency of apple breeding. To identify markers for MAS, we examined fruit quality traits using Canada's Apple Biodiversity Collection. We used a high-throughput image analysis pipeline to quantify variation in 18 colour traits using over 12,000 photographs taken across more than 500 unique apple accessions. In addition to appearance, flavour—of which aroma is an important component—is critical to fruit quality. To quantify this, over 100 aroma compounds were measured. Initially, genome-wide association studies (GWAS) were performed using over 250,000 genetic markers, revealing numerous large-effect loci associated with these key fruit quality traits. More recently, we have performed whole genome sequencing and identified over 20 million markers. The increased marker density has improved the resolution of genetic mapping using GWAS and revealed new loci. Ultimately, these results provide a foundation for the identification of predictive markers that could be leveraged for MAS, improving the efficiency and accuracy of developing new apple cultivars with desirable fruit quality.

***Genome-wide association studies to unravel the control of fruit color and anthocyanin content in red raspberry.** C. Baldassi[1], E. González Segovia[2], L. Rieseberg[2], S. D. Castellarin[1], M. Dossett[3] | *[1]Wine Research Center, Faculty of Land and Food Systems, University of British Columbia; [2] Dept. Botany, University of British Columbia, Vancouver, BC, Canada; [3]BC Berry Cultivar Development Inc., Abbotsford, BC, Canada* • Red raspberry fruit color, primarily conferred by anthocyanins, is a critical trait in determining consumer preference. Knowledge on the genetics of raspberry fruit pigmentation would be valuable for breeding programs, but to date the genetic control of color remains elusive. The present study aims to map the genetic regions underlying the red shades of raspberry fruit through genome-wide association studies (GWAS). Fruits from 765 red raspberry genotypes were harvested over five seasons and analyzed for color and total anthocyanin content. Color coordinate L*, representing lightness, averaged 21.71, and total anthocyanin content averaged 50 mg cyanidin-3-O-glucoside equivalents/100 g fresh weight. Leaves from all genotypes were used for genomic DNA extraction. Whole-genome sequencing of DNA samples was conducted with Illumina technology. Sequences were aligned to the 'Malling Jewel' reference genome and were processed for the detection of single nucleotide polymorphisms (SNPs). The GAPIT toolkit was used to perform the association between phenotypic and genotypic data, by fitting linear mixed models accounting for population structure. The GWAS conducted on total anthocyanins found significant SNPs on chromosomes 1 and 4. The GWAS conducted on L* highlighted multiple significant SNPs across chromosomes, but the signals were stronger on chromosomes 1 and 4. Genes associated with the phenylpropanoid and flavonoid pathways were found in correspondence of the SNPs significantly associated with total anthocyanins and lightness. The results of this study will be valuable for the future development of molecular markers to facilitate the development of raspberry cultivars with desired fruit color.

***Chemically profiling the mysterious colour polymorphism in salmonberries (*Rubus spectabilis* Pursh.).** M.Z. Fenniri[1,2], C. Baldassi[2], A. Jamaldin[1], A. Rosado[1], S.D. Castellarin[2], M. Todesco[1] | *[1] Dept. Botany, University of British Columbia; [2]Wine Research Centre, Faculty of Land and Food Systems, University of British Columbia, Vancouver, BC, Canada* • Salmonberries are a close relative of the red raspberry (*Rubus idaeus* L.) native to the Pacific Northwest. When fully ripe, salmonberries naturally occur in two colours: red and orange, even within the same population (although plants will produce either uniquely red or uniquely orange fruit). The profiles of the pigments across the two morphs, much less the genetic mechanisms underlying them, are unknown. Red raspberries lend their red colouration to an abundance of anthocyanins present in the flesh, with these red pigments obscuring the yellow-orange colouration of co-occurring carotenoids. Similarly, the lack of red colouration in yellow raspberries is attributed to a partial or complete absence of anthocyanins, revealing the underlying yellow-orange colours of the carotenoids. Using raspberries as a model for salmonberries, we hypothesize that red salmonberries are richer in anthocyanins than orange salmonberries, and that carotenoids are present in both salmonberry morphs but that they provide orange salmonberries with their characteristic colouration. In this work, we first perform colourimetric analyses on the red and orange salmonberries to quantify their colours (and how different they appear to the naked eye), followed by total anthocyanin and phenolic analyses, then anthocyanin and carotenoid profiling by HPLC-QTOF. Immediately, see that the metabolite profiles across both salmonberries differ significantly; for instance, red salmonberries are indeed richer in anthocyanins than their orange counterparts. This profiling work was performed in collaboration with C. Baldassi and will be coupled with PoolSeq analyses performed by A. Jamaldin, shedding light onto the genetics underpinning this fascinating, stable polymorphism.

Optimizing apple juiciness measurement: Instrumental methods aligned with sensory perception. M. Bejaei | *AAFC Summerland RDC, Summerland, BC, Canada* • Instrumental measurements have long been used to evaluate fruit textural quality. However, accurately determining juiciness in apple fruit, as correlated with sensory perception, has remained challenging. Experiments at the Sensory Evaluation and Consumer Research Program led to the development of two juiciness assessment methods: Expressed Juice (EJ) and Kramer-Shear Cell (KS). The TA.XTplus Texture Analyzer was utilized in both methods. The EJ method considered absorption material, apple tissue shape and size, compression speed, rates, and hold time. The five-blade KS method was developed considering appropriate apple tissue dimensions, slicing techniques, percent strain setting, holding time, and tissue amount for complete juice absorption. To evaluate the two methods in relation to sensory juiciness perception, a study was conducted with nine apple varieties (Royal Gala, McIntosh, Ambrosia, Golden Delicious, Aurora Golden Gala, Spartan, Red Delicious, Fuji, and Pink Lady). Both EJ and KS methods were applied (on n = 10 fruits per variety) alongside textural sensory panel evaluations (juiciness, crispness, hardness, and skin toughness attributes), using triplicate replications. Results indicated a strong correlation between the percent juice released from the EJ and KS methods and the sensory juiciness attribute (R^2 = 73% and R^2 = 80%, respectively). In a follow-up project to optimize the KS method, 11 apple varieties (Ambrosia, Aurora Golden Gala, Golden Delicious, Granny Smith, Honeycrisp, Royal Gala, Salish, and four unnamed new varieties) were tested, and the standard operating protocol was improved to reduce sample variation and control for fruit mass and sample height.

2.4 Soil BMPs in agricultural systems

Chair Dr. Yunfei Jiang

Effects of enhanced efficiency nitrogen fertilizers on the agronomic and environmental performance of grain corn. B. Lynds[1], D. Burton[1], N. McLean[1], R. Lumactud[1], D. MacEachern[2], Y. Jiang[1] | *[1] Dept. Plant, Food, and Environmental Sciences, Faculty of Agriculture, Dalhousie University, Truro, NS, Canada; [2]Charlottetown RDC, AAFC, Charlottetown, PEI, Canada* • Proper nutrient management is crucial for high yields, economic viability and environmental sustainability in agriculture. Nitrogen fertilizers enhance grain corn yields, but excess application can lead to N loss. Enhanced efficiency nitrogen fertilizers (EENFs) could mitigate this loss, but their effects on grain yields, quality, and the environment in Maritime Canada is under-researched. This study investigated the effects of EENFs on the agronomic and environmental performance of grain corn at three sites in the Canadian Maritimes, through four main comparisons: urea vs. EENFs, reduced vs. standard application rate, split vs. single applications, and EENFs applied alone vs. mixed with urea. Urea acted as a control, while three EENFs (PurYield™, SuperU®, and EENF_X) were evaluated. Results suggest PurYield™ and SuperU® can replace urea at a standard application rate without yield penalty, while EENF_X may cause a marginal yield reduction. PurYield™ reduced N_2O emissions marginally compared to urea, but EENF_X exacerbated post-harvest soil NO_3- N concentrations compared to all other fertilizers. PurYield™ maintained yields at a reduced rate of 100 kg N ha^{-1} while SuperU® reduced Truro-2023 yields at this rate. An application rate of 75 kg N ha^{-1} presented marginal yield reductions for both PurYield™ and SuperU®. Various application rates of EENF_X show no significant effect on yields. PurYield™ and SuperU® reduced N_2O emissions at a rate of 100 kg N ha^{-1} compared to standard rates at Truro-2023 and Truro-2024 respectively. SuperU® showed marginally lower yields for a single application at Truro-2023, but otherwise, there were no yield or environmental differences between single and split applications. Mixing EENFs with urea showed no yield differences compared to applying EENFs or urea alone, but urea had higher N_2O emissions than all treatments containing EENFs at Truro-2024, and higher NO_3- N concentrations than certain EENFs in some cases, although results were inconsistent. These findings provide farmers with recommendations on fertilizer products and management techniques to reduce environmental impact while maintaining grain yield, quality, and profitability, thereby enhancing agricultural sustainability.

Assessing long-term cover cropping effect on in-season nitrogen status of soil and grain corn. Y. Peng, P. Musayidizi, L.L. Van Eerd | *School of Environmental Sciences, University of Guelph, Ridgetown Campus, Ridgetown, ON, Canada* • Cover crops (CC) play an increasingly important role in improving nitrogen (N) cycling. Yet, the long-term CC effect on in-season nitrogen (N) cycling in grain corn (*Zea mays* L.) is unclear. We employed two long-term CC experiments established in 2007 and repeated in 2008 at Ridgetown, Ontario, where CC were annually used in a horticulture-grain system. The CC treatments were no CC control (NOCC), oat, winter cereal rye, radish, and a mixture of radish and rye, with four replications. This study was conducted from 2020 to 2023, including four site-years of grain corn grown without N fertilizer applied. We (1) assessed the effect of long-term CC on N status in the corn growing season using the optical sensor (SPAD: soil plant analysis development; NDVI: GreenSeeker normalized difference vegetation index), plant analysis (corn height and N content), and soil analysis (soil mineral N and soil moisture); and (2) quantified the effectiveness of these attributes to predict corn grain yield, using Structural After Measurement approach. Generally, optical sensor readings and plant sample analysis showed greater in-season N uptake by corn with long-term CC at V6 and onwards, compared to NOCC. Moreover, long-term CC had a greater 4-yr average corn grain yield (up to 43%) with less year-to-year variability than NOCC. Our robust evidence confirmed that long-term use of CC is a promising management strategy for improving N cycling and crop productivity.

Humalite enhances soil nitrogen supply and promotes plant nutrient uptake and assimilation leading to improved yield and oil content in canola. P. Rathor, L.Y. Gorim, G. Chen, M.S. Thilakarathna | *Dept. Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB Canada* • Over the last half-century, the widespread use of synthetic chemical fertilizers has boosted crop yields but caused considerable environmental damage. In recent years, the application of humic substances to enhance plant growth and crop yield has garnered considerable interest, primarily due to their organic origin and ability to minimize nutrient losses while improving plant nutrient use efficiency. Humalite, found exclusively in large deposits in southern Alberta, Canada, is rich in humic substances and contains low levels of unwanted ash and heavy metals, making it particularly valuable for agricultural applications. However, its effects on canola, the largest oilseed crop in Canada, have yet to be evaluated. This

study investigated the effects of five Humalite rates (0, 200, 400, 800, and 1600 kg ha^{-1}) in combination with nitrogen, phosphorus, and potassium (NPK) applied at recommended levels, on canola growth, soil nitrogen availability, plant nutrient uptake, photosynthesis, seed yield, seed oil content, and nitrogen use efficiency under controlled environmental conditions. The results demonstrated that Humalite application significantly enhanced soil nitrogen availability, macro- and micronutrient uptake (N, P, K, S, Mg, Mn, B, Fe and Zn), shoot and root biomass, net photosynthesis, and water use efficiency as compared to the NPK alone treatment. Moreover, the application of Humalite also resulted in increased seed yield, seed oil content, and nitrogen use efficiency. Overall, Humalite could serve as an effective organic soil amendment to enhance canola growth and yield while improving fertilizer use efficiency.

Impacts of BMPs on crop yield and soil nutrients availability: Results from a long-term site. N. Ziadi[1], A.J. Messiga[2], M. St. Luce[3] | *[1]AAFC Quebec RDC, Quebec, QC, Canada; [2]AAFC Agassiz RDC, Agassiz, BC, Canada; [3]AAFC Swift Current RDC, Swift Current, SK, Canada* • The L'Acadie Long-Term Agroecosystem Experiment, located at Agriculture and Agri-Food Canada's experimental farm in Saint-Jean-sur-Richelieu, Quebec, was established in 1992 on a clay loam soil to assess the effects of tillage and mineral fertilization under a typical corn-soybean rotation. Briefly, the experimental design is a split-plot with tillage (no-till vs moldboard plow) as the main plot and nine fertilizer combinations (0, 80, and 160 kg N ha^{-1} in factorial with 0, 17.5, and 35 kg P ha^{-1}) as subplots. The 160 kg N ha^{-1} and 35 kg P ha^{-1} correspond to the local recommendations for grain corn, but the soybean phase is unfertilized. Treatments are replicated in four blocks for a total of 72 experimental units. Throughout the years, the site responded well to N but not consistently to P fertilization. Tillage system did not affect corn grain yield in the first ten years but yield gradually declined under no-till with 2.3 Mg ha^{-1} less than under moldboard plow with recommended N rate in the last eight years. Conversely, no-till reduced soybean yield in the first decade (0.32 Mg ha^{-1}) but not thereafter. After three decades, no-till largely increased organic matter and Mehlich-3 P and K in the 0–5-cm surface layer. Interestingly, microbial population has remained physiologically active under cold winters, contributing to soil nutrient (N and P specifically) availability and/or losses. As reported in other studies worldwide, we found that changes in soil properties, nutrient dynamics and related crop yields should be best investigated using long-term field experiments.

***Envisioning change for BMP adoption in Ontario's potato sector.** S. Sarapura, C. Potter, M. Fontecha | *School of Environmental Design and Rural Development, University of Guelph, Guelph, ON, Canada* • Potato producers in Ontario face individual and structural challenges impacting their operations. Adopting Best Management Practices (BMPs) can improve productivity, profitability, and sustainability of producers in Ontario's potato sector, but depending on their size and market participation, they have different capacity and willingness to adopt certain BMPs. To support the increased use and adoption of BMPs by farmers throughout the sector this study aimed to understand key drivers and barriers to BMP adoption and construct a Theory of Change outlining pathways to increase adoption for diverse producers in the sector. Quantitative survey data was triangulated with qualitative data from semi-structured interviews, participant observation and Focus Group Discussion to understand the context, key challenges, and key differences facing farmers. A systems thinking approach was then used to understand key drivers and barriers of BMP use. A Theory of Change workshop was conducted with policymakers, researchers and practitioners to collaboratively identify the main changes that need to take place to increase the adoption of BMPs in the sector. This study identified that small, medium and large-scale farmers experience different drivers and barriers impacting their operations and BMP use. Different access to resources, market participation, production styles and social networks require that different approaches are required when considering their BMP adoption. This study found that willingness to adopt BMPs largely depends on whether farmers have the capacity, incentives, and a supportive enabling environment to adopt and that distinct approaches are required to address the different barriers experienced by small, medium and large-scale producers.

***Improved nitrogen fertilizer management reduces nitrous oxide emissions in a northern Prairie cropland.** D. Ferland[1], C. Wagner-Riddle[3], S.E. Brown[3], M. Bourgault[1], W. Helgason[4], R.E. Farrell[2], K.A. Congreves[1] | *[1] Dept. Plant Sciences, University of Saskatchewan; [2] Dept. Soil Science, University of Saskatchewan; [3]School of Environmental Science, University of Guelph, Guelph, ON, Canada; [4] Dept. Civil, Geological and Environmental Engineering, University of Saskatchewan, Saskatoon, SK, Canada* • Arable croplands are a significant source of nitrous oxide (N_2O) emissions, largely due to nitrogen (N) fertilizer applications to support crop production. Nevertheless, there is limited research on the N_2O dynamics from canola-wheat rotations in the northern Prairies. We present micrometeorological N_2O fluxes measured in Saskatchewan, Canada, to evaluate the impact of N fertilizer management on the year-round N_2O emissions from a canola-wheat rotation. Two 4R N management practices – a reduced N rate and an enhanced efficiency N fertilizer source – were compared to common fertilizer management practices for the region. Two periods at high risk for N_2O flux events were identified, after N fertilizer applications and the following spring thaw, with the magnitude of emissions varying over the multi-year period. As for cumulative emissions, the growing season (GS) N_2O emissions were 50 % of annual emissions, presenting an opportunity to mitigate N2O emissions through improved N fertilizer management. Indeed, the 4R N management reduced N_2O emissions by 57 % over the study period without impacting yields. The reduction in GS emissions resulted from the 4R N management lowering mean N_2O flux at times of high WFPS. The non-growing season (NGS) N_2O accounted for 11– 67 % of annual emissions. Fall soil nitrate levels were a strong explanatory variable of NGS emissions, but the rate of change and magnitude of NGS emissions depended on thawing conditions – lower for drier thaws, higher for wetter thaws. Ultimately, better N fertilizer management reduces cumulative N_2O emissions from cropping systems when practiced for several years.

***Mechanistic analysis of microbe-mediated storage of root derived carbon in response to defoliation.** H.S. Aiyer[1,2], J. Cornelis[2], L.V. Koppen[1], B. Frey[1], J.D. Bainard[1], L.D. Bainard[1] | *[1]AAFC Agassiz RDC, Agassiz, BC, Canada; [2]Faculty of Land and Food Systems, University of British Columbia, Vancouver, BC, Canada* • Changes in plant and microbial communities associated with moderate levels of cattle grazing are known to influence soil carbon storage. However, specific mechanisms by which grazing related changes in root derived carbon compounds affect microbial pathways for carbon storage have not been fully explored. In this project, greenhouse trials were conducted to study the effects of defoliation on plant growth, root exudate composition, and microbial activity. We set up a hybrid hydroponic system for growing Orchardgrass (*Dactylis glomerata*). Defoliation treatments were

applied at either the 3-month or 5-month growth stages and compared to paired uncut controls. Defoliation was either done with scissors or by cow (only at the 5-month time point). Plant growth measurements, chlorophyll content and root exudate solution were collected either 3 days or 2 weeks after defoliation. Rhizosphere soil samples were also collected to measure physico-chemical properties and microbial activity. There was significant increase in shoot and root growth post defoliation when compared to the uncut controls. Soil carbon and nitrogen content significantly decreased at 2 weeks compared to the 3 days post-cut sampling timepoint. Analysis to measure defoliation induced differences in root-derived organic components and variation in microbial response post defoliation are still ongoing. Despite little differences in dissolved organic carbon in root exudate solutions, the quality of organic compounds in the root exudates are expected to be different. Studying these differences and how they impact microbial activity related to carbon storage will be essential to understanding long term carbon storage in natural grazing lands.

***Response to varying phosphorus application in an Ontario perennial forage stand.** K. Beukeboom, K. Schneider | *Dept. Plant Agriculture, University of Guelph, Guelph, ON, Canada* • The agricultural industry has a growing interest in reducing phosphorus (P) inputs due to concerns of finite sources, the risk of P loss in agricultural runoff, and increasing fertilizer costs. While P is essential to Ontario forage cropping systems, recent research supports that perennial forage yields are not significantly reduced in fields with soil test P concentrations which would be considered limiting by provincial recommendations, potentially due to symbioses with arbuscular mycorrhizal (AM) fungi. In a 3-year field trial using a randomized complete block design, perennial forages were grown under four different P application rates over a period of three years. These blocks were divided into spit-plots of legume and grass monocultures, as well as grass-legume mixtures. In the three years studied, yields were not significantly greater when the recommended rate of P (60 kg ha^{-1}) was applied than when half the recommended rate (30 kg ha^{-1}) was applied. Root colonization by AM fungi was highest in the 30 kg ha^{-1} treatment, potentially compensating for lower P fertilization. Alfalfa monocultures and grass-legume mixes removed significantly more P from the system through harvest than grass monocultures. A simulated freeze-thaw experiment on forage samples collected from the field found that P application rate is positively associated with leaching of soluble P, indicating a possible environmental risk from P fertilizer taken up by forages. These findings provide supporting evidence for a reassessment of recommended P application rates for forages in Ontario.

***Nitrification inhibitor affects greenhouse gas emissions in Western Canadian barley cropping systems.** B. Liu[1,2], L. Gorim[2], M. Thilakarathna[2], R.E. Farrell[3], S.X. Chang[1] | *[1]Dept. Renewable Resources, University of Alberta; [2]Dept. Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB, Canada. [3]Dept. Soil Science, University of Saskatchewan, Saskatoon, SK, Canada* • Nitrogen (N) fertilisers are a major source of greenhouse gas (GHG) emissions in agriculture, and nitrification inhibitors (NIs) are often applied to reduce N_2O losses from soils. However, their effectiveness may vary depending on site conditions and crop type and has not been fully assessed in barley-based systems in western Canada. In this study, we evaluated the effect of eNtrench, a nitrapyrin-based NI, on soil GHG emissions at two sites—St. Albert Research Station (University of Alberta) and Kernen Farm (University of Saskatchewan)—under feed and malting barley production. Five treatments were applied: no N fertiliser, 100 percent recommended rate of urea, 70 percent rate of urea, 100 percent urea with eNtrench, and 70 percent urea with eNtrench. In the first year, soils were sources of CO_2 and N_2O and sinks of CH_4. At St. Albert, CO_2 and CH_4 fluxes ranged from 0.078 to 4.95 g C per square metre per day and –0.58 to 0.13 mg C per square metre per day, respectively. At Kernen, they ranged from 0.022 to 4.24 g C and –0.95 to 0.20 mg C per square metre per day. N_2O emissions ranged from –0.12 to 1.67 mg N at St. Albert and 0.005 to 2.14 mg N at Kernen. In St. Albert, applying 100% urea combined with eNtrench significantly reduced N_2O emissions compared to the urea-alone treatment in soil planted with feed barley. These findings support the use of NIs as a promising strategy to mitigate N_2O emissions in barley cropping systems.

3.1 Crop adaptation for system resilience

Chair Dr. Bao-Luo Ma

Opportunities for adaptation strategies for wheat and chickpea in Australia. MF Dreccer[1], B.Zheng[1], L.Clancy[1], P. Hu[1], J. Whish[1], A. Delahunty[2], M. Richards[3], N. Graham[3], Power S[4], D. Rodriguez[5], P.de Voil[5], M. Mumford[6], L. Farqhuarson[7]. | *[1]Commonwealth Scientific and Industrial Research Organisation, Agriculture and Food, QLD, Australia; [2]Agriculture Victoria, VIC, Australia; [3]Dept. of Primary Industries and Regional Development, NSW, Australia; [4]Dept. of Primary Industries and Regional Development, WA, Australia; [5]Queensland Alliance for Agriculture and Food Innovation The University of Queensland, QLD, Australia; [6]Dept. of Agriculture and Fisheries, Toowoomba, QLD, Australia; [7]South Australian Research and Development Institute, Adelaide, SA, Australia* [Invited talk] • Australia's climate has warmed by 1.51 ± 0.23 °C since 1910, accompanied by a decline in cropping season rainfall, particularly in the southern regions. This paper examines the current knowledge on abiotic stress damage in two main winter crops for the Australian grains industry, wheat and chickpea, with the aim of suggesting likely adaptation avenues. In wheat, historical changes in yield potential (1970-2024) and the timing of last frost and first heat were examined using historical climate records and the APSIM NextGen model. Results showed a decline in yield potential, later frosts and earlier heat stress events. The combination of cultivar and planting date is utilized to minimize the reduction of maximum water-limited yield due to frost and heat; however, they still cause a significant level of damage in cultivars of diverse phenology. The study suggests that, as phenology is already a management tool utilized to minimize losses, adaptation research should focus on reducing sensitivity to extreme temperatures during critical periods, particularly frost. In chickpea, significant productivity gaps remain due to abiotic stress. A nationwide study benchmarked chickpea's water-limited yield potential, water use efficiency, and N fixation across 32 environments. An upper boundary water use efficiency of 16.6 kg ha^{-1} mm^{-1} (decile 9) was determined for crops yielding between 1000 and 7000 kg ha^{-1}. The highest-yielding trials for a given level of plant available water had a high harvest index associated with a shorter flowering to podding period, higher VPD, and fewer days with extreme

temperatures. Higher podding biomass was associated with higher shoot fixed N but not necessarily yield. Practices minimizing carbon trade-off between pod set and N fixation are likely to positively impact productivity and sustainability outcomes.

Early seeding boosts organic wheat production in the semi-arid Canadian prairies. Kui Liu[1], Brian Beres[2], Shaun Sharpe[3], Prabhath Lokuruge[4], Cindy Gampe[4], Kennedy Choo-Foo[1] | *[1]AAFC Swift Current, SK; [2]AAFC Lethbridge, AB; [3]AAFC Saskatoon, SK; [4]AAFC Scott, SK, Canada* • In the semi-arid Canadian prairies, early seeding is gaining interest as a strategy for enhancing wheat yields under the impacts of climate change, which has resulted in drier and warmer conditions during growing seasons. Several studies in conventional cropping systems have demonstrated the yield advantages of early seeding, attributing these gains to improved soil moisture availability, longer grain filling period, and reduced water stress. However, in organic systems, seeding is often delayed for a better weed control, a persistent challenge in organic production. In organic systems, early seeding itself has potentials to increase yield, particularly in water- and heat-limited environments, but such yield gains may be offset by increased weed pressure caused by early seeding. As a result, it remains uncertain whether the yield benefits of early seeding observed in conventional systems can be directly applied to organic systems. This presentation will explore the potential of early seeding in organic systems, highlighting its impact on yield under various weed management practices. The preliminary results showed that early seeding on the semi-arid Canadian prairies increased wheat yield by compared normal seeding.

Evaluation of spring seeded winter cereals as a drought mitigation strategy. A. Krawchuk, M. Farzand | *Lakeland Agricultural Research Association, Fort Kent, Alberta, Canada* • A field trial was carried out from April 19, 2024 to September 17, 2024, at the LARA research farm (54º 18'N, 110º 37'W; NE 25-61-5-W4), Alberta, to compare the establishment, forage dry matter (DM) yield and nutritional quality of early spring seeded winter cereals at soil temperature between 2-6°C and late spring seeded winter cereals at soil temperature above 10°C. Three varieties of fall rye (AC Hazlet, KWS Serafino, and SU Performer), winter triticale (AB Provider, AB Bronco, and Tadeus) and winter wheat (AAC Coldfront, AAC Wildfire, and Pintail) were grown in small plots with four replications both in early and late seeded treatment. Harvest took place when each variety was at least 30 cm tall on average and regrowth on the plots was harvested throughout the summer when regrowth was at least 30 cm tall. The results indicated that average forage DM yield in early seeded treatment was approximately 34 % higher than the late seeded treatment. The early seeded treatment was harvested a total of four times throughout the grazing season while the late seeded treatment was harvested three times. When considering crude protein (CP) and total digestible nutrients (TDN), the early seeded treatment had higher CP and TDN content than the late seeded treatment and the first harvest showed higher CP (~ 25%) and TDN (70.31%) content than the subsequent harvests in that treatment. Thus, we may conclude that during the periods of dry conditions, early spring seeded winter cereals can provide more grazing periods with higher quality forage than the late spring seeded winter cereals.

Potential of short duration millets as a post-winter wheat crop in Ontario, Canada. R. Pudasaini, M.N. Raizada | *Dept. Plant Agriculture, University of Guelph, Guelph, Ontario, Canada* • In northern latitudes, the diversity of the corn-soybean cropping system can be increased by including winter wheat as a rotation crop, providing long-term benefits including improved nutrient availability and nutrient use efficiency, improved soil structure and moisture holding. However, in Ontario, Canada, few farmers have adopted winter wheat due to low profitability. After the wheat harvest, there is a 3-month window with warm days and moist soil, sufficient to grow a short duration crop. Some millet varieties are short duration. Millets are increasingly valued economically as 'ancient grains' for humans, as a nutritious forage and as effective cover crops due to their fibrous roots and dense foliage. Though millets offer similar long-term benefits to wheat in a rotation, they cannot economically compete with maize or soybean as a summer season crop. We hypothesized that the economic constraints of winter wheat and millets could be overcome by double cropping, specifically by adding a low-input, short-duration millet after winter wheat is harvested. The objective of this study was to evaluate the potential of millets as a post-winter wheat crop in Ontario. Three years of field trials (2020-2022) were conducted in Elora and Essex, Ontario, starting with 81 accessions of five millet crops. Selected accessions of proso millet produced up to 0.5 t/ha grain yield, whereas foxtail and barnyard millets at Elora, and fonio in Essex, produced up to 0.9-1.6 t/ha dry shoot yield. However, planting date, initial soil moisture, weed management and fall frost were observed to be critical for millet success.

Performance evaluation of two-row and six-row forage barley mixtures. M. Farzand, A. Krawchuk | *Lakeland Agricultural Research Association, Fort Kent, AB, Canada* • A field trial was set up from May 15, 2024, to Aug 02, 2024, at the LARA research farm in Fort Kent, Alberta, to investigate if mixed cultivation of two-row and six-row barley in varietal seed mixtures could increase forage dry matter yield and nutritional quality compared to their component varieties in pure stands. The treatments were comprised of 2 two-row (AB Maximizer and AAC Lariat) and 2 six-row (AB Tofield and AB Standswell) varieties in pure stands as well as in twelve possible binary mixtures of 1:1, 1:3, and 3:1 seedling ratio. CDC Austenson was seeded as a check variety. The results indicated that mixtures ought to be more advantageous to farmers than corresponding pure stands. A total of two mixtures; AB Maximizer and AB Tofield at seeding ratio of 3:1 and AAC Lariat and AB Tofield at seeding ratio of 3:1 yielded 9 and 7% higher than CDC Austenson, respectively. AB Maximizer was the only variety grown in pure stands, which yielded 1% higher than CDC Austenson. Of the 12 mixtures tested in this study, 11 had crude protein content (> 11%) adequate to meet the nutrient requirements for beef cattle after calving. In terms of total digestible nutrients, all mixture contained sufficient (≥ 65%) to meet the energy demands of lactating beef cattle. So, mixed cultivation of two-row and six-row barley could increase the overall forage biomass and nutritive value and provide a diet that is able to meet the nutritional requirements for different categories of beef cattle.

3.2 Expanding trait innovation from genome to phenome

Chair Dr. Beatrice Amyotte

Breeding pool and market class differentiation in leaf functional traits across cultivated sunflower. Chase Mason | *Dept. Biology, University of British Columbia, Kelowna, BC, Canada* [Invited talk] • Domestication has often been reported to reduce crop plant genetic and phenotypic diversity in relation to wild progenitors. However, the process of crop improvement and cultivar divergence can generate substantial trait diversity among breeding pools and market classes. Here we document the degree of functional trait diversity present in the germplasm of cultivated sunflower (*Helianthus annuus*) in relation to crop-wild relatives (genus *Helianthus*), with a focus on leaf ecophysiology and secondary metabolism known to influence plant growth rate and pest and pathogen resistance. Results highlight the impact of historical breeding practices on unintended breeding pool divergence, and the relative importance of constraints on the simultaneous optimization of plant functions through targeted breeding. As the third-largest oilseed crop globally, optimization of plant-biotic interactions is a route to improved yields and more sustainable production under a changing climate.

***Development of an image-based phenotyping pipeline for stem anatomy and fiber characteristics in *Cannabis sativa*.** V. Fetterley[1], I.C. Couling[1], A. Mykitiuk[1], J. MacKenzie[2], J. Celedon[2], M. Deyholos[4], M. Todesco[1,3,4] | *[1]Michael Smith Laboratories, University of British Columbia, Vancouver, BC, Canada; [2]Breeding and Genetics Dept., Aurora Cannabis, Inc., Comox, BC, Canada; [3] Dept. Botany, University of British Columbia, Vancouver, BC, Canada; [4] Dept. Biology, University of British Columbia, Kelowna, BC, Canada* • Cannabis (*Cannabis sativa*) has been cultivated for its grains, fibers, and flowers for more than 6,000 years. Taking advantage of the potential of cannabis as a multi-purpose crop requires end use-specific breeding, especially when it comes to the multiple current and potential application of its fibers. Hurd fibers can be used to make hempcrete, biofuel, and bioplastics, while bast fibers can be used in textile and fiber reinforced materials. However, the legal status of the plant in the last century has limited research and improvement activities, and our genetic understanding of end use-specific traits is limited. A reliable phenotyping platform for important anatomical traits affecting cannabis fibers would allow for the selection of desirable cultivars for specific end uses, and ultimately aid in the identification of important genes for tailored breeding. We developed an image-based phenotyping pipeline to characterize and compare anatomical characteristics of cannabis stems. To test the applicability of our phenotyping platform, we collected, stained, imaged, and analyzed stem cross sections of 394 sibling cannabis lines. This allowed us to rapidly identify those harboring traits of interest. Image-based phenotyping provides a quantitative measurements of stem traits that can be used in genetic studies to identify genes controlling such traits. Considering the renewed interest of cannabis as a fiber crop in Canada, we hope that our platform will aid in breeding and research efforts for this crop.

***Deciphering terpenoid biosynthesis in grapevine: A multi-omics approach.** M. Petersen[1], M. Paineau[2], A. Minio[3], R. Figueroa-Balderas[2], D. Cantu[2], S.D. Castellarin[1] | *[1]Faculty of Land and Food Systems, University of British Columbia, Vancouver, BC, Canada; [2] Dept. Viticulture and Enology, University of California Davis, Davis, CA, USA; [3]Institute for Biomedicine – Eurac Research, Bolzano, Italy* • Grapes (*Vitis vinifera* L.) are a fruit crop of high economic significance globally. Each grapevine variety is characterized by its distinctive berry aroma, affecting the wine quality. In several varieties, the aroma is shaped by mono- and sesquiterpenoids. The biosynthesis of terpenoids is controlled by terpenoid biosynthesis genes (TBS), consisting of MEP and MVA pathway genes and terpenoid synthases (TPS), which are part of a largely expanded gene family. We manually annotated TBS genes in seven major genomes. TBS expression patterns and terpenoid accumulation during flowering and berry development were characterized using RNA-Seq and SPME-GC/MS platforms, respectively. Copy number variation of pathway genes was limited among varieties, but varied vastly for TPS genes, ranging between 195 (Riesling) and 129 (Fiano). Total terpenoid accumulation patters were similar among varieties at anthesis and pre-veraison, while differences were found in ripening berries. Increasing concentrations of α-terpineol, geraniol, linalool, terpinolene, and derivatives were the strongest contributors to final variety-specific terpenoid content in berries. The expression of pathway genes was comparable among all varieties throughout development whereas total TPS expression positively correlated with total terpenoid concentrations. Transcript–metabolite network analysis revealed correlations between TPS gene expression and their associated products - β-ocimene, α-terpineol, and geraniol, and derivatives - across varieties. Additionally, TPS expression was linked to other associated ripening-related metabolites in a subset of varieties. New correlations found between TPS and not previously associated terpenoids were identified, indicating co-regulations of TPS and terpenoid production, but also calling for further characterization of TPS function.

Development of functional food ingredients from wild blueberries for metabolic disease management. K.G.D. Kaushalya, H.P. Vasantha Rupasinghe | *Dept. Plant, Food and Environmental Science, Faculty of Agriculture, Dalhousie University, Truro, NS, Canada* • Wild blueberry, a valuable North American agricultural resource, is gaining prominence in nutraceutical and functional food markets. However, the instability of their bioactive compounds limits their full potential health benefits. Fermentation enhances the bioactive profile of wild blueberries, while microencapsulation improves their stability during storage, processing, and gastrointestinal digestion. This study attempts to utilize the synergistic effects of fermentation and microencapsulation to enhance the stability and bioavailability of wild blueberry bioactives, followed by understanding their physiological benefits in improving lipid and glucose dysmetabolism *in vivo*. Wild blueberries were subsequently fermented using *Saccharomyces cerevisiae* and *Komagataeibacter* spp., followed by microencapsulation through spray-drying using prebiotic fibers and plant proteins as partial or complete substitutes for maltodextrin. The physicochemical characteristics of resulting microparticles were assessed. The physiological benefits of this novel functional food ingredient against metabolic syndrome were assessed using a high-fat high-sucrose diet-induced obesogenic C57BL/6J mice model. Interestingly, dual fermentation generated health-promoting post-biotics such as isoferulic acid, protocatechuic acid, caffeic acid, and short-chain fatty acids. The novel microparticles displayed robust stability under UV light exposure and various storage conditions indicating improved shelf-life and potential for commercial applications. Biotransformed, microencapsulated wild blueberry bioactives show promise as a safe, non-pharmaceutical

intervention for metabolic diseases. The new findings help to expand the market potential of wild blueberries through product diversification through functional food ingredients.

Genome-wide association mapping for common scab (*Streptomyces scabies* L.) resistance in diploid potatoes. B. Fofana[1], D. Main[1], M. Zaidi[1], S. Fillmore[4], B. Soto-Cerda[2,3] | *[1]AAFC Charlottetown RDC, Charlottetown, PEI, Canada; [2]Departamento de Ciencias Agropecuarias y Acuícolas, Universidad Católica de Temuco, Temuco, Chile; [3]Núcleo de Investigación en Producción Alimentaria, Facultad de Recursos Naturales, Universidad Católica de Temuco, Temuco, Chile; [4]AAFC Kentville RDC, Kentville, NS, Canada* • Common scab disease is caused by *Streptomyces* species including mainly *S. scabies*. It leads to high economic losses and food waste. With climate change, and its frequent drought episodes, common scab incidence will likely be increased in all potato agro-systems. Using a 384 diploid potato germplasm panel, we recently uncovered the genetic architecture for maturity and drought tolerance traits. In the current study, the same panel was evaluated for common scab surface coverage, severity, and incidence over three growing seasons in field conditions, and to dissect and uncover the genetic architecture for potato resistance to common scab. The data showed a wide diversity in the potato clone's reactions to the bacterial disease, and the genomic regions and genes tightly associated with each common scab trait were identified. The study also showed that common scab resistance is polygenic and pleiotropic in diploid potatoes, contrary to previously thought, and that the more a clone carries scab-associated QTL/QTN markers, the higher is its resistance to common scab. The data suggest that some of the diploid potato clones herein identified can be used either directly as diploid potato varieties for common scab mitigation solutions in the current climate change context or as sources of resistance in breeding programs, while contributing to reducing food waste and economic losses to growers.

3.3 Overcoming environmental stress in horticulture production

Chairs Drs. J. Wahab & L. Abbey

Dry onion cultivars for irrigated production in Saskatchewan. J. Wahab[1], E. Karppinen[2], E. Derdall[1], E. Mupondwa[1], J. Wanasundara[1], C. Drury[2], E. Svendsen[1] | *[1]AAFC Saskatoon RDC, Saskatoon, SK; [2]Canada-Saskatchewan Irrigation Diversification Centre, Outlook, SK* • Canada-Saskatchewan Irrigation Diversification Centre, Outlook, SK evaluates higher-value vegetables taking advantage of the opportunities presented by climate change, by mitigating challenges through irrigation, agronomic refinements, and germplasm selection. Dry onion is one of the crops being evaluated that has considerable economic potential, i.e. with a Farmgate value of approximately $ 26,000 per ha in 2023. Four Long-day cultivars [Frontier (yellow), Sedona (yellow), Talon (yellow), Rossa di Milano (red)] and two Intermediate-day cultivars [Calibra (yellow), Cabernet (red)] were evaluated during the summer of 2024. The crop was raised using transplants. Comparisons were made between irrigation treatments ('Full' and 'Partial' irrigation) and nitrogen sources (Urea and Sulphate of Ammonia). Harvested bulbs were graded, according to bulb diameter: 'Small' (25.4-50.8 mm), 'Medium' (50.8-76.2 mm), and 'Large' (76.2-95.3 mm) grades. Storability was examined after six months in storage in a ventilated room (10oC-15oC). Sedona, Calibra, and Talon were top yielders. Sedona produced 45-53 t ha^{-1} marketable yield and 41-50 t ha^{-1} large grade yields; Talon recorded 33-47 t ha^{-1} marketable yield and 29-46 t ha^{-1} large grade yield, and Calibra recorded 28-49 t ha^{-1} marketable yield and 24-47 t ha^{-1} large grade yields. Sedona, Calibra, and Talon produced higher proportion (88%-99%) of large grade bulbs compared to Cabernet, Rossa di Milano, or Frontier (13%-55%). Sedona, and Talon recorded 6%-8% storage loss compared to 15%-25% for the other cultivars. Urea and sulphate of ammonia produced similar bulb yields. Full irrigation produced higher bulb yields than Partial irrigation. Agronomic implications and economic performance will be discussed.

Mugwort response to growing temperature. L. Abbey[1], R. Ofoe[1], T. Mutemi[2] | *[1]Dalhousie University, Faculty of Agriculture, Dept. Plant, Food, and Environmental Sciences, Truro, NS, Canada; [2]Meru University of Science and Technology, Meru, Kenya* • Among the genus Artemisia, mugwort (*A. vulgaris* L.) is known to have a wide range of chemical properties for culinary use and for treating non-communicable diseases. However, the response of mugwort to variations in growing temperature conditions is unknown. A study was carried out to determine the response of mugwort to varied temperatures (18°, 24° and 30°C). Comparatively, mugwort plant leaf stomatal gas exchange, and transpiration and photosynthesis rates were significantly ($p<0.01$) highest at 24°C except leaf internal carbon dioxide concentration, which was significantly ($p<0.01$) highest at 18°C. Exposure of mugwort to 18°C significantly ($p<0.05$) increased plant internode elongation while the length of leaves was significantly ($p<0.05$) increased at 24°C. The number of leaves per plant was also highest at 30°C compared to the 18° and 24°C treatments. The expression level of ADS in mugwort leaves increased after 24 h and 72 h of exposure to 24°C and 30°C, respectively. The levels of CYP71AV1 in the leaves were highly expressed after 24 h and 48 h following exposure of the plants to 30°C and 18°C, respectively, but maintained this level after 72 h at 18°C. Furthermore, mugwort plants exposed to the 18°C had a very high expression of ORA and ALDH1 after 72 h, while the expression pattern of SQS was similar irrespective of the growing temperature. The results suggest a coordinated regulation of metabolic flux under varying temperatures, which can potentially increase artemisinin and dihydroartemisinic acid production. Studies are underway to evaluate artemisinin production under varied growing temperature.

***Photosynthetic responses to heat stress by grapevine (*Vitis vinifera* L.) varieties grown in British Columbia.** N.W. Wilson, S.D. Castellarin | *Wine Research Centre & Faculty of Land and Food Systems, University of British Columbia, Vancouver, BC, Canada* • Climate change is a growing concern for grape and wine production in British Columbia. Heat stress can cause severe, prolonged damage by impairing physiological processes such as photosynthesis in grapevines. Understanding the impact of heat stress and how different grapevine varieties respond to excessively high temperatures is crucial for the grape growers in British Columbia, but there is currently limited knowledge available regarding the impacts of heat stress on major varieties grown in the province. In this study, heatwaves with 40°C maximum temperatures were simulated in growth chambers for eight grapevine

varieties: 'Cabernet Franc', 'Riesling', 'Semillon', 'Malbec', 'Merlot', 'Gewurztraminer', 'Viognier', and 'Chardonnay'. Photosynthetic rates were measured using an infrared gas analyzer and chlorophyll fluorescence measurements were taken with a portable fluorometer. Results showed that 'Semillon', 'Cabernet Franc', and 'Merlot' had sensitive photosynthetic rates to increased temperatures compared with other varieties tested, largely due to reductions in stomatal conductance at 40°C. Permanent damage to photosynthetic machinery was not observed during chlorophyll fluorescence measurements. Sensitivity to more extreme temperatures was tested for several varieties by submerging leaves in water baths set between 22-51°C, then allowing leaves to recover overnight. Permanent, irreversible damage to photosynthetic machinery occurred at approximately 47°C for all varieties tested.

***Responses of grapevine (*Vitis vinifera* L.) to heat and drought: Vine physiology and grape aroma.** Sarah Davis[1], Fabio Del Conte[2], Simone D. Castellarin[1] | *[1]The University of British Columbia, Vancouver, BC, Canada; [2]University of Udine, Italy* • Wine grapes (*Vitis vinifera* L.) are an economically important fruit crop globally, cultivated in over ninety countries for various products. Climate change is altering grape production patterns, prompting shifts even in northern regions like Canadian wine areas. Abiotic stresses, including drought, temperature variations, and UV light exposure, profoundly influence grape metabolism, including modifying the synthesis of volatile organic compounds (VOCs). Terpenoids are key VOCs in grapes, contributing to grape and wine aroma and quality. Recent research suggests that moderate drought and UV light may enhance terpene production in grapes. However, it is unknown how heatwaves and drought events – two extremes that are occurring at increased frequency in several wine regions due to climate change – will affect vine physiology and terpenoid concentrations. Riesling and Viognier potted vines were subjected to both high temperatures and water deficit conditions alone and in combination in controlled growth chambers. Vine physiological measurements were taken throughout development, and terpenoid profiling was conducted during ripening. The study showed that high temperatures and water deficit have a strong negative influence on photosynthesis and stomatal conductance. Additionally, high temperatures and water deficit decrease levels of organic acids, while increasing levels of total free terpenoids in post-veraison stress. This research aims to inform strategies for adapting grape production to climate change, benefiting scientists, growers, and wine producers alike.

***From Blight to Bright: Understanding water needs of EFB-resistant hazelnuts in British Columbia.** Steven Tyler Bristow, Andy Black, Thorsten Knipfer | *The University of British Columbia, Vancouver, BC, Canada* • The hazelnut industry in British Columbia has experienced significant growth in the past eight years, following a period of near-collapse due to damage caused by eastern filbert blight (EFB) from 2006 to 2015. The introduction of EFB-resistant cultivars led to the launch of the BC Hazelnut Renewal Program in 2018, supporting the planting of at least 55,000 new trees by 2021, with further expansion through private efforts and the Perennial Crop Renewal Program since 2023. Despite this resurgence, research on hazelnut water use and drought tolerance is minimal, as previous research prioritized disease resistance. As climate change intensifies water stress, a critical knowledge gap remains regarding the irrigation needs and drought tolerance of these new cultivars. To address this knowledge gap, we established a sensor station in a double-density 8-year-old hazelnut orchard (cv. 'Yamhill') with a grass interrow in Chilliwack B.C. in July 2024. We monitored potential evapotranspiration (ET) and compared with crop ET (ET_c) using an LICOR 710 ET Sensor. We calculated potential ET using the FAO 56 formula for ET_o by incorporating a PAR sensor, pyranometer, wind monitor, net radiometer, two soil heat flux plates, and four soil moisture/temperature sensors. Our preliminary results found that the expected crop coefficient ($K_c = ET_c / ET_o$) was 0.70 from July-October. Efforts to account for energy balance closure and grass ET are ongoing in 2025.

***Robot vs. Tractor: Weed management in beet and carrot fields in organic and mineral soils.** I.N. Ezeh, G. Farintosh, K. Vander Kooi, M.R. McDonald | *Dept. Plant Agriculture, University of Guelph, Guelph, ON, Canada* • The Naïo Orio autonomous electric robot was evaluated for weed management and crop yield in table beet and carrot on muck (high organic matter) and mineral soils and compared to conventional tractor-based methods. Vegetable growers face labour shortages, herbicide-resistant weeds, and limited herbicide availability, especially in beets. Alternative weed control strategies are needed. This study compared the effectiveness of the robot and tractor for both conventional cultivation and herbicide application. The experiment was completely randomized with the robot and tractor as treatments and two and three replications on muck and mineral soil, respectively. On muck soil, robot-treated plots had higher weed biomass later in the season. The tractor treatment had a significantly higher beet yield (40.7 t ha^{-1}) than the robot treatment (24.8 t ha^{-1}), likely related to better weed control. There were no differences in weed density or beet yield on mineral soil. There were no differences between the two treatments for carrots on either soil type. Weed biomass was negatively correlated with beet yield on muck soil ($r = -0.68$, $p = 0.015$). There was no correlation between weeds and the yield of carrots or mineral soil beets. In conclusion, treatment only influenced weed biomass and marketable yield on muck soil beets. Some deficiencies were identified in the cultivator used for the robot and improvements are ongoing. The similarities in weed management and yield are important for growers considering a shift to self-driving electric robots for horticulture.

3.4 Optimizing nutrient inputs and cycling in crop production

Chair Dr. Joshua Nasielski

Economic vs. Environmental best management practices for in-season nitrogen applications in corn: a multi-environment study. Joshua Nasielski | *University of Guelph, Guelph, ON, Canada* • We present results of a multi-environment study aimed at identifying best management practices for in-season nitrogen (N) applications in corn made past canopy closure. A replicated study was conducted across five locations (Ontario, Indiana and Illinois) over 3 years (2020-2023). 179 kg N ha^{-1} was applied in one of three split-applications: 30%, 50% or 70% of total N applied in-season with remainder applied around planting. In-season N was applied using one of six methods. Urea or UAN were either injected or surface-applied. Surface-applied N was either unprotected or had an added urease inhibitor. Various soil, crop and weather properties were measured, including NH3 volatilization. Our goal was to identify how and why best management practices change across environments, specifically the use of urease inhibitors or injection. We identified environments where NH3 losses are high: soils with low CEC and seasons where small rainfall events (<30 mm) occur after N application. While the environmental benefits of urease inhibitors or injection are greatest in these environments, yield response to these practices were often null. Only when both NH3 volatilization is high and corn N demand is high were positive yield responses to urease inhibitors or injection observed. Thus, urease inhibitor and injection resulted in significant yield increases in only 2 of 15 tested environments. Results of a partial profitability analysis will also be shown. Our findings will help agronomists identify environments where urease inhibitors and injection have the greatest potential for both economic and environmental returns larger than surface-application of untreated N.

Impact of minor oilseed crops on productivity and nitrogen use efficiency of cropping sequences. M. St. Luce[1], S. Shahariar[1], M. Bandara[2], C.M. Geddes[3], K. Liu[1], P. Lokuruge[4], M. Khakbazan[5], B. McConkey[6] | *[1]AAFC Swift Current RDC, Swift Current, SK, Canada; [2]Alberta Agriculture and Irrigation, Crop Diversification Centre South, Brooks, AB, Canada (Retired); [3]AAFC Lethbridge RDC, Lethbridge, AB, Canada; [4]AAFC Scott Research Farm, Scott, SK, Canada; [5]AAFC Brandon RDC, Brandon, MB, Canada; [6]Viresco Solutions, Edmonton, AB, Canada* • Cropping system diversification with minor oilseed crops such as Oriental (*Brassica juncea*), industrial (*Brassica carinata*) and yellow (*Sinapis alba L.*) mustard, camelina [*Camelina sativa* (L.) Crantz] and flax (*Linum usitatissimum* L.) could enhance productivity and sustainability in the Canadian prairies. A five-year (2018-2022) field experiment was conducted at four sites (Brooks and Lethbridge in Alberta, and Scott and Swift Current in Saskatchewan) with 14 cropping sequences to (i) assess system productivity and nitrogen use efficiency (NUE), (ii) determine the effect of minor oilseeds on subsequent crop yields, and (iii) examine the soil and environmental driving factors. System productivity was estimated as annualized canola equivalent yield (CEY). On average across sites, CEY was significantly higher for the cropping sequences with minor oilseed crops and pulses compared to continuous spring wheat (*Triticum aestivum* L.) or wheat with fallow. There were no significant differences in CEY among sequences with oilseed crops, and between sequences with oilseeds and field pea (*Pisum sativum* L.) vs. lentil (*Lens culinaris* Medikus). While sequences with minor oilseed crops and those with canola (*Brassica napus* L.) had similar CEY, NUE significantly differed between traditionally diversified sequences with canola and those with minor oilseed crops. Importantly, minor oilseed crops had no adverse effect on subsequent pulse grain yields. We found that growing season mean air temperature, particularly in July, most significantly impacted system productivity. This study showed that diversifying existing cropping systems with minor oilseed crops can sustain productivity while enhancing NUE in the semi-arid Canadian prairies.

Response of canola to high rates of N application from different sources. Tarlok Singh Sahota | *LUARS, Thunder Bay, ON, Canada* • Field experiments were conducted during 2020-2024, in RCBD replicated 4 times, to study the response of N @ 90, 180, 270 and 360 kg N ha^{-1} from urea, urea superu (SUPERU™), urea + ESN (2:1 on N basis) and urea + superu (2:1 on N basis) with two additional treatments; no N and a blend of urea, ESN and superu each @ 60 kg N ha^{-1}. Pooled analysis over 2020 - 2024 indicated that urea + superu (4.34 Mg ha^{-1}), superu (4.26 Mg ha^{-1}) both @ 360 kg N ha^{-1} and urea or urea + ESN @ 270 kg N ha^{-1} (4.09 Mg ha^{-1}) produced higher seed yields than the other treatments. Seed yield with the blend of three N fertilizers was no better than the other fertilizers or their combinations at an equal rate of N (180 kg N ha^{-1}). Straw yield (7.64 Mg ha^{-1}) was highest with urea @ 270 kg N ha^{-1}. While all sources of N gave higher seed and straw yield than no N, there was no significant difference in the yields from the different sources of N. However, higher rates of N (270 and 360 kg ha^{-1}) recorded higher seed yields (4.01 and 4.07 Mg ha^{-1}) than the lower rates of N (90 and 180 kg ha^{-1}) – 3.25 and 3.70 Mg ha^{-1}. Plant height was lowest without N (102 cm), but didn't differ with rates of N (116-118 cm). Though superu produced the tallest plants (119 cm).

Nitrogen fertilization of irrigated dry bean. G. Singh[1], G. Hantowich[2] | *[1]Plant Agriculture, University of Guelph, Ridgetown, ON, Canada; [2]Irrigation Crop Diversification Corporation (ICDC), Outlook, SK, Canada* • Dry bean, a high-value irrigated crop in Saskatchewan, can fix nitrogen (N) biologically through symbiosis with Rhizobia, though it's generally considered a poor N fixer and relies on fertilizer N. With commercial inoculants recently limited, this study assessed pinto bean (CDC WM-2 and WM-3) response to fertilizer N rates (30–150 kg N/ha) and sources (urea vs. ESN) across nine irrigated field trials (2019, 2021, 2022) using a randomized complete block design. While most individual sites showed limited statistical yield response, combined analysis revealed yield increased only when total available N (soil + fertilizer) reached 120 kg N/ha, with no further gains at higher rates. ESN outperformed urea in yield. Unfertilized controls yielded 2889 kg/ha, suggesting strong N fixation, possibly due to effective symbiosis with native Rhizobia, particularly in CDC WM-3. Though not directly measured, nodulation was observed. Given varietal differences, a cautious approach to N fertilization is recommended, ideally combining inoculants with modest N rates (60–80 lbs N/ac). Further research across Western Canada is advised.

***Identifying sod-seeding rates of legumes for rejuvenating grass pasture.** T. Peterson[1], J. Schoenau[2], K. Larson [3], B. Kelln[1], B. Biligetu[1]. *[1] Dept. Plant Sciences, College of Agriculture, University of Saskatchewan; [2] Dept. Soil Science, College of Agriculture, University of Saskatchewan; [3] Dept. Agriculture and Resource Economics, College of Agriculture, University of Saskatchewan, Saskatoon, SK, Canada* • Declining forage productivity is a significant challenge to the beef industry. Rejuvenating old pastures through sod-seeding of perennial legumes offers a sustainable strategy to improve forage productivity while minimizing soil disturbance. Currently, there are no optimal seeding rates for sod-seeded legumes in competitive mixed-species stands. This two–year research study evaluated the success of stand establishment of three legume species, alfalfa (*Medicago sativa*), cicer milkvetch (*Astragalus cicer*), and sainfoin (*Onobrychis viciifolia*), seeded into stands of meadow (*Bromus riparius*) or smooth bromegrass (*Bromus inermis*) at different seeding rates (0.5–3.0× provincial monoculture recommended rates) under greenhouse and field (2024) conditions in Saskatchewan. Greenhouse trials evaluated early seedling emergence, height, maturity, harvest yield, 20-day regrowth yield, and forage quality. Field trials conducted near Asquith and Birch Hills, SK, Canada, measured establishment, maturity, leaf area index (LAI), forage yield, and forage quality. Greenhouse results showed that emergence and biomass were generally higher at increased seeding rates, with improved quality. In the field, seeding rates influenced forage yield, quality, and early growth depending on site and species. Establishment was species- and site-specific, with sainfoin having higher plant counts with increased seeding rate at Asquith ($P < 0.001$). At Birch Hills, alfalfa displayed higher total forage yield and quality with increasing seeding rate ($P < 0.05$). Results suggest that seeding rates of legumes in bromegrass-dominated stands should be adjusted according to species and site conditions to support successful establishment and early growth.

***Impacts of nitrification inhibitor eNtrench on Western Canadian barley cropping systems.** Nolan Steven Johnson | *University of Alberta, Edmonton, AB, Canada* • Barley is an important crop in Western Canada, yet most research on enhanced-efficiency nitrogen (N) fertilizers has focused on wheat systems. This study is the first to evaluate the nitrification inhibitor (NI) eNtrench in barley production systems in Western Canada. We assessed the effects of the NI eNtrench on the agronomic performance of barley in different soil zones and under various management systems across several prairie sites, aiming to provide answers to prairie producers seeking to reduce urea application rates in the presence of NI. The objectives are as follows: (1) to determine the effects of eNtrench-treated and untreated urea at recommended (RR) and reduced (70% RR) rates on malt and feed barley performance across the Canadian prairies (CP); and (2) to evaluate eNtrench's impact on N dynamics under contrasting management practices in the CP. Two barley varieties (AAC Synergy and AB Cattlelac) were tested from 2024–2026 at four sites: St. Albert, AB; Lethbridge, AB (irrigated); Saskatoon, SK; and Red River Valley, MB (tillage). Treatments included urea at RR, 70% RR, RR + eNtrench, 70% RR + eNtrench, and a no-N control. Preliminary results from the first season showed no significant differences in yield, protein, or biomass between reduced urea rates or eNtrench use. However, these findings are based on only one of three growing seasons, so no conclusions can yet be drawn.

4.1 Expanding trait innovation from genome to phenome

Chair Dr. Letitia Da Ros

Mapping and characterization of a novel powdery mildew resistance locus (PM2) in *Cannabis sativa* L. S. Seifi[1], K.M. Leckie[1], I. Giles[1], T. O'Brien[1], J.O. MacKenzie[1], M. Todesco[2], L.H. Rieseberg[2], G.J. Baute[1], J.M. Celedon[1] | *[1]Breeding and Genetics Dept., Aurora Cannabis, Inc., Comox, BC, Canada; [2] Dept. Botany, University of British Columbia, Vancouver, BC, Canada* • Breeding for genetic resistance remains a cornerstone of sustainable crop improvement, particularly in high-value horticultural species where pesticide use is limited or prohibited. In *Cannabis sativa*, powdery mildew (PM), caused by *Golovinomyces ambrosiae*, poses a persistent threat to both yield and quality, challenging breeders to develop resistant cultivars without compromising commercial traits. Here, we present a case study demonstrating the discovery and deployment of a novel PM resistance locus, PM2, as part of an applied cannabis breeding pipeline. Using bulked-segregant RNA sequencing (BSRSeq), we mapped PM2 as a single dominant locus on chromosome 9. Histological assays confirmed that PM2-mediated resistance operates through a hypersensitive response localized to epidermal cells, effectively halting pathogen development. To enable marker-assisted selection, SNP markers tightly linked to PM2 were developed and validated in breeding populations. These markers have enabled the introgression of PM resistance to elite cultivars and inbred lines through repeated backcrosses. This study exemplifies how integrating molecular tools and classical breeding approaches can deliver tangible genetic gains and support the development of more resilient, sustainable cannabis varieties.

Black knot in plums: Addressing resistance using a multi-omic approach. Jayasankar Subramanian[1], Ranjeet Shinde[1], Chloe Shum[1], Walid El Kayal[2], Darwish Ahmad[3], Islam El Sharkawy[3], Murali M Ayyanath[1], Mukund Shukla[1], Praveen Saxena[1] | *[1]University of Guelph, Guelph, ON, Canada; [2]American University of Beirut, Beirut, Lebanon; [3]Florida Agricultural and Mechanical University, Tallahassee, FL, USA* • Black knot is a serious cancer of plums. It is caused by a fungus *Apiosporina morbosa*. Since the disease takes multiple seasons to develop fully there is no *in vitro* assay to check for resistance. Thus, the existence of genetic resistance is either unavailable or was not analysed properly. We used a multi-pronged 'omics' based approach to understand the mechanism of resistance in a genetically diverse population of Japanese and European plums, which were left unchecked, so that BK infestation can flourish in the orchard. Metabolomic analyses revealed that 2 anti-microbial compounds are differentially present in the 2 resistant genotypes tested. Phytohormone analyses of the black knot disease and progression suggested that auxin-cytokinins interplay, possibly driven by *A. morbosa* is vital in disease progression by hampering the plant defense system. Further, contrary to the conventional reports, both salicylic acid and jasmonic acid levels were elevated in the susceptible genotypes, the reason for which is being currently investigated. Collectively our results have made

significant progress in our understanding black knot in plums and the possibility of a genetic, metabolomic and hormonomic marker to identify BK resistance is closer.

Overcoming recalcitrance in Cannabis somatic embryogenesis: Insights from transcriptomics toward synthetic seeds and genome editing. M. Hesami, A.M.P. Jones | *Dept. Plant Agriculture, University of Guelph, Guelph, ON, Canada* • This study delves into the differential gene expression profiles of cannabis calli, specifically exploring the differences between non-embryogenic and embryogenic types to unravel the mysteries of callus development and bolster biotechnological applications in cannabis cultivation. Based on our results, 6118 genes displayed significant differential expression, with 1850 genes downregulated and 1873 genes upregulated in embryogenic callus. Phytohormone-related genes showcased diverse expression patterns, emphasizing the pivotal role of PGRs in callus development. Moreover, varied expression levels among 42 classes of transcription factors suggest their regulatory involvement in callus maturation. Epigenetic scrutiny uncovered 247 genes with distinctive expressions across all callus types, with notable upregulation of key epigenetic-related genes in embryogenic calli, potentially hindering the transition to somatic embryogenesis by repressing embryogenesis-related genes. The observed repression of auxin-dependent pathway-related genes may contribute to the recalcitrant nature of cannabis, shedding light on the challenges associated with efficient cannabis tissue culture and regeneration protocols.

Preliminary study on pre-breeding and selection of high performing okra (*Abelmoschus esculentus* (L. Moench) mutant population through induced mutation in South Africa. A.I. Moalafi[1,2], A.S. Gerrano[1,2], S. Mavengahama[2] | *[1]Agricultural Research Council - Vegetable, Industrial and Medicinal Plants, Pretoria, South Africa; [2]Food Security and Safety Focus Area, Faculty of Natural and Agricultural Sciences, North West University, Mafikeng, South Africa* • Okra is an important fruit vegetable crop grown in tropical and subtropical regions of the world. The objective of the study was to evaluate different dozes of gamma radiation on nutrition and agronomic traits of okra mutant lines. The seeds of okra parental lines were irradiated with dozes of 0, 50, 100, 150 and 200 GY later sown under field trial together with the control. Data were collected on plant height, leaf length, leaf width, number of branches, number of pods per plant, pod length, pod width, number of seeds per pod, 100 seed weight and grain yield per plot. There was a significant variation among the M1 population and parental lines for the traits measured. Moreover, there was a significant trait association observed at various dozes of gamma radiation. The identified best performing M1 mutant lines will be further evaluated and developed to an M2 generation, which will be useful in the development of an improved variety of okra through mutation breeding for traits of interest.

***Revolutionizing the production of psychoactive organisms for research and conservation: Current tissue culture applications for peyote and psychedelic mushrooms.** M. Pepe, A.M.P Jones | *Dept. Plant Agriculture, University of Guelph, Guelph, ON, Canada* • Research relating to clinically and culturally import psychoactive natural products can be challenging. Batch variability introduces inconsistency to scientific research, while bioprospecting can deplete natural populations and lead to cultural exploitation. While synthetically derived active ingredients provide a potential solution and adhere to Good Manufacturing Practices (GMP), they fail to capture potential entourage effects that may enhance therapeutic benefits. Tissue culture methods offer completely controlled systems to mass-produce whole organisms with high consistency in accordance with Good Agricultural and Collection Practices (GACP) and GMP guidelines. Beyond research, tissue culture can support reintroduction of threatened species to help preserve natural populations. This presentation explores how the use of tissue culture techniques allows production of *Lophophora williamsii* (peyote) and *Psilocybe* spp. (psychedelic mushrooms) with predictable yields and metabolite profiles in compliance with GACP and GMP guidelines. This approach can ultimately benefit research initiatives while supporting preservation of sensitive plant and fungal species and cultural heritage.

4.2 CSA Annual General Meeting

Chair Dr. Kui Liu

Integrating enhanced efficiency fertilizers and nitrogen rates to improve Canada Western Red Spring wheat. Adam Fast, Sheri Strydhorst, Zhijie Wang, Guillermo Hernandez-Ramirez, Xiying Hao, Greg Semach, Laurel Thompson, Chris Holzapfel, Jessica Enns, Dean Spaner, Brian L. Beres | *AAFC Lethbridge Research and Development Centre, Lethbridge, AB, Canada; University of Alberta, Edmonton, AB, Canada* [Invited Talk: Canadian Journal of Plant Science Best Paper of 2024] Granular urea fertilizer applied at planting is prone to nitrogen (N) losses in certain environments. Enhanced efficiency fertilizers (EEFs) are developed to mitigate losses and optimize plant uptake. To determine the benefits of EEFs in grain yield and quality enhancement in Canada Western Red Spring (CWRS) wheat, an experiment was conducted from 2019 to 2022 at eight sites in Alberta and Saskatchewan, Canada. The effects of five N sources [urea; urea + urease inhibitor, N-(n-butyl)thiophosphoric triamide (NBPT); urea + nitrification inhibitor, nitrapyrin; urea + dual-inhibitor, NBPT + dicyandiamide; and polymer-coated urea, ESN® (Environmentally Smart Nitrogen®)] and four N rates (60, 120, 180, and 240 kg N ha−1) on CWRS wheat production were examined. Results indicated that N source affected grain yield in Dark Brown Chernozem soils but not in Black Chernozem or Dark Grey Luvisol soils. In Dark Brown Chernozem soils, a dual inhibitor increased grain yield by 3.1% and 3.9% relative to urea and polymer-coated urea, respectively, while all other EEFs attained similar results. The use of a dual inhibitor EEF led to greater net returns compared to urea and polymer-coated urea in the Dark Brown Chernozem soils. Grain protein concentration increased linearly with increasing N rate from 60 to 240 kg N ha−1. Generally, a rate of 120 kg N ha−1 was optimal for CWRS wheat grown in Canadian prairie conditions when coupled with EEFs, particularly a dual inhibitor, and grain yield and protein were often responsive. Reference: Fast et al. https://doi.org/10.1139/cjps-2023-0095

5.1 Crop and nutrient management

Chair Dr. Linda Gorim

Agronomic adaptations to heat stress: Sowing summer crops earlier. Rodriguez D., Zhao D., de Voil P. | *Centre for Crop Sciences, Queensland Alliance for Agriculture and Food Innovation (QAAFI) The University of Queensland, Gatton Australia* [Invited talk] • Summer crops are exposed to heat and drought stresses at critical stages during and after flowering, and their intensity and frequency are likely to increase with climate change. Agronomic stress avoidance offers the opportunity to temporally separate critical crop stages from heat and drought events [1]. However, it might require sowing cold-sensitive summer crops earlier into colder than recommended soil temperatures. There is a need to understand how cold is too cold to sow summer crops early in late winter as well as what are the yield benefits and risks. Here, we quantify the likely benefits and trade-offs of sowing sorghum, a summer cereal, earlier to adapt to the increased frequency and intensity of heat and water stresses during flowering and grain filling. Two years of multi-environment (n=32) genotype (G) by management (M) trials were conducted across the main sorghum-growing regions of Australia. Environments (E) consisted of the combination of years, sites, three times of sowing, and the use of supplementary irrigation. At each E a factorial combination of four plant populations (M) and eight commercial sorghum hybrids (G) were sown with three replications. Early sowing was associated with a reduced risk of heat stress and water use transfer from vegetative to reproductive stages. Early sowing yielded between 1 and 2 t ha− 1 more at the hottest sites and years. This resulted from both the avoidance of heat stresses and milder or no terminal drought stresses. Reference: Rodriguez et al. https://doi.org/10.1016/j.fcr.2024.109592

Soil pH stratification and the need to lime in Western Canada. Linda Y. Gorim | *Dept. Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB, Canada* • Past research in western Canada reports that approximately 6.3 million acres of agricultural land with pH ≤ 6.0, and an additional 8.5 million acres with slightly acidic soils (pH 6.1 - 6.5). Over 90 percent of these acidic soils occur in Alberta, where one million acres of land are strongly acidic (pH < 5.5), and 4.5 million acres are moderately acidic (pH of 5.6 - 6.0). Reviewed literature indicates that common crops grown show different sensitivity to low soil pH, implying that yields may be impacted by low soil pH in Alberta. pH stratification with depth has been reported as a widespread problem, but research documenting the scale on-farm is lacking. Liming is one strategy that can potentially address low soil pH, but liming research in Western Canada is limited and dated. Therefore, we conducted on-farm trials at several Alberta sites to assess the scale of pH stratification and the impact of locally available liming materials on soil and agronomic parameters. Results indicated that soil pH is stratified by depth, but most importantly, spatially, within fields; pH ranges varied between fields. Local liming materials, such as cement kiln dust, can be used to increase soil pH, and the impact of low soil pH may be buffered by soil organic matter content. The impact of liming on soil microbiome and soil microbiota is ongoing.

Nitrogen fertilizer replacement values of farm manure for corn in long-term study. Bao-Luo Ma | *AAFC, Ottawa, ON, Canada* • Manure is a by-product of livestock production and an excellent source of plant nutrients. Research is needed to correctly quantify the nutrient equivalents of animal manure for sustainable crop production under various environmental conditions. Using a long-term corn-dominated cropping system, we compared the effects of mineral N fertilization and solid dairy cattle manure on corn grain yield, estimated the manure N fertilizer replacement value (NFRV), and quantified the impact of environmental factors on corn yield and manure NFRV. Our results indicate that manure application recommendations need to consider manure total N content and corn yield response patterns influenced by key seasonal environmental factors. While mineral fertilizers can increase crop yields, they have little or negative effects on soil C sequestration. Manure application plays an important role in enhancing crop production resilience and soil C sequestration in agroecosystems.

Effect of cover crops on nutrient cycling and cash crop yield: exploring the knowns and the unknowns. Y. Peng[1], I. Chahal[1], C. Wagner-Riddle[2], Y. Lawley[3], A. Woodley[4], M. Bourgault[5], L.L. Van Eerd[1] | *[1]School of Environmental Sciences, University of Guelph, Ridgetown Campus, Ridgetown, ON, Canada N0P; [2]School of Environmental Sciences, University of Guelph, Guelph, ON, Canada; [3]Faculty of Agricultural and Food Sciences, University of Manitoba, Winnipeg, MB, Canada; [4] Dept. Crop and Soil Sciences, North Carolina State University, Raleigh, NC, USA; [5] Dept. Plant Sciences, University of Saskatchewan, SK, Canada* • Understanding how cover crops (CC) affect nutrient cycling and crop yield is critical for promoting widespread adoption and advancing agricultural sustainability. However, existing reviews lack a comprehensive synthesis of the mechanisms by which CC enhance nutrient availability and subsequent crop yield. Here, we addressed this gap, particularly for temperate climates. Key findings revealed that CC reduce nitrate leaching by 40 to 70%, lower surface runoff phosphorus losses by 54 to 94%, and mitigate annual nitrous oxide emissions when fertilizer N applications are reduced accordingly, compared to fallow systems. By compiling findings of 67 meta-analyses and reviews, 39% reported greater crop yield with CC and only 15% showed yield penalties. However, these benefits largely depend on CC species, duration of CC use, and crop rotation. Legume CC add biologically fixed atmospheric nitrogen (30 to 200 kg N ha^{-1} yr^{-1}) to the agroecosystem, partially contributing to legume CC demonstrating the most consistent positive effects on crop yield. Furthermore, long-term use of CC enhances soil health attributes (e.g., organic matter, microbial community), which boosts nutrient cycling and crop performance. Despite these potential benefits, adoption barriers persist including poor CC establishment, added costs, and interference with the main crop. Future research priorities, therefore, should focus on developing regional- and cropping system-specific CC strategies to meet farmer goals, optimize crop yield, and enhance nutrient cycling while mitigating losses. Overall, this research aims to guide researchers, policymakers, and extension personnel in scaling CC implementation and achieving sustainability goals.

Enhancing lodging resistance, yield, and quality in feed barley (*Hordeum vulgare* L.) through optimized plant growth regulator strategies. Balwinder Kumar[1], Mike Gretzinger[2], Vance Yaremko[3], Wilfried Dusso-Yovo[1], Haider Abbas[1], Carlo van Herk[2], Megan Allard[3], Surendra Bhattarai[3], Lori Oatway[4], Carla Weidner[4], Robyne Davidson[1], Francois Paradis[1] | *[1] Dept. Applied Research, Lakeland College, Vermilion, AB, Canada; [2]Farming Smarter, Lethbridge County, AB, Canada; [3]SARDA Ag Research, Donnelly, AB, Canada; [4]Western Crop Innovations, Lacombe, AB, Canada* • A field experiment was conducted for three years (2022-2024) to evaluate the effects of plant growth regulator (PGR) application rates and timings on plant height, lodging mitigation, and agronomic performance of three feed barley cultivars CDC Austenson, AB Hague, and Esma across three agro-climatic sites in Alberta: Vermilion, Lethbridge, and Falher. Mixed model analysis revealed differential cultivar responses to PGR treatments. Esma showed the greatest plant height reduction compared to CDC Austenson and AB Hague. All PGR treatments significantly reduced plant height compared to the untreated control, with Moddus (Trinexapac-ethyl) applied at 125 g a.i. ha^{-1} at growth stage (GS) 37 producing the most significant ($p < 0.05$) height reduction across locations. Days to maturity were unaffected by PGR applications at most sites, except at Lethbridge, where CDC Austenson matured 3.15 days later under early and late-stage treatments. AB Hague exhibited a significant yield reduction of 196.7 kg ha^{-1}, increased plant height (+2.6 cm), and higher lodging index (+2.23), whereas Esma significantly reduced height (−5.3 cm), grain protein content (−0.2%), and increased NDF content (+0.28%). The highest yield (increase of 287 kg ha-[1]) was recorded with a split application of Moddus at 62.5 g a.i. ha^{-1} + herbicide at GS 21–24, followed by GS 30–32. Meanwhile, Moddus at 125 g a.i. ha^{-1} with fungicide at GS 37 significantly reduced height (−4.6 cm), suggesting a role in lodging suppression. Overall, PGR applications effectively reduced plant height and lodging risk. However, optimizing timing and dosage is essential to maximize yield benefits.

Nodule crushing: a technique to improve symbiotic traits and nitrogen fixation in legumes. R. Pudasaini, M.N. Raizada | *Dept. Plant Agriculture, University of Guelph, Guelph, ON, Canada* • In symbiosis with rhizobia bacteria, legumes can fix atmospheric nitrogen into plant-available ammonia inside root organs called nodules. However, symbiotic nitrogen fixation (SNF) is often sub-optimal mainly because of legume-rhizobia incompatibility or poor rhizobial efficacy. The first objective was to test an alternative method of rhizobia inoculation, called 'nodule crushing'. In a sequential series of indoor and outdoor experiments, we demonstrated that root nodules could be harvested and crushed onto legume seeds (soybean, lentil, peas, cowpea), ultimately improving nodulation and leaf chlorophyll under field conditions. In another experiment, we successfully tested the viability of rhizobia in dried nodules stored for 6 months, confirming storability between cropping seasons. We then hypothesized that sequential rounds of nodule-based selection could improve legume symbiotic traits and potentially SNF. We theorized that nodules are ideal targets for selection, rather than rhizobia, because rhizobia live within a complex microbiome. Common bean root nodules were serially crushed onto seeds in combination with symbiotic trait selection (shoot weight, SPAD chlorophyll) for four generations under low and high N environments in parallel. Only four rapid cycles of nodule crushing based evolution significantly improved the traits under both low N and high N, including SPAD chlorophyll, shoot dry weight, nodule number, and nodule weight. Critically, the %N in shoots increased significantly by 22-23% under both N environments. Nitrogen fixation (%Ndfa) increased by 30% under low N conditions (however, at p=0.16). Overall, the study indicates that nodule crushing-based selection has the potential to rapidly improve rhizobia inoculants and SNF in legumes.

Nutritional improvement and fermentation analysis of corn silage made from intercropping corn with legumes. A. Baghdadi[1,2], R.A. Halim[2], M. Bourgault[1] | *[1] Dept. of Soil and Plant Sciences, University of Saskatchewan, Saskatoon, SK, Canada; and [2] Dept. Crop Science, Faculty of Agriculture, Universiti Putra Malaysia, Selangor, Malaysia* • Cereal-based silage production has the potential to produce giant amounts of energy-rich feed for animal diets. Corn silage protein concentration of 6-10% makes it necessary to enrich corn silage with protein sources to make it a complete ration. Experiments were conducted to compare monocrop silage corn with corn intercropped with three legumes to enrich the protein concentration of the feed when the mixed corn-legume forage was ensiled. Silage corn (*Zea mays* L.) was grown with mungbean (*Vigna radiata*), soybean (*Glycine max*), and stylo (*Stylosanthes guianensis*). The nutritive quality of silage is estimated using Near-infrared reflectance spectroscopy (NIRS), and volatile fatty acid (VFA) content is determined using gas-liquid chromatography (GC). Corn monocrop and corn-soybean intercrops had a higher forage dry matter yield (14.08 and 14.10 t/ha, respectively) than that of corn-mungbean (12.97 t/ha) and corn-stylo (7.93 t/ha) intercropping. Corn-soybean intercropping produced good-quality feed in terms of the nutritive quality and VFA content of the silage. Soybean increased the crude protein (CP) concentration in mixed corn-soybean silage (13.18%) compared with those in the corn monocrop (10.01%), the corn-mungbean (12.04%) and corn-stylo (11.12%) intercrops. Among the legumes, soybean produced the lowest pH when intercropped with corn. The higher CP concentration of soybean at maturity compared to that of the other legumes contributed to the higher silage quality and DM yield of the corn-soybean forage. The study demonstrated that mixed silage made from legumes and corn combination is a feasible strategy to increase the crude protein content of silage corn.

Triple Super Phosphate (TSP) discovered to enhance drought resilience in maize. Amarjit Basra | *OCP North America* • Diammonium phosphate (DAP) is a commonly used phosphorus fertilizer in maize production. However, Triple Super Phosphate (TSP) is a viable alternative with a different chemical composition. In a series of controlled-environment experiments, TSP application unexpectedly conferred drought resilience in maize by reducing transpiration rates even at relatively high soil moisture levels. Rewatering experiments after dry down further demonstrated that this TSP-induced moderation of water loss resulted in an increase in plant biomass compared to DAP-treated plants. This enhanced drought resilience was linked to a significant reduction in root hydraulic conductance. Interestingly, this physiological response to TSP was only observed under near-neutral soil pH conditions, both in soil-based and hydroponic systems. The active component driving this response appears to be the dihydrogen phosphate ion ($H_2PO_4^-$), a key constituent of TSP. These findings suggest that TSP, under the right soil pH conditions, can modulate maize water use in a way that supports growth under drought stress. Field evaluations are currently underway to validate these results in real-world agricultural settings.

***Unravelling the effects of RCA on hydraulic function in hydroponic corn subject to multiple abiotic stressors.** Michael A. Bilek[1], Simone D. Castellarin[1], Italo F. Cuneo[2], Thorsten Knipfer[1] | *[1] Dept. Land and Food Systems, The University of British Columbia, Vancouver BC; [2] School of*

Agronomy, Pontificia Universidad Católica de Valparaíso, Quillota, Chile • Corn is used to feed both humans and livestock, generate biofuels, and has diverse uses in industrial and household products. Due to the detrimental effects of climate change on global crop production, we must identify stress adaptations in key crops to ensure future food security. One such adaptation is root cortical aerenchyma (RCA), vacant channels found in the root cortex that form along the root axis: RCA facilitate oxygen diffusion to waterlogged, hypoxic roots, promote soil exploration under nutrient deficiency, and prevent water backflow into the soil under drought conditions. Overlapping factors make the true impact of RCA on whole-plant physiology and yield unclear, and we aim to examine the effect of RCA formation on root water transport. We grew sweetcorn for two weeks in hydroponics under a factorial design of stress treatments: high/low oxygen, high/low nutrients, and high/low osmotic potential (simulated drought with polyethylene glycol), with high oxygen/nutrients as a control. We monitored daily growth and solution conditions, measured root hydraulic conductivity, leaf gas exchange, and performed fluorescence microscopy on three root developmental zones. Preliminary results show no RCA in control treatments and over 25% RCA in stressed roots. Surprisingly, Lpr is slightly higher in low nutrient/oxygen roots despite significantly lower biomass and water content compared to controls. We aim to provide strong evidence to correlate root function and plant performance with RCA by building a large dataset and using linear regression models, which will guide breeders towards climate-change resilient cultivars and assist farmers in best management practices.

5.2 Horticultural crop resilience to stressors

Chairs Drs. Mehdi Sharifi & Melanie Kalischuk

Effects of postharvest deficit irrigation on sweet cherry (*Prunus avium*) in five Okanagan Valley, Canada, orchards. E. Houghton[1], K. Bevandick[1], D. Neilsen[2], K. Hannam[2], L.M. Nelson[1] | *[1] Dept. Biology, University of British Columbia (Okanagan), Kelowna, BC, Canada; and [2]AAFC Summerland RDC, Summerland, BC, Canada* [Invited talk: Most Cited Horticulture Paper in Canadian Journal Of Plant Science 2022] • The timing and availability of water supply are changing in the Okanagan Valley, and the availability of irrigation water in the late summers is a growing concern. Postharvest deficit irrigation (PDI) is a strategy that can be used to reduce water demands in sweet cherry orchards; previous studies in this region have reported no change in plant physiology or tree growth with irrigation volume reductions of up to 25%, postharvest. However, the effects of more severe postharvest reductions in irrigation volume remain unknown. We compared the effects of full irrigation (100% of conventional grower practice through the growing season) with 27%–33% reductions in irrigation postharvest (~70% of conventional grower practice) and 47%–52% reductions in irrigation postharvest (~50% of conventional grower practice) over a 3-year period (2019–2021) in five commercial sweet cherry orchards that ranged in elevation and latitude across the Okanagan Valley, BC, Canada. In the growing season following treatment application, PDI had no effect on stem water potential or photosynthesis in any year and at any site; there were also no effects of PDI treatment on tree growth. Findings from this study suggest that postharvest stem water potentials from −0.5 to −1.3 MPa, and one-time stem water potentials as low as −2.0 MPa, have no lasting effects on future plant water status, rates of photosynthesis, or plant growth. PDI shows potential as an effective water-saving measure in sweet cherry orchards in the Okanagan Valley. Reference: Houghton et al. https://doi.org/10.1139/cjps-2022-0201

Biofertilizers in horticulture: When and where? M. Hart | *Dept. Biology, University of British Columbia (Okanagan), Kelowna, BC, Canada* [Invited talk] • The use of biofertilizers is commonplace, yet we lack data on how to use them and even if they are needed at all. Here I discuss the current knowledge about what biofertilizers can and cannot do for your growing system, including information about best practices.

Soil fertility responses to two years of cover cropping in an irrigated vineyard system. M. Sharifi[1], J. Yearley[2], M. Jones[2] | *[1]AAFC Summerland, British Columbia, Canada; [2]University of British Columbia Okanagan Campus, Kelowna, BC, Canada* • Cover crops can enhance soil fertility in irrigated vineyards, but their effects vary by species composition and site-specific conditions. This study evaluated the influence of drive-row cover crop mixtures on soil fertility parameters in two organic irrigated vineyards in Okanagan Valley, BC: one in Oliver (loamy sand, S1) and one in West Kelowna (sandy loam, S2). Three cover crop mixtures were established in May 2021 and annual species reseeded in 2022: perennial ryegrass + tillage radish + white clover (TRPRWC), fescue mixture + Dutch white clover (FWC), fall rye + hairy vetch (RHV), and cultivated and allowed to revert to native vegetation (CON). Composite soil samples (0–15 cm depth) were collected pre-treatment (Oct 2020) and post-treatment (Oct 2022) and analyzed for soil organic matter (SOM), pH, cation exchange capacity (CEC), and available macronutrients. A two-way ANOVA assessed treatment and sampling date effects. Soil values were generally higher in S2 than S1, except for pH and available P, which were greater in S1. In S1, cover crop treatments significantly affected soil organic matter (SOM), Ca, and estimated nitrogen release (ENR), with values ranked as RHV > CON ≈ FWC > TRPRWC. Specifically, SOM was highest in RHV, significantly exceeding TRPRWC, while CON and FWC were intermediate. In S2, treatments significantly influenced P, K, Mg, Ca, and P saturation. Phosphorus levels were highest in CON and TRPRWC, followed by FWC and RHV. For K, Mg, and Ca, the ranking was CON > TRPRWC ≈ RHV > FWC, with CON significantly exceeding FWC. The nitrate concentrations only affected by sampling date in both sites. Cover crops can improve soil fertility depending on the site and species mixtures.

Improved disease and nutrient deficiency scouting in watermelon using multispectral imagery. M.L. Kalischuk[1], M. Paret[2] | *[1]University of Guelph, Dept. Plant Agriculture, Guelph, ON, Canada; [2]University of Florida, Dept. Plant Pathology, Gainesville, Florida, USA* • Multispectral imaging has been increasingly used in field scouting but its benefits and improvements to conventional practices remain unknown. Multispectral imaging was conducted using an unmanned aerial vehicle over a site that exposed cucurbits to full and/or 50% flow rates of nitrogen and irrigation. At 46 days after watermelon transplants were placed in the field, a 50% deficiency in nitrogen or combination of nitrogen and irrigation deficiency could be detected using the

green, red, red edge normalized difference vegetation indices (NDVIs) and composite stress and chlorophyll indices. Multispectral images taken later than 46 days after planting watermelon transplants were less useful at detecting deficiency in nitrogen and irrigation due to combined effects of biotic stress. Manual scouting the fields before harvest identified diseases including gummy stem blight, mildew, anthracnose, and insect damage. Disease incidence and severity ratings were significantly different between conventional and UAV-assisted multispectral scouting ($P<0.05$, Bhapkar exact test). Higher severities of 4 and 5 on a scale of 1 to 5 from no disease to complete loss of the canopy were more consistent after scouts used the multispectral images in determining locations for observations. Conventional scouting involving human evaluation remains necessary for disease validation, but multispectral imaging can improve field scouting owing to the increased ability to find stress foci more rapidly than conventional field scouting alone.

***Rapid soil microbiome assessment in vineyards under cover crop management.** M. Sharifi[1], E. Wannop[1], T. Algar[2], J. Yearley[2], and M. Jones[2] | *[1]AAFC, Summerland, British Columbia, Canada; [2]University of British Columbia Okanagan Campus, Kelowna, British Columbia, Canada* • Rapid, simple, and cost-effective soil health assessments are essential for growers. Conventional molecular soil tests, however, are often expensive, time-consuming, and require specialized expertise. The microBIOMETER® soil test offers a viable alternative to evaluate the soil microbiome, a key indicator of soil health. This study used the microBIOMETER® device to quantify fungal and bacterial communities in vineyard soils under different alleyway cover crop treatments. Field experiments were conducted at Covert Farms Family Estate in Oliver, BC, and Kalala Organic Estate Winery in West Kelowna, BC. Three treatments were applied: a mixture of perennial ryegrass, tillage radish, and Dutch white clover (TRPRWC); fall rye combined with hairy vetch (RHV); and a control where cultivated soils reverted to native vegetation (CON). Microbial biomass carbon (MBC) was significantly greater in the CON (413 µg C/g soil) and RHV (388 µg C/g soil) treatments compared to the TRPRWC treatment (238 µg C/g soil). TRPRWC and RHV treatments fell within the "low" MBC range (200–400 µg/g soil), while CON reached the "fair" range (400–600 µg/g soil). Despite the lack of a standardized optimal MBC baseline in agricultural systems, higher MBC is generally associated with improved soil health. Bacteria dominated the microbial communities across all treatments. The fungal-to-bacterial ratios (F:B) were 0.45 in TRPRWC, 0.75 in RHV, and 0.86 in CON. Although higher F:B ratios can enhance nitrogen mineralization and reduce leaching, their agronomic benefits warrant further empirical investigation. Previous studies have reported variable accuracy of the microBIOMETER® compared to conventional methods, warranting further validation.

***Detection of novel viruses/variants in highbush blueberries of British Columbia.** S. Kannangara[1], J. Rodriguez[1], A. Gilewski[1], G. De Villiers[2], M. Ellis[2], P. Ellis[2], E. Gerbrandt[3], J. Mattsson[1] | *[1] Dept. Biological Sciences, Simon Fraser University, Burnaby, BC, Canada; [2]Phyto Diagnostics Company Ltd., North Saanich, BC, Canada; [3]BC Blueberry Council, Abbotsford, BC, Canada* • In British Columbia and elsewhere there are currently two viruses that cause severe disease and impact on commercial production of blueberries. While the symptoms of disease are initially similar, plants diseased from Blueberry Shock virus can recover, whereas plants diseased from Scorch virus never recover and ultimately die. Shock-infected plants can be left in the field whereas Scorch-infected plants should ideally be removed to prevent further spread of the disease. In recent years, however, growers have increasingly received test results that are negative for both viruses, indicating that one or several new viruses have emerged and may explain the hitherto undiagnosed disease. We used large scale RNA sequencing to identify potential novel viruses in healthy as well as diseased plants. We found four luteoviruses, two recently identified in the USA and two novel luteoviruses. The luteoviruses are, however, widespread in healthy blueberry plants and not associated with disease. Instead, we found many novel variants of the Scorch virus and the Shock virus. When PCR testing was adjusted to identify plants carrying these variants as positive, the frequency of plants that tested positive for either or both of Scorch and Shock viruses increased dramatically and the number of false negative plants fell from 22% to 1% of plants. We also found that improved PCR also detects Scorch and Shock viruses at levels below that of cost-efficient ELISA testing. Taken together, detection of Scorch and Shock viruses rather than novel viruses appear to be the main reason behind undiagnosed disease.

***Organic waste compost improves soil fertility and controls pathogenic dagger and pin nematode populations in a crown gall-diseased vineyard.** P. McGonigal[1], T. M. Voegel[1], P. Munro[2], T. Forge[2], L.M. Nelson[1] | *[1] Dept. Biology, University of British Columbia, Okanagan Campus, Kelowna, BC, Canada; [2]AAFC Summerland RDC, Summerland, BC, Canada* • Organic compost application benefits soil fertility and grapevine performance by enhancing soil nutritional status and diversifying microbial populations. Pathogen suppression following compost application can subsequently be achieved through several mechanisms. Grapevine crown gall (GCG), caused by *Allorhizobium vitis*, negatively impacts grapevine performance and crop quality. Soil-borne *A. vitis* infection is exacerbated through grapevine root parasitism by nematodes. Root-feeding nematodes create entry points for *A. vitis* bacteria to enter grapevine vasculature and establish systemic infection. However, pathogenic nematode populations in agricultural soil have been shown to be reduced via compost. Therefore, we hypothesized that organic compost application would improve soil fertility parameters, vine performance, crop yield and quality, and reduce GCG symptoms by reducing pathogenic nematode soil populations. Three organic waste composts were applied in-row for three years in a Chardonnay (Vitis vinifera) vineyard with A. vitis and plant-parasitic nematodes present in soil. Several soil fertility parameters, including total carbon and nitrogen (%), organic matter (%), and phosphorus content (mg kg^{-1} soil), improved following compost application. Compost containing peat moss decreased *Paratylenchus* population densities in soil over three years, while vineyard waste and grape marc compost reduced *Ximphinema* population densities for only one year. However, no changes in fresh gall growth (%) were observed. Grapevine performance, crop quality, or yield were also not meaningfully affected. Studies examining the effect of compost on new plantings in infected soil are needed. Future studies should also investigate the impact of compost on the soil microbial population to examine the effect on soil metabolic activity.

***The mycovirome of hypovirulent *Botrytis cinerea* isolates infecting strawberries and raspberries.** S.C. Drury[1,2], A. Poursalavati[1,2], P. Lemoyne[1], D. Xu[1], P. Moffett[2], O. Carisse[1], H. van der Heyden[1], M.L. Fall[1] | *[1]AAFC Saint-Jean-sur-Richelieu RDC, Saint-Jean-sur-Richelieu, Québec, Canada; [2]Centre SÈVE, Département de Biologie, Université de Sherbrooke, Sherbrooke, Québec, Canada* • *Botrytis cinerea* causes significant economic losses to many crops, including vegetables, fruits, and ornamental plants, and its management is becoming increasingly difficult due to rising fungicide resistance.

Harnessing mycoviruses that cause reduced virulence (hypovirulence) in *B. cinerea* is a promising alternative. Over 100 mycoviruses have been identified in *Botrytis* spp. to date, including several hypovirulence-inducing mycoviruses. This research aimed to explore, for the first time in Canada, the mycovirome of *B. cinerea* and identify potential hypovirulence-inducing mycoviruses. B. cinerea isolates were collected from fruits and vegetables in Quebec, and fitness and pathogenicity criteria, including colony morphotype and lesion size, were evaluated. A double-stranded RNA (dsRNA) extraction protocol was used to sequence dsRNA from 45 isolates, most of which had low fitness/pathogenicity. An in-house bioinformatics workflow was used to profile the mycovirome. Mycoviruses were identified in 44/45 isolates. Most mycoviruses had positive-sense single-stranded RNA or dsRNA genomes, and a small number had negative-sense single-stranded RNA, single-stranded DNA, or reverse-transcribing RNA genomes. Several mycovirus species positively and/or negatively co-occurred with *B. cinerea* isolates collected from strawberry or raspberry plants. Potential hypovirulence-inducing mycoviruses, including *Botrytis cinerea* mitovirus 1, *Botrytis cinerea* hypovirus 1, and *Botrytis porri* botybirnavirus 1, were identified. Additionally, we identified 62 unique contigs belonging to new strains of known mycovirus species and four putative novel mycovirus species belonging to the taxa *Endornaviridae*, *Botybirnaviridae, Peribunyaviridae*, and *Bunyavirales*. Some of the mycoviruses identified belonged to taxa known to produce viral particles, which can be an interesting feature for their use as biocontrol agents.

***Improving nitrogen use efficiency and reducing nitrous oxide emissions in potato production.** L.C. Carruthers, K.A. Congreves | *Dept. Plant Sciences, University of Saskatchewan, Saskatoon SK* • Agricultural soils are a significant source of nitrous oxide (N_2O), a potent greenhouse gas. Low nitrogen use efficiency (NUE) of cropping systems, paired with high fertilizer rates, increases risk of N_2O production. Potatoes, due to their high nitrogen (N) demand and low NUE, present an increased emissions risk. This study in Saskatchewan compared six potato cultivars under multiple fertilizer rates and soil textures to determine if cultivar influences NUE. We also monitored N_2O emissions from three cultivars over two growing seasons. Findings reveal cultivar can significantly impact yield and NUE of potato, and therefore selecting high NUE cultivars could be a sustainable management strategy. We report cumulative growing season emissions in line with other Prairie research, but much lower than other regions of Canada. Results show emissions differ by soil texture and are driven by N cycling processes and environmental conditions. A lack of yield benefit from higher N rates found in this study, paired with understanding that emissions increase with higher fertilizer application, highlights a need to refine soil testing and provincial N recommendations to optimize fertilizer inputs and crop productivity. This study provides key considerations for mitigating N2O emissions, including fertilizer management and cultivar selection.

5.3 Genetics and breeding in oilseeds and pulse crops

Chairs Dr. G. Singh Brar &H. Randhawa

The Pulse of Progress: Canada's role in global crop innovation. Mohsen Yoosefzadeh-Najafabadi | *Dept. Plant Agriculture, University of Guelph, Guelph, ON, Canada* • Accelerating crop production plays an important role in agricultural sustainability, a focus for plant breeders, agronomists, and the food industries. In recent decades, production has increased significantly due to rising demand, technological advancements, and expanded cultivation areas. Canada is emerging as a key player in agriculture, leveraging its rich landscapes and advanced technologies to enhance crop production. Supported by government and private sectors, Canadian research focuses on developing high-yield, pest-resistant varieties suited to local conditions. This presentation reviews global trends in crop production, consumption, trade, and research, with a particular emphasis on dry bean breeding in Canada. It highlights collaborations between Canadian and international bodies that enhance productivity and sustainability. The session aims to provide insights into the factors influencing the agricultural industry and offers practical recommendations for policymakers and stakeholders to boost competitiveness and sustainability. Addressing challenges such as climate change and the rising demand for plant-based proteins, the presentation underscores the importance of innovative research and breeding to ensure crops' ongoing critical role in global food security.

Accelerated Breeding: Flax on fast-forward. M.A. House, B. Tar'an | *Crop Development Centre and Dept. Plant Sciences, College of Agriculture and Bioresources, University of Saskatchewan, Saskatoon, SK, Canada* • Adoption of speed breeding methods is increasing as a means to shorten the breeding cycle, reduce costs, and enhance adaptability to changing market demands. At the University of Saskatchewan's flax breeding and research program, we created a speed breeding protocol that has proven successful in developing novel germplasm in a relatively short period. We first tested 10 diverse genotypes in four sets of conditions: (1) control (22 °C/17 °C, 16 h/8 h day night cycle), (2) high day temperature (24 °C/17 °C, 16 h/8 h), (3) long daylength (22 °C/17 °C, 22 h/2 h), and (4) both high temperature and long daylength (24 °C/17 °C, 22 h/2 h). Generally, the most accelerated development occurred during high temperature and long-day conditions, which we selected for our official speed breeding protocol. Additionally, we determined that, depending on genotype, mature seeds can be reliably collected up to nine days earlier in accelerated breeding conditions. We illustrated the value of our speed breeding approach by developing novel breeding lines using a combination of speed breeding and (a) visual selection for high value traits, such as seed size and short plant stature, and (b) molecular marker-assisted selection for disease resistance and important seed quality traits. We also combined speed breeding with a high plant-density growth system to quickly develop a large recombinant inbred line population. With our approach, average generation time is reduced by 1-1.5 months, allowing completion of 5-6 generations per year, demonstrating the usefulness of our protocol to rapidly develop novel flax genotypes.

Long term soybean protein trends in Canada. Elroy Cober, Malcolm Morrison | *AAFC Ottawa RDC, Ottawa, ON, Canada* • A study of old to newer Canadian soybean cultivars showed a reduction in soybean seed protein in cultivars developed over years. Temporal and geographic differences in seed protein have been observed in the US. In Canada, Western grown soybean has lower protein than Eastern soybean. Using Canadian Grain Commission data from 2005 to 2023, we characterised the temporal and geographic trends in Canadian soybean seed protein and estimated protein level in soybean meal. The protein level in soybean meal is decreasing over years and approaching the minimum level required before discounts are applied. Expansion of soybean production in Canada, environmental changes over years, and ongoing effects of breeding for high yield all impact the decline in soybean protein. It is possible, but costly, to increase soybean seed protein and would require the entire value chain to make this a priority.

When is yield determined in Ontario soybean? Environment and management effects. H. Earl[1], M. Rundle[1], D. Hooker[1], I. Rajcan[1], H. Bohner[2], E. Glemser[1] | *[1] Dept. Plant Agriculture, University of Guelph, Guelph, Ontario, Canada; and [2]Ontario Ministry of Agriculture, Food and Agribusiness, Stratford, Ontario, Canada* • Ontario soybean yields vary significantly, and the physiological basis of this yield variation is poorly understood. We conducted a field experiment in nine environments (three locations in Ontario in each of three years) to investigate the effects of environment and management on soybean yield and yield components, and also the relationship between individual yield components and crop growth rates (CGRs) measured at different crop developmental stages. Three varieties were grown using high-input management and a control; the high-input treatment included a comprehensive fertilizer package, two fungicide applications, and two in-season N applications. Exclusion treatments were also included to test the individual effects of the three high-input components. In general, we found yield to be recalcitrant to inputs, with the high-input treatment yielding only 0.64 Mg/ha (18%) higher than the control on average, and only the in-season N component providing a consistent benefit. High input management increased seed size (100-seed weight) more than seed number (seeds m-2), and seed size variation between treatments was positively correlated with CGRs during early reproductive development (R2 to R3). Effects of environment were large, with yield ranging from 3.26 to 4.59 Mg/ha; four high-yielding environments yielded 24% more than five low-yielding environments, mostly because of higher seed number caused by higher pod number. Seed number was positively correlated with CGRs at R5. In summary, effects of management and environment on soybean yield were found to be physiologically distinct, and CGR during early reproductive development had a larger than expected effect on seed size.

Identifying canola (*Brassica napus* L.) accessions with superior photosynthetic traits and unique resource partitioning strategies. F. Guerrero-Zurita, S. Jahan Liza, S. Lopez, K. Gill, B. Kebede, H. Rahman, L.Y. Gorim | *Dept. Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB, Canada* • Canola yields in Canada is not increasing sufficiently to meet future global demands. Improving photosynthetic efficiency and optimizing photoassimilate allocation represent a promising strategy to enhance yield potential. This study evaluated the photosynthetic and agronomic traits of 168 diverse canola accessions belonging to six pedigree groups: spring × spring (SP×SP), spring × winter (WI×SP), spring × rutabaga (SP×RU), (winter × spring) × rutabaga ((WI×SP)×RU), spring × B. oleracea (SP×BO), spring × B. rapa (SP×BR), and a Gene bank collection. Field experiments conducted over three growing seasons in Central Alberta, Canada identified moderate to high heritability for four chlorophyll fluorescence parameters and five agronomic traits. Distinct source-sink allocation strategies emerged among pedigree groups. The SP×SP group optimized resource allocation for maximal seed yield, while winter canola-derived groups prioritized seed size (TKW) while maintaining competitive yields, likely through extended grain-filling periods. Unique physiological linkages were observed in progenitor-derived groups: SP×BR accessions exhibited coordinated regulation of NPQ photoprotection, biomass production, and yield, whereas SP×BO demonstrated an association between root biomass and reduced minimal fluorescence (Fo'), suggesting improved PSII efficiency. These findings highlight the value of physiological trait-based selection in canola breeding. The identified germplasm and trait relationships provide a foundation for developing improved spring canola cultivars through targeted integration of favorable photosynthetic and allocation characteristics.

Genomic selection for oil and fatty acid profile in rapeseed (*Brassica napus* L.). Jared Bento, Jia Sun, Sakaria Liban, Curt McCartney, Harmeet Chawla, Robert Duncan | *Dept. Plant Science, University of Manitoba, Winnipeg, MB, Canada* • Genome-wide association studies (GWAS) and genomic selection (GS) are important methods that provide the potential to improve plant breeding efficiency. These tools facilitate more rapid responses to agronomic/quality challenges. The research focused on three main objectives: 1) GWAS to identify quantitative trait loci (QTL) for five seed quality traits, 2) evaluate GS accuracy in predicting rapeseed hybrid fatty acid profile components, and 3) evaluate the "GS + de novo GWAS" method proposed to improve GS prediction accuracy. This project analyzed 454 *Brassica napus* genotypes (92 parents, 362 hybrids) grown over 48 site-years. All genotypes were genotyped via *Brassica* 60K Illumina SNP array. FarmCPU identified 89 peak QTL across the five traits. Several peak QTL identified in this study co-localize with QTL described for the same traits in previous studies. Thirty previously discovered fatty acid biosynthesis candidate genes coincide with QTL identified in this study. Genomic selection prediction accuracy was compared across 135 unique GS analyses for each trait, evaluating responses to model, population, and marker density. Prediction accuracies ranged from negative values to as high as 0.89, exhibiting distinguishable trends that included prediction accuracies above 0.70 for all five traits. Prediction accuracy generally decreased in response to trait complexity, increased in response to training population size and degree of training/validation population relatedness, and exhibited no significant differences among marker densities or parametric models. We identified GWAS-guided GS analyses which slightly outperformed conventional GS across all seed quality traits, however significant differences between the two methods were not identified.

Quantification of genetic variation in nutrient compositions in cowpea [*Vigna unguiculata* (L) Walp] genotypes grown in marginal areas of South Africa. Abe Shegro Gerrano | *Agricultural Research Council - Vegetable, Industrial and Medicinal Plant Institute, Pretoria, Republic of South Africa; Food Security and Safety Focus Area, Faculty of Natural and Agricultural Sciences, North West University, Mafikeng, South Africa* • The identification of potential cowpea (*Vigna unguiculata* (L) Walp) genotypes with dense nutritional and phytochemical compositions is key to improving global food and nutrition security. This study aimed at identifying cowpea genotypes possessing suitable nutritional and phytochemical compositions for consumption, production and breeding. The responses of diverse cowpea genotypes cultivated under a dryland farming system were studied using fresh leaves and,

green pods to evaluate seed micronutrients [i.e., iron (Fe), zinc (Zn) and protein] and phytochemicals [i.e., phenols, flavonoids and condensed tannins]. The genotype-by-environment interaction effect was significant ($p \leq 0.05$) for all studied traits. Pearson's correlation (r) analysis revealed the following positive and significant ($p \leq 0.001$) correlations: protein correlated with Fe ($r = 0.92$), and Fe and Zn ($r = 0.33$). Negative and significant ($p \leq 0.001$) correlations were recorded between phenolic content and protein ($r = -0.40$), Zn and condensed tannin ($r = -0.16$), and total phenolics and protein ($r = -0.42$). Based on principal components analysis (PCA), the genotypes G10, G12, G24, G29 and G47 were superior for Fe, and Zn contents, while G14, G23, G25, G27, G30, G34, G45 and G50 were associated with increased phenolic contents. The genotypes possessing desired nutritional and phytochemical compositions were recommended for consumption, cultivation, and breeding for dryland areas of South Africa.

Characterizing variation in root architectural traits among chickpea (*Cicer arietinum* L.) interspecific population grown in a hydroponic setup. T.A. Jahan, B. Tar'an | *Crop Development Centre & Dept. Plant Sciences, University of Saskatchewan, Saskatoon, SK, Canada* • Sustainable production of chickpea (*Cicer arietinum* L.), a second most important pulse crop, poses is limited by the low plant-available phosphorus. Phosphorus (P) is essential for chickpea growth, supporting root and shoot development, nodulation, nitrogen fixation, flowering, and stress tolerance. However, large amount of P fertilizer tends to form complexes with other minerals and makes it less available to plants. Previous studies found that root structure like total length, root hairs, and growth rate are closely linked to low-P tolerance. Understanding root trait variation in chickpea germplasm can help breed lines with better resource uptake and stress tolerance like phosphorus deficiency. An experiment was conducted in the greenhouse using a hydroponic system to study the root architectural traits. The objective of this study was to characterize root trait variation in an interspecific population of 200 lines derived from a cross between *Cicer arietinum* and *Cicer reticulatum*. Plant roots were measured using Winrhizo root image scanner as well as manual measurements. The chickpea interspecific lines exhibited large variation for all roots and few shoot traits. The Pearson correlation showed a strong correlation among the selected traits ($p \leq 0.01$). Principal components analysis identified 7 lines that showed strong association with root surface area, root projected area, total root length and shoot length. The genome wide association analysis showed significant association of root traits and SNP variations across the genome. This research is continuing with the same interspecific population for the identification of QTLs associated with phosphorous utilization efficiency (PUE).

***Dissecting the genetic basis of heat tolerance in interspecific chickpea population.** Duchesne S.A., Kalve S., Gali K.K., Tar'an B. | *Crop Development Centre & Dept. Plant Sciences, University of Saskatchewan, Saskatoon, Canada* • Heat stress is one of the major yield-limiting factors in chickpea (*Cicer arietinum* L.), particularly under the shifting climate conditions facing Canadian agriculture. To address this, we evaluated an interspecific population of 200 inbred lines developed from a kabuli parent crossed with wild *Cicer reticulatum* accessions. Previous field trials under late-sown conditions revealed lines maintaining their performance under stress. To dissect the response to heat stress, we imposed simulated heatwaves in controlled environments during flowering (35°C day/29°C night). A subset of the most tolerant and sensitive lines was further evaluated under more extreme conditions (40°C/25°C), revealing that both the growth stage exposed to stress (flowering vs. podding) and night recovery temperatures influenced yield retention. Sensitive lines and elite checks showed significant yield reduction, while tolerant lines sustained productivity. Four lines (three tolerant and one sensitive) were selected for physiological and transcriptomic analysis. The majority (~90%) of floral abortion occurred post-pollen release, and the sensitive line exhibited reduced pollen viability and altered pollen structure. Analyses of pigment levels, osmoprotectants, membrane stability, and antioxidant response revealed distinct coping strategies among tolerant lines. Genome-wide association analysis for seed yield and harvest index showed significant associations with genomic regions on Chr04, known for an abiotic stress tolerance hotspot. A notable SNP associated with heat tolerance emerged within a sugar transporter gene, offering potential for marker development. Leveraging phenotypic, genomic, and transcriptomic tools to integrate wild genetic diversity into elite lines will lead the development of more heat-resilient chickpea cultivars.

***Exploring Pasmo resistance from *Linum bienne* for flax improvement.** Xinjie Yu, Keiko Nabetani, Randy Kutcher, Bunyamin Tar'an | *University of Saskatchewan, Saskatoon, SK, Canada* • Pasmo, caused by *Septoria linicola*, is the most prevalent foliar disease of flax (Linum usitatissimum) in Western Canada, often resulting in significant yield and quality losses. Currently, no Canadian flax cultivars have effective resistance to pasmo. The wild progenitor *Linum bienne* has been reported to show moderate resistance to pasmo, making it a valuable source of improving pasmo resistance in cultivated flax. To investigate the genetic basis of pasmo resistance, we are using a recombinant inbred line (RIL) population derived from a cross between CDC Bethune and *L. bienne*, developed by Agriculture and Agri-Food Canada (AAFC). We screened 106 RILs under controlled growth chamber conditions using a standardized indoor inoculation protocol. This screening provides a foundation for identifying quantitative trait loci (QTL) associated with pasmo resistance which ultimately provides tools for marker assisted selection to support the development of flax cultivars with improved resistance against pasmo. By exploring the genetic potential of *L. bienne*, this research contributes to the broader goal of re-domestication flax though wild introgression.

5.4 Digital Agriculture: Tools for Tomorrow's Agriculture

Chairs Dr. Adrian Correndo &Aitazaz Farooque

Role of precision agriculture technologies for sustainable farming: Atlantic Canadian perspective. Aitazaz Farooque[1] | [1]*Faculty of Sustainable Design Engineering, University of Prince Edward Island, Charlottetown, PE, Canada* • Precision agriculture technologies are transforming sustainable farming by enabling data-driven, site-specific management practices that boost productivity while minimizing environmental impact. This invited talk explores the pivotal role of these innovations in promoting soil health through the targeted application of nutrients and organic matter, guided by real-time sensors and geospatial mapping. We will examine how autonomous robots and variable rate applicators allow for the precise deployment of inputs, reducing chemical overuse and decreasing reliance on manual labor. The talk will also highlight advanced systems for monitoring greenhouse gas emissions, which support the development of best management practices to mitigate agriculture's climate footprint. In addition, we will explore smart irrigation and water management tools that optimize water use, enhancing resilience to drought and water scarcity. The role of deep learning and artificial intelligence will also be discussed in forecasting crop health, predicting pest outbreaks, and anticipating resource needs. Together, these technologies pave the way for long-term agricultural sustainability, balancing increased productivity with responsible ecological stewardship.

Optimizing yield data aggregation in on-farm "strip trials." J. Sulik, C. Niemeyer | *Dept. Plant Agriculture, Guelph, Ontario, Canada* • On-farm Experiments are often implemented as "strip trials" by farmers and chemical companies to evaluate crop inputs and/or management practices, such as the application of Plant Growth Regulators (PGR) in winter wheat. Although these trials are often considered unreplicated and subject to confounding by field variability, they have little up-front costs in terms of specialized equipment or planning. Although not as powerful as randomized controlled trials, it is still worth exploring how to improve such experiments, which lack sophisticated research design. One major issue is that even if yield monitor data can disaggregate yield measurements within each strip, they are still considered to be unreplicated unless spatial statistical models are used for analysis and field variability is accounted for. This poster uses a t-test framework for evaluating different levels of granularity for yield data aggregation for comparison between strips with and without PGR application. A spatially corrected t-statistic was compared with a standard t-statistic at a range of plot lengths from 1 meter to 40 meters to explore tradeoffs between spatial autocorrelation and model uncertainty. Based on the exploratory data analysis, our results suggest that a plot length of 15 meters is the shortest practical plot length for site-specific analysis of yield response to PGR for our on-farm experiments. Further research examines how to account for field variability when conducting on-farm strip trials.

***Downscaling in-season yield forecasts across Western Canada using remote sensing and machine learning methods.** S. van Steenbergen, K. Nketia, T. Ha, H. Fernando, S. Shirtliffe | *Dept. Plant Sciences, University of Saskatchewan, Saskatoon, SK, Canada* • Wheat is the most widely grown crop in Canada, with over 27 million acres seeded in 2023, primarily spring wheat (19 million acres). Saskatchewan leads national production, followed by Alberta and Manitoba. Like all crops, spring wheat yields are influenced by environmental conditions. To better understand how climate change may impact wheat and food security in Western Canada, this study developed a downscaled statistical model to forecast spring wheat yields during the growing season using weather, climate indices, crop masks, and remotely sensed data. Forecasting began June 15 and continued biweekly to August 1, using a stepwise temporal approach. Environmental predictors were collected at a 5 km Å~ 5 km resolution, while yield data were at the rural municipality or RiskZone level. Google Earth Engine was used to derive predictors, including NDVI from MODIS, soil moisture, precipitation, temperature, and evapotranspiration. Three machine learning models; Random Forest, XGBoost, and Stepwise Regression were trained and evaluated using leave-one-year-out cross-validation. Stepwise regression was the most accurate and environmentally robust (average R. up to 0.82), particularly under extreme conditions like the 2021 drought. Key predictors included July NDVI, soil moisture, late-July temperature, and evapotranspiration. This research enables real-time yield forecasting and supports sustainable resource allocation, risk management, and climate adaptation strategies. It also lays the foundation for modelling future production under climate change and guiding genotype development for weather resilience. Ultimately, it contributes to national food security by enabling earlier, more accurate yield predictions.

***Integrating Deep Learning and UAV remote sensing for precision Plant stand counting and spatial fertility analysis in potato crops.** Hassan Afzaal[1], Aitazaz A. Farooque[1,2], Nicholas Krouglicof[3], Gurjit S. Randhawa[4], Arnold W. Schumann[5], Qamar Uz Zaman[6] | [1]*Faculty of Sustainable Design Engineering, University of Prince Edward Island;* [2]*Canadian Centre for Climate Change and Adaptation, University of Prince Edward Island, St Peters Bay, PE, Canada;* [3]*Intempco Canada, Montreal, QC, Canada;* [4]*School of Computer Science, University of Guelph, Guelph, ON, Canada;* [5]*Citrus Research and Education Center, University of Florida, Gainesville, FL, USA;* [6] *Dept. Engineering, Faculty of Agriculture, Dalhousie University, Truro, NS, Canada* • Plant stand count is pivotal parameter in determining crop density, influencing resource competition, light interception, and ultimately affecting yield potential. To address the challenges of intense measurement and to improve crop monitoring, this study implemented advanced deep learning techniques integrated with Unmanned Aerial Vehicle (UAV) imagery. In this investigation, high-resolution aerial images were acquired through comprehensive planned UAV flights conducted throughout the growing season over five distinct potato fields in Prince Edward Island. Bi-weekly UAV flights throughout the growing season of 2023 enabled continuous monitoring of crop establishment. Three object detection models—DETR, YOLO, and Mask R-CNN—were deployed to automatically quantify plant stand counts. Over 10,000 images and 50,000 supervised labels were used in training (70%), validation (15%) and testing phases (15%). Furthermore, spatial analyses were also performed using Soil and Water Assessment Tool (SWAT) Map technology to assess the crop potential in fertility (low, medium and high) zones. This integration provided a detailed evaluation of plant stand variability across fertility zones, thereby establishing the relationship between soil nutrient heterogeneity and crop establishment. The spatial assessment allows for the delineation of distinct fertility regimes and provided a deeper understanding of how localized environmental factors influence plant density and subsequent yield outcomes. Preliminary results demonstrate that the deep learning models were highly effective in accurately mapping plant stand

counts in potato crops. Detailed analyses, including quantitative performance comparisons, spatial variability assessments, and discussions regarding model scalability and implementation challenges, will be presented at the upcoming annual conference.

***Enhancing potato crop coefficient estimation using XGBoost optimized with the Chaos Game algorithm and SHAP analysis.** Saad Javed Cheema[1], Aitazaz A. Farooque[1,2] | [1]*School of Climate Change and Adaptation, University of Prince Edward Island;* [2]*Faculty of Sustainable Design Engineering, University of Prince Edward Island, Charlottetown, PE, Canada* • Precise crop coefficient (K_c) value estimation is essential for optimizing water use efficiency in agriculture and irrigation scheduling. Empirical models are frequently employed to estimate K_c. However, these models can be limited by the complexity and unpredictability of environmental and crop-specific factors. This article introduces a distinctive machine learning approach utilizing Extreme Gradient Boosting (XGBoost) optimized with the Chaos Game algorithm to estimate the K_c of potatoes (*Solanum tuberosum* L.). The incorporation of SHAP (Shapley Additive exPlanations) values improves interpretability, facilitating a more profound comprehension of the elements affecting the model's predictions. Three distinct input scenarios were established: comb1: All meteorological and soil data, comb2: Only soil data, and comb3: Exclusively meteorological data. The XGBoost model was trained and refined utilizing the Chaos Game algorithm, which improves the convergence rate and precision of the model. The findings indicated that the XGBoost model utilizing the comb2 input scenario, optimized by the Chaos Game algorithm, markedly surpasses conventional machine learning models in prediction accuracy (R= 0.9978, RMSE=0.02151, and MAPE = 1.63%). The SHAP analysis indicated that variables like soil moisture and field capacity (FC) substantially influenced the prediction of the crop coefficient. This machine learning method enhanced the forecast accuracy of potato K_c and offered actionable insights for farmers and agronomists to optimize irrigation strategies, ultimately fostering sustainable water management practices in potato agriculture.

***Eco-friendly hybrid nano-fertilizers from marine waste for enhanced nutrient retention and controlled release.** Muhammad Jahandad Khan[1], Manmeet Kaur Chhina[2], Khalil I. Al-Murghrabi[3], Kuljeet Singh Grewal[1], Gurpreet Singh Selopal[2], Aitazaz A. Farooque[4] | [1]*Faculty of Sustainable Design Engineering, University of Prince Edward Island;* [2] *Dept. Engineering, Faculty of Agriculture, Dalhousie University, Truro, NS, Canada;* [3]*Potato Development Centre, Agriculture, Aquaculture & Fisheries, Government of New Brunswick, NB, Canada;* [4]*School of Climate Change and Adaptation, University of Prince Edward Island, Charlottetown, PE, Canada* • The excessive loss of nutrients from conventional fertilizers leads to reduced nutrient use efficiency, environmental contamination, and elevated greenhouse gas (GHG) emissions. Nano-fertilizers (NFs) offer a promising alternative by enabling controlled nutrient release and minimizing ecological impact. This study developed a sustainable hybrid nano-fertilizer using oyster shell-derived hydroxyapatite (HA) as a base material, functionalized with nano-urea (NU) through a green, scalable wet-chemical synthesis route. The influence of different NU:HA ratios and calcination durations on the structural morphology of the hybrid NFs was characterized using scanning electron microscopy (SEM). Nutrient release behaviour was assessed via column leaching experiments, comparing the performance of hybrid NFs with conventional fertilizers and untreated controls. The hybrid formulation exhibited significantly lower nutrient leaching, indicating improved nutrient retention in soil, enhanced potential for plant uptake, and a reduced risk of environmental pollution. This approach demonstrates the value of marine waste in producing efficient, environmentally friendly fertilizers for sustainable agriculture.

Poster Abstracts

CSA Student Poster Presentations

P01. *The effect of liquid humalite on symbiotic nitrogen fixation and growth in red clover (*Trifolium pratense* L.). Oshadhi Athukorala Arachchige, Pramod Rathor, Malinda S. Thilakarathna | *Dept. Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB, Canada* • Legumes form a symbiotic relationship with nitrogen (N) fixing soil bacteria called rhizobia, which convert atmospheric N_2 into bioavailable forms. However, suboptimal nodulation can hinder the symbiotic nitrogen fixation (SNF) efficiency, highlighting the need for optimization. Liquid Humalite, a humic acid-rich amendment from Southern Alberta, has shown enhanced SNF in grain legumes, but its impact on forage legumes remains largely unexplored. This study evaluated the effects of four liquid Humalite concentrations (0.1, 0.2, 0.4, and 0.8% v/v) on red clover growth, nodulation, and SNF under controlled conditions using a modified Leonard jar setup. After six weeks of growth, plant biomass, root, and nodulation parameters were measured, while SNF was assessed using the 15N isotope dilution method. Results indicate that compared to the untreated control, 0.1% Humalite treatment increased shoot biomass (23%), root length (17%), surface area (17%), and root volume (29%). At 0.2% Humalite concentration, root and total biomass increased by 44% and 37%, respectively, compared to untreated plants. Similarly, 0.1% concentration enhanced nodule number (19%), nodule dry weight (33%), and average nodule dry weight (19%). At 0.2% Humalite concentration, SNF capacity and total N fixed in shoots increased by 80% and 134%, respectively, compared to untreated plants. In terms of shoot N content, a 40% increase was observed at 0.1% Humalite treatment compared to the control. These findings suggest that liquid Humalite positively impacts plant growth and SNF in red clover.

P02. *Measuring agricultural nitrous oxide emissions in variable rate fertilization cereal plots. S. Bahmutsky[1,2], N. Pelletier[1] | *[1]Charles E. Fipke Centre for Innovative Research, University of British Columbia, Kelowna, BC, Canada; [2]Smart Agriculture Applied Research, Centre for Innovation, Olds College of Agriculture & Technology, Olds, AB, Canada* • Nitrous oxide (N_2O) is a potent greenhouse gas (GHG) with a global warming potential 273 times that of carbon dioxide (CO_2). Agriculture accounts for 8% of total GHG emissions in Canada, with approximately half of the warming effect caused by N_2O. An approach to reduce emissions is through beneficial management practices (BMP's) such as variable rate fertilization. A small plot variable rate fertilization trial in central Alberta, Canada was conducted to monitor N_2O emissions relative to varying fertilization application rates throughout the 2023 and 2024 growing seasons for barley and wheat production. Treatments of varying fertilizer rates were used (prescribed rate, +30%, -30%). A long-term LI-COR measurement system (LI-8250 Multiplexer, LI-870 CO_2/H_2O Analyzer, LI-7820 N_2O/H_2O Trace Gas Analyzer, and eight 200-104C Clear Long-Term Chambers) was deployed to obtain high temporal resolution measurements over the 2023 and 2024 agricultural seasons. Results displayed diurnal patterns, changes with weather, and throughout the season as crops grew. High fertilization treatment plots had the highest emissions following seeding, but comparatively lower emissions nearing harvest. The low fertilization treatment plots had the highest cumulative emissions. End of season total emissions did not clearly manifest from trends seen during instantaneous flux measurements. Year to year changes were observed, and greater emissions in 2024. N_2O emissions are affected by many variables, a better understanding of mechanisms and other variables interacting with flux is necessary.

P03. *Investigating aquaporin expression and actin dynamics in wheat under drought × heat stress conditions. Julie Clarke[1], Abdul Halim[1], Abidur Rahman[2], Glen R. Uhrig[3], Raju Soolanayakanahally[4], Karen Tanino[1] | *[1] Dept. Plant Science, University of Saskatchewan, Saskatoon, SK, Canada; [2] Dept. Plant Bio Sciences, Iwate University, Morioka, Japan; [3] Dept. Biological Sciences and Dept. Biochemistry, University of Alberta, Edmonton, AB, Canada; [4]AAFC Saskatoon RDC, Saskatoon, SK, Canada* • Wheat (*Triticum aestivum* L.) is an economically important crop in Canada. However, drought and heat stress threaten productivity and yield. To overcome this, resilient cultivars need to be developed. Aquaporins (AQPs), which are membrane integral proteins that conduct bidirectional movement of water and other small neutral molecules, could be a viable molecular breeding target to improve wheat resilience to abiotic stress. AQPs show highly diverse expression patterns that are influenced by many factors, including abiotic stress. Intracellular trafficking of AQPs is facilitated by the vesicle-mediated secretory pathway that travels along actin filaments. Hence, the abundance of AQPs may be affected by altered actin dynamics. The objectives of this study are 1) to examine the alterations in AQP abundance in sensitive and tolerant wheat genotypes under drought × heat stress, and 2) to determine if the differences in AQP abundance are due to alterations in actin function. Two drought sensitive genotypes, BW45646 and Rac875, and two drought resistant genotypes, AGG198301QUWH and Kukri, were grown in a high tunnel system under drought × heat stress in simulated field conditions. Quantitative proteomic analysis will be performed to determine AQP abundance in root and leaf tissue. Actin dynamics will be investigated in the wheat genotypes and Arabidopsis thaliana actin mutant systems to determine the effect of drought × heat stress conditions. This project will help to identify specific AQPs and aspects of their trafficking to be targeted for future breeding projects to improve resilience of wheat.

P04. *Assessing the sensitivity of soil nitrogen processes to pre-incubation conditions through N_2O flux and isotopomer distribution in a Saskatchewan soil. S.J. Demers[1], K.A. Congreves[1], P. Fehr[1], R. Farrell[2] | *[1]University of Saskatchewan, Dept. Plant Science; [2]University of Saskatchewan Dept. Soil Science, Saskatoon, Saskatchewan, Canada* • Soil incubation studies offer a controlled approach to investigate processes driving nitrous oxide (N_2O) emissions, but a lack of standardization in soil "pre-incubation" methods (used to re-activate microbial communities in dry soils) introduces uncertainty. This study examined how pre-incubation moisture (20% vs. 40% water-filled pore space, WFPS) and duration (1 vs. 5 days) affected N_2O flux and isotopomer distribution ($\delta^{15}N$-α and $\delta^{15}N$-β) in a Saskatchewan soil. Following pre-incubation, soils were incubated for 24 hours at either 55% or 75% WFPS in sealed 1L jars, and gas samples were analyzed for N_2O-N flux and isotopomer signatures. Results showed no

significant effect ($p > 0.05$) of pre-incubation moisture or duration on N_2O flux or isotopomer distribution. The only significant variable was soil moisture during the 24-hour incubation, with N_2O-N flux ranging from 0.0161–0.128 ng g^{-1} d^{-1} at 75% WFPS and 0.00886–0.0260 ng g^{-1} d^{-1} at 55% WFPS. Isotopomer site preference (SP) values ranged from 11.9 to 23.8, indicating that nitrification was the dominant source of N_2O across both treatments. These findings suggest that while pre-incubation conditions had little influence on immediate N_2O dynamics, soil moisture during incubation plays a key role in shaping both flux and microbial source partitioning. For this soil type, denitrification may become more dominant above 75% WFPS. A follow-up experiment will map isotopomer responses across a wider range of soil moisture levels (up to 100% WFPS) using a standardized 1-day pre-incubation at 40% WFPS.

P05. *Cover the cost of cover crops. Connor Goodwin, Kim Schneider, John Lauzon, Jake Munroe, Donna Hancock, Liz Lee | *University of Guelph, Guelph, ON, Canada* • Cover crops have many long-term benefits including erosion prevention, increased organic matter and nitrogen fixation. A common rotation in Ontario that could benefit from these enhancements is the corn (*Zea mays* L.)- soybean (*Glycine max* L.)-winter wheat (*Triticum aestivum* L.) rotation. The early (July/Aug) harvest of winter wheat provides an opportunity to plant a fall cover crop before corn. This study compares the conventional practice of frost seeding a red clover cover crop to alternative fall annual cover crops and a no cover crop control. The project's goal is to support farmers with the short-term financials of cover crop use in two ways. First, determining whether cover crop biomass can generate a profitable fall forage. Secondly, determining which cover crop contributes the largest fertilizer nitrogen replacement value (FNRV) to a subsequent corn crop. In 2021, red clover produced the largest aboveground dry matter (DM) biomass and FNRV to the subsequent corn, with values of 1.76 Mg DM ha^{-1} and 65.51 kg N ha^{-1}, respectively. However, red clover struggled to grow due to drought in the 2022 season and weed pressure in the 2023 season. Whereas the oat (Avena sativa L.) monoculture and oat/pea (Pisum sativum L.) mixture were the most stable, with reliable forage yields across all growing seasons regardless of conditions.

P06. *Impacts of nitrification inhibitor eNtrench on Western Canadian barley cropping systems. Nolan Johnson | *University of Alberta, Edmonton, AB, Canada* • Barley is an important crop in Western Canada, yet most research on enhanced-efficiency nitrogen (N) fertilizers has focused on wheat systems. This study is the first to evaluate the nitrification inhibitor (NI) eNtrench in barley production systems in Western Canada. We assessed the effects of the NI eNtrench on the agronomic performance of barley in different soil zones and under various management systems across several prairie sites, aiming to provide answers to prairie producers seeking to reduce urea application rates in the presence of NI. The objectives are as follows: (1) to determine the effects of eNtrench-treated and untreated urea at recommended (RR) and reduced (70% RR) rates on malt and feed barley performance across the Canadian prairies (CP); and (2) to evaluate eNtrench's impact on N dynamics under contrasting management practices in the CP. Two barley varieties (AAC Synergy and AB Cattlelac) were tested from 2024–2026 at four sites: St. Albert, AB; Lethbridge, AB (irrigated); Saskatoon, SK; and Red River Valley, MB (tillage). Treatments included urea at RR, 70% RR, RR + eNtrench, 70% RR + eNtrench, and a no-N control. Preliminary results from the first season showed no significant differences in yield, protein, or biomass between reduced urea rates or eNtrench use. However, these findings are based on only one of three growing seasons, so no conclusions can yet be drawn.

P07. *Rooted Connections: Unraveling arbuscular mycorrhizal fungi (AMF) effects on yield, shoot biomass, and nutrient uptake in wheat under canola-wheat rotations. Dayani Patuwatha Withanage[1], Kabal Singh Bhullar[2], Gurcharn Brar[1], Linda Gorim[1], Malinda Thilakarathna[1] | *[1] Dept. Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB, Canada; [2]Gateway Research Organization, Westlock, AB, Canada* • Wheat is Canada's largest crop in terms of production, with most of the production coming from the prairie provinces, including Alberta. Canola is frequently rotated with wheat, offering agronomic benefits such as reduced disease pressure in subsequent crops. Arbuscular mycorrhizal fungi (AMF), a group of beneficial fungi, form mutualistic associations with wheat, enhancing nutrient and water uptake and supporting higher yields, particularly under abiotic stress conditions. However, canola, a non-mycorrhizal crop, disrupts AMF colonization, which can suppress these benefits when wheat follows in rotation. Despite AMF's potential to improve wheat performance, limited research has examined its role in canola-wheat rotations. In particular, no detailed evaluations exist for AMF on Canada Western Red Spring (CWRS) cultivars under Alberta field conditions. This study hypothesizes that variability exists among CWRS cultivars in their ability to interact with AMF in a canola-wheat rotation system, which would be reflected in differences in plant growth, nutrient uptake, water use efficiency, yield, and grain quality parameters following canola. Six CWRS cultivars will be evaluated with and without AMF inoculation at two Alberta field sites over two growing seasons. First year results showed that AMF significantly improved crop yield, shoot biomass, and phosphorus and nitrogen content in shoots, with cultivar and site dependent variations. Soil available nitrogen and total organic carbon were also increased under AMF treatment. Notably, AMF enhanced yield in CWRS cultivars without reducing protein content, suggesting its potential to boost wheat productivity in canola-based rotations without compromising grain quality.

P08. *Compost-based biostimulants on crop performance and soil microbial diversity. Aayushi Rambia, Malinda Thilakarathna | *Dept. Agriculture, Food and Nutritional Science, University of Alberta, Edmonton, AB, Canada* • Over the past few decades, synthetic fertilizers have increased crop production but caused environmental issues such as greenhouse gas emissions, nutrient depletion, and declining soil quality. With the growing demand for sustainable farming to address climate change, bioinoculants are gaining recognition as eco-friendly alternatives. H-start, a novel bioinoculant, combines mature compost with beneficial microbes to restore soil health. This study assessed H-start's impact alongside 75% and 100% nitrogen-phosphorus-potassium (NPK) fertilizer rates on wheat, canola, and barley rotations. Field trials were conducted at two central Alberta sites: the Battle River Research Group (BRRG) site near Forestburg (dark brown soil) and the Gateway Research Organization (GRO) site in Westlock (dark gray soil). Results showed that combining H-start with 75% NPK achieved yields, seed protein, and oil content comparable to the full 100% NPK rate across all crops at both sites. Total available soil nitrogen under the 75% NPK, along with H-start, was also found comparable to the 100% recommended rate of fertilizer for all three crops at the BRRG site. H-start treatments showed higher available soil nitrogen compared to the 100% NPK rates at the GRO site. H-start also enhanced soil microbial communities, increasing the abundance of plant growth-promoting bacteria such as

Actinomycetota, Bacillota, Planctomycetota, and Pseudomonodota. Additionally, it improved microbial alpha diversity compared to NPK-only treatments. These findings highlight bioinoculants' potential as a sustainable alternative, promoting soil health and nutrient cycling while reducing synthetic fertilizer reliance without sacrificing productivity.

P09. *Assessing the impact of enhanced efficiency fertilizer on the growth, yield and quality indices of potato cultivated in a boreal climate. Abdullah Sami[1], Yeukai Katanda[1], Muhammad Umar[2], Muhammad Nadeem[2], Lakshman Galagadera[1], Mumtaz Cheema[1] | *[1]School of Science and the Environment, Memorial University of Newfoundland, Corner Brook, NL, Canada; [2] Dept. Fisheries, Forestry and Agriculture, Government of Newfoundland and Labrador, NL, Canada* • Enhanced Efficiency Fertilizer (EEF) play a crucial role in enhancing nutrients availability and potato (*Solanum tuberosum* L.) yield. This field trial was conducted to assess the impact of urea and urea-blended EEF such as PurYield fertilizer on growth, yield and quality attributes of potato. The treatments included were: N0 as control with no fertilizer, N1: 100% recommended rate of urea whereas, N2, N3, and N4 were 50/50 blend of urea and PurYield applied at 75%, 100%, and 125% of the recommended rate, respectively. For the N1 treatment, 50% of the urea was applied at seeding, and the remaining 50% at hilling. In contrast, urea and PurYield blends were applied at seeding. Results showed that urea application significantly enhanced chlorophyll content by 24% and 17% in 2023 and 2024, respectively compared to the control. While urea and urea blended PurYield did not show significant effects on potato yield in either year, though N3 and N4 treatments produced (11.68 Mg ha^{-1}) and (24.02 Mg ha^{-1}) yield in 2023 and 2024, respectively compared to the control. The treatments significantly influenced total soluble sugar and starch contents, with N4 and N3 yielding the highest soluble sugar levels (17.21 mg g^{-1} in 2023 & 14.18 mg g^{-1} in 2024). Overall, urea-blended PurYield fertilizers improved potato yield, soluble sugars and starch content compared to the urea. However, long-term field trials are required to fully explore the potential of PurYield and its blended formulations on the growth, yield and quality attributes of potato in boreal climate.

P10. *Assessing nitrogen fertilizer management and cover crops establishment in a forage production system in western Newfoundland and Labrador. Muhammad Umar[1], Yeukai Katanda[2], Abdullah Sami[1], Vanessa Kavanagh[2], Lakshman Galagadera[1], Mumtaz Cheema[1] | *[1]School of Science and the Environment, Memorial University of Newfoundland, Corner Brook, NL, Canada; [2] Dept. Fisheries, Forestry and Agriculture, Government of Newfoundland and Labrador, NL, Canada* • Optimizing nitrogen (N) application rates and cover crop (CC) inclusion in annual forage systems can improve forage yield and quality. Short growing seasons, low crop heat units, and early or late frost in the fall or spring, respectively, pose challenges to CC establishment in western Newfoundland. This two-year study evaluated the effects of N fertilizer rates on the growth, yield, and forage quality of an oat-pea mixture and post-harvest CC establishment and yield. Experimental treatments included four N rates: 0 (N0), 75% (N1), 100% (N2), and 125% (N3) of the recommended N rate (42.5 kg ha^{-1}), and three CC mixtures: no CC, cereal rye + red clover (CC1), and Italian ryegrass + white clover (CC2), which were seeded following the oat-pea harvest. In 2023, dry matter yield was 21% higher in N2 (10.3 Mg ha^{-1}) compared to N0 (8.5 Mg ha^{-1}), but no yield responses were observed at the 75% or 125% rates. In 2024, no significant differences in oat-pea yields were observed. Forage quality was also similar among N rates in both years. Yields of CC1 in N2 and N3 were significantly higher than CC2 (2.7 vs 1.0 and 2.8 vs 1.0 Mg ha^{-1}, respectively). These results suggest that the recommended N rate is sufficient for oat-pea cultivation, with no added benefit from higher N applications. Due to a lack of yield responses in 2024, longer-term research across multiple sites must confirm optimized N rates. CC1 showed better yield potential than CC2 and could be included in annual forage rotation systems.

P11. *Impact of ABA and GA_3 on lentil and field pea on seed survival and seedling emergence of lentils and field peas under simulated winter field conditions. Prerana Upretee[1], Manjula Bandara[2], Lawrence V Gusta[1], Kenneth J. Kirkland[3], Karen K. Tanino[1] | *[1] Dept. Plant Sciences, University of Saskatchewan, Saskatoon, SK, Canada; [2]MCB Agric-Research Consulting, Brooks, AB, Canada; [3](Retired) AAFC, Scott, SK, Canada* • Fall-dormant seeding is a process where a grain is seeded in the fall and harvested the following year. This practice has been demonstrated to increase grain yield, advance maturity and reduce abiotic stress such as heat, drought and freezing injury. However, this process has not been implemented due to winterkill and uneven germination of crops in following spring. Seed priming is a pre-sowing seed treatment practice to improve seed survival and induce seed stress tolerance. Abscisic acid (ABA) induces cold-responsive genes, whereas gibberellic acid (GA_3) may counteract cold tolerance. We hypothesized that ABA-priming enhances winter survival in lentil and field pea seeds, while GA_3-priming has opposite effect. Therefore, this study investigated the impact of ABA- and GA3-priming on survival of lentils and field pea seeds under simulated soil winter conditions in Saskatoon from late fall to early spring. Seeds were primed with ABA (100µM) or GA_3 (433µM) or H2O and exposed to controlled freezing cycles simulating field winter conditions. Germination and viability assessments were conducted after 21, 47, and 91days. Lentil and field pea seeds primed with ABA delayed germination, improving seed viability, particularly after exposure to freezing temperatures for a short period (47days), in contrast, GA3- and H2O-priming did not improve winter survival. However, impact of these priming agents on survival and germination of lentils and field pea seeds ultimately diminished after exposure to freezing temperatures for more extended periods (> 91 days). These findings highlight hormonal priming, and additional protective treatment may enhance the adoption of fall-dormant seeding.

P12. Soil carbon fractions over three years in the agrosilvopastoral system. L.C. Muniz[1], V.H.L.S. Santos[1], M.K.C.R. de Sousa[2], T.L. Figueiredo[2], V.X.O. Apolinário[2], D.V. Pessoa[2], I.S.L. Cantanhede[3] | [1]Center of Agricultural Sciences. Dept. Rural Economy, Brasil; [2]State University of Maranhão - UEMA, Brasil; [3]Federal Institute of Maranhão - Maracanã Campus, Brasil • Soil conservation management systems, such as agroforestry, are a viable alternative to reduce pressures exerted by agriculture, livestock, and erosion and nutrient leaching processes in areas with some degree of soil degradation. Therefore, this study evaluated the effect of nitrogen fertilization on soil organic matter fractions over 3 years (2020 to 2022) in an agroforestry system, with the integration of the tree legume Sabiá (*Mimosa caesalpiniifolia* Benth.) and the grass (*Panicum maximum* cv. Massai). The experiment was conducted at the Technological Reference Unit - TRU in ICLF of EMBRAPA Cocais in Pindaré Mirim - MA. The experimental design used was randomized blocks, with four nitrogen fertilization treatments (0, 100, 200 and 400 kg of N ha^{-1} $year^{-1}$) and three replicates, in a total area of 3 ha. The deformed samples were collected at: 0 - 10, 10 - 20, 20 - 30 cm, perpendicular to the tree legume. For the organic matter fractions, the values found for total organic carbon ($P < 0.0001$) were (> 18.69 g kg^{-1} and < 20.93 g kg^{-1}) for the respective treatments of 0 kg and 400 kg of N ha-1 year-1 respectively, with the third year showing the greatest accumulation. For particulate carbon ($P < 0.0001$) with the third year of collection standing out from the others (< 12.86 g kg^{-1}). For mineral associated carbon ($P < 0.0001$), the third year showed the highest accumulation (< 8.07 g kg^{-1}). An integrated approach of a legume and a grass promotes the sustainability of production systems.

P13. Carbon dynamics of a sandy soil under nitrogen fertilization in an agrosilvopastoral system in the humid tropics. M.K.C.R. Sousa[1], V.X.O. Apolinario[2], L.C. Muniz[2], J.B. Costa[3] | *[1]Agricultural Sciences, State University of Maranhao, Sao Luis-MA, Brasil; [2] Dept. Animal Science and Rural Economic, State University of Maranhao, Sao Luis-MA, Brasil; [3]Researcher at Embrapa Cocais, Sao Luis-MA, Brasil* • Understanding the influence of mineral nitrogen fertilization on carbon fractions is essential to promote efficient use of nutrients and achieve agricultural sustainability. The objective was to evaluate the effect of mineral nitrogen fertilization on the carbon dynamics of a sandy soil in an agrosilvopastoral system. The experiment was conducted at the Technological Reference Unit in ICLF of EMBRAPA Cocais in Pindare Mirim - MA, with a randomized block design, with four nitrogen fertilization treatments (0, 100, 200 and 400 kg of N ha^{-1} $year^{-1}$) and three replicates in a total area of 3 ha. Soil samples were collected in a transect perpendicular to the double rows of trees at five distances (0, 3.5, 7, 10.5 and 14 m) at depths of 0 - 10, 10 -20 and 20 - 30 cm, in the years 2019 and 2020. Total carbon, particulate organic carbon (POC) and organic carbon associated with minerals (MAOC) were different ($P < 0.01$) as a function of soil depth. TOC contents were higher at the depth of 0-10 cm (10.4 g kg^{-1}) and lower (6.5 g kg^{-1}) with increasing depth, 20-30 cm. MAOC was higher in the 0-10 cm layer (7.1 g kg^{-1}). The POC presented higher levels in the most superficial layer of the soil (3.3 g kg^{-1}) decreasing in depth with 2.2 and 1.7 g kg^{-1}, respectively. The higher concentrations of carbon in the most superficial layer of the soil demonstrate the importance of agrosilvopastoral systems in increasing organic matter for the soil.

P14. Soil carbon stock in an integrated system with gypsum and nitrogen in the Amazon-Cerrado Ecotone, Brazil. Figueiredo T.L.[1], Apolinário, V.X.O.[1], Silva J.S.[1], Alves L.H.M.[1], Pessoa D.V.[1], Coelho J.J.[2], Silva V.H.L.[1] | *[1]State University of Maranhão, São Luís – MA, Brasil; [2]State University of Ceará, Campus, Tauá – CE, Brasil* • Greater plant biomass leads to increased soil carbon incorporation through organic residues. This study aimed to evaluate total organic carbon (TOC) and carbon stock in a grass-legume pasture with and without gypsum application. The experiment was conducted at the State University of Maranhão, in São Luís – MA, Brazil, using a randomized block design with three replications and five treatments: (I) Ipyporã; (II) Ipyporã + urea; (III) Ipyporã + urea + gypsum; (IV) *Stylosanthes* mixture (80% *Stylosanthes capitata* Vog. + 20% *Stylosanthes macrocephala*) + Ipyporã; and (V) Stylosanthes + Ipyporã + gypsum. Urea was applied at 100 kg N ha^{-1} $year^{-1}$ and gypsum at 4 Mg ha^{-1} $year^{-1}$. Pasture management was performed by manual mowing. Undisturbed soil samples were collected in May 2024 at depths of 0–10, 10–20, 20–30, and 30–40 cm. TOC concentrations and carbon stock were evaluated. Statistical analysis was conducted using InfoStat, and means were compared by Tukey's test at a 5% significance level. The highest TOC value ($P < 0.0001$) was observed in the Ipyporã + Urea + Gypsum treatment, with 5.6 g kg^{-1} at the 0–10 cm depth. The greatest carbon stock ($P < 0.0001$) was also found in this treatment, reaching 2.1 Mg C at 30–40 cm. Urea application increased soil carbon stock, possibly by stimulating plant growth and organic matter deposition.

P15. Diversified production systems affect soil phosphorus forms and crop productivity in the Brazilian of Mato Grosso. B.S.S. Castro[1], E.D. de Souza[2], L.S. Santos[2], V.X.O. Apolinário[1], M.K.C.R. Sousa[1] | *[1]Departament of Agricultural Science, State University of Maranhão, São Luis - MA, Brazil; [2]Federal University of Rondonópolis, Rondonópolis – MT, Brazil* • Diversified agricultural systems linked to greater functional diversity (DF) can modify the phosphorus (P) dynamics in sandy loam soil and intensify crop productivity, but this is not yet well understood. With this study, the forms of P and the productivity of soybeans and cotton were evaluated in a sandy loam Argisol under functional diversity in the Cerrado of Mato Grosso. The experiment was carried out at Mato Grosso Cotton Institute, installed in 2017, with an area of 6.25 hectares. The experimental design in randomized blocks consisted of five DF levels with three replications: very low (VL), low (LW), medium (AVG), long-term medium (AVL) and high (ICLS). In soil samples, in 2022, for layers 0 5, 5-10 and 10-20 cm, the levels of total P, available P (Mehlich 3), inorganic P (NaOH) were determined, organic P (total P – inorganic P), PHCl (extracted by HCl). From these determinations, P occluded and P legacy were calculated. From grain and plume counts, crop productivity in Mg ha^{-1} was estimated. DF, through integrated systems, increases P levels in more labile fractions in the sandy loam soil profile. The increase in functional diversity levels in the system did not influence soybean productivity, but increased cotton productivity by 156%. The high P legacy index indicated functional diversity as a conservation strategy to promote sustainability.

P16. Evaluating productivity and quality of high-digestibility alfalfa cultivars grown in a maritime climate. K.E. Glover[1], Y.A. Papadopoulos[1], S. Fillmore[2], S. Fromm[3], M. Crouse[2] | *[1]AAFC, Truro, NS, Canada; [2]AAFC Kentville RDC, Kentville, NS, Canada; [3]AAFC Nappan Research Farm, Nappan, NS, Canada* • Both conventional breeding and genetic modification have been used to produce alfalfa cultivars with reduced lignin content as this has been linked to decreased digestibility and nutritional quality. This experiment evaluates the productivity and nutritional quality of alfalfa

cultivars selected for reduced lignin content in comparison to other alfalfa cultivars currently being grown in a Maritime climate. Eight alfalfa cultivars were seeded in the spring of 2019 at the Nappan Research Farm in Nova Scotia. Forage productivity and quality were assessed from three cuts harvested at the early bud stage in the first production year and for three cuts at the early bud and two cuts at the early flower stage for the second and third production years. Cultivars were significantly different with respect to seasonal forage yield in all production years, which ranged from 5.1 to 8.3 t ha-1 at the early bud stage and 6.8 to 9.4 t ha-1 at the early flower stage in the second production year. Similarly, lignin content was significantly different for all production years ranging from 5.5% to 6.2% for the early bud stage and 7.9% – 8.9% when harvested at the early flower stage for the second production year. While alfalfa cultivars selected for low lignin content had lower lignin (5.5 and 5.6%) than the mean of reference cultivars (5.9%) there were reference cultivars that were not significantly different from the low-lignin cultivars at the early bud stage. Interestingly at the early flower stage, the low-lignin cultivars were not lower in lignin content (8.9 and 8.6%) than the mean of the reference cultivars (8.2%).

P17. Evaluating 'AAC Trueman' alfalfa in Saskatchewan. B. Houston[1], C. Kayter[2], K. Glover[3], Y. Papadopoulos[3] | *[1]AAFC, Regina, SK, Canada; [2]AAFC Saskatoon RDC, Saskatoon, SK, Canada; [3]AAFC, Truro, NS, Canada* • It is often challenging for farmers to get sufficient forage due to extended periods of too much or too little rainfall. AAC Trueman was developed with significant tolerance to water logging conditions. It has deep roots and underground rhizomes. We explored the adaptability of this new alfalfa variety in Saskatchewan with demonstration and applied research sites successfully seeded in three soil zones: Brown (Swift Current), Dark Brown (Outlook); and Black Soil Zone (Melfort). The large plot trial at the Outlook site was seeded in 2020 while the other plots were seeded in 2021. Outlook large plots were irrigated, and soil moisture was monitored to achieve moisture treatment levels: (a) excess moisture, (b) normal irrigation and (c) dryland conditions. The plots at Swift Current and Melfort were not irrigated but have topographic variation which provides a range of soil moisture levels. Average seasonal forage yields from 2021 to 2024 were: 3.6 to 4.4 tonne/ha at Swift Current (1 cut), 6.8 to 7.7 tonne/ha at Melfort (1 or 2 cuts), and 9.6 tonne/ha under dryland conditions and 12.2 tonne/ha under irrigation at Outlook (2 cuts). Climate conditions were generally drier and hotter than normal during the project years. Forage quality was also assessed and the average percent protein ranged from 16.0% for an alfalfa-brome mixture to 18.7% for straight alfalfa. Results of this study demonstrate that in addition to tolerance to wet growing conditions AAC Trueman also tolerated drought conditions in Saskatchewan and sustained good forage yield and quality during this study.

P18. Optimizing nitrogen fertilizer recommendations post-drought using AFFIRM in Alberta's Agroecosystems. Chunjing Zhu, Miles Dyck, Linda Y. Gorim | *Dept. Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB, Canada* • Drought is a recurring stressor in Alberta's agroecosystems, disrupting nitrogen (N) cycling and often leaving substantial residual soil nitrogen (RSN) after harvest. This study investigates how drought-induced RSN variations influence nitrogen fertilizer recommendations for the subsequent growing season. Using AFFIRM, we simulated 5,100 scenarios across diverse agroecological zones under wheat-canola and canola-wheat rotations. The simulation model crop yield, RSN, and optimal nitrogen rates under three moisture conditions: drought, medium, and optimum. A second-stage analysis incorporates price sensitivity, examining how urea and crop prices affect recommended nitrogen rates. Our results show that drought significantly increases RSN, particularly in dark gray and black soil zones, enabling reduced fertilizer requirements in the following season. Optimal nitrogen recommendations vary considerably across soil types, precipitation regimes, and economic conditions. These findings offer practical guidance for adjusting nitrogen management strategies after drought.

P19. Agronomic performance and disease resistance in two winter barley collections. G. Humphreys[1], O. Wu[1], L. Langille[1], C. Thomsen[1], J. Nicoll[1], H. Booker[2], M. Serajazari[2]. *[1]AAFC Ottawa Research &Development Centre, Ottawa, ON, Canada ; [2] Dept. Plant Agriculture, University of Guelph, Guelph, ON, Canada* • Between 2015 and 2020, spring barley production in Ontario dropped 40% to 113,200 t. This decline has resulted in shortfalls of locally produced barley. Winter barley (WB) represents an innovative avenue to increase barley production and offers the possibility of double cropping in Ontario. Entries from the 'PGR' and 'OLDS' collections were evaluated at AAFC-Harrow and U. of Guelph Elora research station in 2024 along with five registered WB cultivars. Significant variability among PGR and check entries for grain yield, test weight, 1000 kernel weight and net spot was observed across the two locations. Registered WB checks ranked higher than PGR entries for grain yield and 1000 kernel weight; however, PGR germplasm with significantly ($P<0.05$) higher test weight and lower net spot scores were identified. Within the OLDs collection, winter survival ranged from 10 to 100 percent. While the OLDs collection had been previously selected for winter hardiness in Alberta, several older European WB varieties showed low winter hardiness under Ontario winter conditions. Julian heading date ranged from 125 to 137 among OLDS collection entries which was similar or later than checks; however, seven OLDS entries were identified with earlier heading than the earliest check. Mean spot blotch scores of checks at Elora ranged from 4-6 out of 9. Sixteen OLDS Collection entries had scored less than 4. PGR and OLDS collections represent valuable resources for genetic studies and WB improvement of agronomics and disease resistance for production in Ontario.

P20. Responses of malting and feed barely varieties to nitrogen fertilization on the Canadian Prairies. Kui Liu[1], Yu Jia[1], Hiroshi Kubota[2], Brian Beres3, Brett Mollison[4], Curtis Cavers[5] | *[1]AAFC Swift Current, SK; [2] AAFC Lacombe, AB; [3]AAFC Lethbridge, AB; [4]AAFC Scott, SK ; [5]AAFC Portage la Prairie, MB, Canada* • Implementing genetically diversified varieties represents a sustainable strategy for barley production; however, the responses of these genetically diversified varieties to nitrogen fertilizers, a key crop management practice, remain unknown, particularly for newly developed high-yielding barleys. A 3-year study was initiated in 2023 at five sites (Swift Current and Melfort, SK; Lethbridge and Lacombe, AB; and Portage la Prairie, MB) across the Canadian Prairies, with the goal of developing nitrogen management strategies for barley crops. This two-factor factorial study involved four genetically diversified varieties, including two malting barleys (AAC Connect and CDC Churchill) and two feed barleys (Sirish and AB advantage), and seven nitrogen fertilizer rates (0, 40, 80, 120, and 160 kg N ha^{-1} using urea as the N source, and 80 and 100 kg N ha^{-1} using enhanced efficiency N fertilizer SuperU as the N source). Crop yield, nitrogen use efficiency, water use efficiency, Fusarium head blight, lodging, post-harvest soil residual N, grain quality and economic returns were assessed. The preliminary results from the first year indicated that 1) the average barley yield varied significantly among sites; 2) the response of barley yield to N fertilization varied among sites and years; and 3) at the N rate of 80 kg ha^{-1}, the average yield of barley fertilized with SuperU was similar to that fertilized with urea.

P21. Differences in soil test results for high organic matter soils among accredited laboratories. M.R. McDonald, K. Vander Kooi, F. Farintosh, K. Vivekananthan, K. Schnieder | *Dept. Plant Agriculture, University of Guelph, Guelph, Ontario, Canada* • Most onions, and about half of the carrots, in Ontario are grown on high organic matter (muck) soils. Soil organic matter content in the Holland Marsh, Ontario, ranges from ~ 50 - 80%. Fertilizer recommendations for these crops have been the same for decades. There have been discussions with fertilizer suppliers about the validity of some recommendations, especially for phosphorous (P). Observations over years have suggested differences in the soil analysis results for muck soils from different labs. To test this, soil samples were taken from 15 fields in the Holland Marsh in the fall of 2024, the standard timing for soil testing. Cores were taken to a depth of 15 cm to collect ~ 2 kg of soil. This was thoroughly mixed and sent to three accredited labs: SGS Labs (Guelph, ON), A&L Canada Laboratories Inc. (London, ON), and Brookside Laboratories Inc. (New Bremen, OH, USA). There were differences among labs for all characteristics and nutrients except pH, which was 6.2-6.3. Percent organic matter ranged from 54% (A&L Labs) to 68% (SGS Labs). SGS Labs also reported the highest P levels of 99 ppm, compared to Brookside and A&L Labs) with 65 and 55 ppm, respectively. All labs reported using the Olsen (bicarbonate) test. The range of P levels among fields was 37-107 ppm. Initial studies suggest that differences are related to different drying times and temperatures among laboratories and some labs using volume instead of weight in the lab protocols for muck soils.

P22. Grain yield and protein profiling of field pea, lentil, and faba bean genotypes under organic management in Northern Alberta. Daniel Menge, Nicole Driedger, Naveen Arora, Tien Hsin Chiu | Mackenzie Applied Research Association, Fort Vermilion, AB, Canada • Twenty field pea (*Pisum sativum*), eleven lentil (*Lens culinaris*), and ten faba bean (*Vicia faba*) genotypes were evaluated for yield and protein content with the aim of classifying them based on performance to guide selection for organic systems. The experiment was laid out in a randomized complete block design with four replicates. Grain yield and protein content were analyzed using ANOVA, and means were separated using the HSD test at $P < 0.05$. Ward's Clustering method was conducted to classify crop genotypes based on the two traits. Average yields were highest in field peas while protein content was highest in faba beans. Genotypic effects were significant for both traits across all three crops. Cluster analysis revealed four groups among field peas. Cluster 1 had the highest yield and moderate protein. Cluster 3 had the highest protein content but lower yield. Clusters 2 and 4 showed intermediate to low performance. In lentils, three clusters were identified. Cluster 1 had the highest yield and lowest protein, while Cluster 3 had the highest protein and lowest yield. Cluster 2 showed moderate values for both traits. Faba bean clusters exhibited a similar pattern. Cluster 1 had the highest yield and moderate protein, while Cluster 3 had the highest protein and lowest yield. Cluster 2 had the lowest performance in both traits. Field peas and faba beans showed a moderate trade-off while lentils exhibited the strongest inverse relationship. These patterns underscore the importance of aligning genotype selection with the intended production objective.

P23. Increasing lentil seeding rates for improved yield. Manpreet Singh Brar, Linda Y. Gorim | *Dept. Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB, Canada* • Canada is a leading global producer of lentils, with 87.1% of production in Saskatchewan and 12.9% in Alberta, where small red lentil acreage has expanded due to climate shifts. Lentil production faces agronomic challenges, including its short stature, resulting in poor weed competition, and lodging. This study aimed to identify optimum seeding rates for small red lentils (CDC Proclaim) in two Alberta prairie ecozones. In 2024, on-farm trials were established in Southern (Zone 1) and Central Alberta (Zone 2) at four locations (Coaldale, Strathmore, Oyen, Cereal) using a randomized complete block design with three replications and three seeding rates (12, 16, 20 plants/ft²). Data collected included plant counts, weed density, leaf area index (LAI), light canopy interception (LCI), canopy cover, biomass, and nitrogen fixation (15N recovery efficiency). Mixed model analysis indicates that seeding rate significantly affected plant count and total nodules per plant, with 16 and 20 plants/ft² outperforming the current 12 plants/ft² rate. Site effects were significant for most parameters except 15N recovery. Seeding rate did not influence canopy dynamics, but growth stage significantly affected LAI, LCI, and light interception. Notably, 15N recovery increased with higher seeding rates, although differences were not statistically significant. Weed pressure was higher in Oyen than in Coaldale, while nodule counts were greater in Zone 2 than in Zone 1, suggesting underlying soil factors. These preliminary findings indicate potential benefits of increased seeding rates for improving lentil productivity and nitrogen efficiency. Further multi-season data will help refine site-specific seeding recommendations for enhanced sustainability and profitability.

P24. Emergency forage crop using winter cereals and annual legumes. G. Telmosse[1], J. Lajeunesse[1], F. Hassanat[2] | *[1]AAFC Normandin Research Farm, Normandin, QC, Canada; [2]AAFC, Quebec Research and Development Center, Québec, QC, Canada* • In northern regions, adverse winter conditions pose a significant threat to the survival of grasslands and, thus, to the annual forage production. The transient establishment of perennial grasslands by means of winter cereals and annual legumes could offer producers the opportunity to substitute their annual forage crop while accessing additional revenue the subsequent year, by harvesting the cereal grain, until the perennial grassland is well established. The objectives of this study were to 1) assess the possibility of using winter cereals as an emergency forage crop during the sowing year and harvesting grains the subsequent year; 2) assess the forage quality of winter cereals grown with annual legume intercropping; and 3) assess the effect of annual legume intercropping on grain yield of winter cereals. In June 2022 and 2023, winter cereals were sown at Normandin (Quebec) with annual forage legume intercropping. During the 2022 and 2023 growing seasons, winter cereals and legumes were harvested as a forage crop and produced between 3 and 5 t DM ha^{-1} yr^{-1}. In August 2023 and 2024, grains were harvested. Intensive forage management significantly reduced grain yield by three to eight times when compared to controls. Annual legume intercropping had no effect on forage yield, grain yield and grain quality, and no or slight effect on forage quality. The poor establishment of the intercropping might explain this lack of effect. In conclusion, the results suggest that there is no advantage of using an annual legume intercropping with winter cereals as an emergency forage crop.

P25. Relationships between soil nitrate fluxes as measured by anionic exchange membranes and N_2O emissions: On-Farm Trials. N. Ziadi, A. Robichaud, N. Bertrand | *AAFC Quebec RDC, Quebec, Canada* • Converting grasslands to field crops is common in many agricultural systems and may results in substantial net mineralisation of soil organic matter that leads to increased N_2O emissions. As a part of the Carboneutral milk Living Lab project, we examined the effect of grassland destruction in the fall of 2023 (FD) or spring of 2024 (SD) on soil NO_3^- dynamics and N_2O emissions across four farms in Quebec. In the fall of 2023, each grassland was destroyed with glyphosate, divided in two (FD and SD) and then subjected to mechanical destruction: plowing or stubble cultivation, depending on each farm's practices. The NO_3^- fluxes were measured with anionic exchange membranes and N_2O emissions were measured with a closed dynamic chamber during the 2024 growing season. Results showed that the highest NO_3^- fluxes were obtained between crop sowing and post-emergence fertilization, which also corresponds to periods of the highest N_2O emissions. Significant relationships were observed between NO_3^- fluxes and N_2O emissions in both stubbled (R^2: 0.78–0.91 for FD; 0.54–0.56 for SD) and plowed (R^2: 0.70–0.86 for FD; 0.54–0.66 for SD) plots. Organic matter decomposition after FD seems to favor greater NO_3^- availability and thus increased denitrification under such conditions. For instance, for the same NO_3^- flux, N_2O production is higher after SD in stubbled soils, while the opposite effect is observed in plowed soils. The availability of O_2 under these conditions could partly explain the results. This project will continue during the 2025 growing with new trials across Quebec to increase our data set and further develop our knowledge in narrow collaboration with farmers.

CSHS Student Poster Presentations

P26. *Unraveling hormonal regulation of flower bud dormancy in northern highbush blueberry. Charitha P.A. Jayasinghege[1,2], Oluwatomiwa Babarinde[1,2] | *AAFC Agassiz Research & Development Centre, Agassiz, BC, Canada; Simon Fraser University, Burnaby BC, Canada* • Plant hormones are key regulators of dormancy acquisition and release in perennial plants, yet the precise contributions of different hormones remain unclear. Here, we examined the hormonal regulation of flower bud dormancy in Northern Highbush Blueberries (*Vaccinium corymbosum*). Canes with dormant buds were collected from the cultivar 'Duke' in late February, dipped for 3 days in solutions containing various plant growth regulators, and then transferred to water under controlled conditions (23°C/18 h day, 19°C/6 h night). Bud break stages were scored using a nine-point scale to calculate a bud break index (BBI), where 0% represents fully dormant buds and 100% represents full bloom. After nine days, gibberellin (GA_3; 20 ppm) produced a BBI of 69%, compared to 56% in controls, while the GA biosynthesis inhibitor Chlormequat Chloride (CC; 750 ppm) reduced the BBI to 49%, suggesting GA promotes bud break. Abscisic acid (ABA; 400 ppm) and synthetic jasmonic acid (JA) prohydrojasmon (400 ppm) delayed bud break, resulting BBIs of 33% and 39%, respectively. Hormonal profiling in flower buds collected monthly from October to March revealed a gradual decline in ABA over that period, while JA peaked in October and February. These hormone-level shifts, together with observed differences in bud break timing, suggest that both ABA and JA help maintaining flower bud dormancy. Comparative transcriptomic analyses of buds collected at different stages are underway to elucidate how these hormonal dynamics govern flower bud development.

P27. **In vivo* imaging of reactive oxygen species dynamics in harvested lettuce (*Lactuca sativa*) exposed to abiotic stress. Mohamed Hawali Bata Gouda[1,2,3], Christophe B.Y. Cordella[1,3,4], Arturo Duarte-Sierra[1,2,3] | *[1]Food Science Department, Laval University; [2]Centre SÈVE, Research in Plant Science; [3]Institute on Nutrition and Functional Foods (INAF), Laval University; [4]Laboratoire de Recherche et de Traitement de l'Information Chimiosensorielle (LARTIC), Laval University, Quebec, QC, Canada* • Reactive Oxygen Species (ROS) play a crucial role in plant stress responses, acting as both signaling molecules and promoters of oxidative damage. However, their detection remains challenging owing to their brief lifespan and high reactivity. Notwithstanding progress in ROS imaging techniques in plants, their application to fresh produce is still limited. In this study, we employed *in vivo* imaging (IVIS) to visualize ROS production in harvested lettuce subjected to mechanical wounding and ultraviolet (UV) treatments (UV-A, UV-B, and UV-C) at irradiances of 11.56 W/m^2 (UV-A), 15.5 W/m^2 (UV-B), and 60 W/m^2 (UV-C). UV-C treatments were applied at doses of 1.71 kJ/m2 and 3.42 kJ/m^2, with equivalent doses for UV-B (2.1 1.71 kJ/m^2 and 4.21 1.71 kJ/m^2) and UV-A (2.44 1.71 kJ/m^2 and 4.89 1.71 kJ/m^2). The fluorogenic probe H2DCF-DA facilitated real-time monitoring of ROS accumulation. Our findings demonstrated distinct ROS signatures depending on the type and intensity of the applied stress. Wounding induced a rapid and localized ROS burst, whereas UV-C exposure triggered the highest ROS accumulation. Notably, ROS production patterns differed over time, with UV treatments showing a delayed but sustained signal compared to the immediate response observed in wounded tissues. These findings highlight the potential of IVIS for studying oxidative stress responses in fresh produce and provide insights into the different impact of physical and light-induced stressors on lettuce redox homeostasis.

P28. *Onion leaf nutrient assessment: Comparing Picketa LENS technology with laboratory tissue analysis. I.N. Ezeh, G. Farintosh, K. Vander Kooi, M.R. McDonald | *Dept. Plant Agriculture, University of Guelph, Guelph, Ontario, Canada* • Fertilizer recommendations for onions (*Allium cepa* L.) grown on high-organic-matter soils have not been updated for decades. Changes in cultivars and production practices, including increased micronutrient and foliar fertilizer applications, highlight the need to improve nutrient monitoring efficiency, validate real-time sensing technologies, and optimize fertilizer application strategies to boost crop productivity. This study evaluated tissue nutrient levels in onion crops from grower fields using real-time technology, the new Picketa Leaf Evaluated Nutrient System (LENS), in comparison to SGS Laboratory tissue analysis. The objectives were to determine the accuracy of Picketa LENS while collecting data to further train the Picketa LENS for nutrient assessment in onions. Onion leaf samples were collected between 19 July and 21 August 2024 from five commercial fields. Each sample was scanned using Picketa LENS and the same leaves were sent to the laboratory for analysis. Nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), zinc, manganese, copper, iron, boron, and sulphur were assessed. Both methods reported nutrient levels within or above sufficiency ranges. However, the Picketa LENS

consistently recorded higher N, P, and K values compared to SGS Lab. Calcium levels were negatively correlated ($r = -0.59$, $p = 0.002$) for the 15–19 July sampling, while N and K had the highest agreement mid-season. There was a low but significant association for Mg ($R^2 = 0.15$) and Ca ($R^2 = 0.31$). In conclusion, real-time tissue testing technology could be an important tool for fertilizer use efficiency. Evaluations and algorithm training will continue.

P29. *Melatonin supplementation enhances heat tolerance of *Fragaria vesca*, Yellow Wonder Strawberry. Emily Foster, Lauren Erland | *BERRI Lab, University of the Fraser Valley, Chilliwack, BC, Canada* • Melatonin is a plant growth regulator which can mediate abiotic stress, including heat stress, by interacting with stress signaling pathways and directly inhibiting the accumulation of reactive oxygen species. Climate change is increasing growing season temperatures, and heat stress has been found to reduce the photosynthesis, growth, and development of strawberries. Here we use alpine strawberries (*Fragaria vesca* cv Yellow Wonder) as a system in which to investigate the role of melatonin in heat stress. The objective of our study was to examine how exogenous melatonin could reduce heat stress in a native crop grown using an *in vitro* culture system. We hypothesized that melatonin supplementation would improve growth and reduce markers of stress under increased temperatures. We grew ten replicates of the strawberry at 24 and 35°C with 0, 10 and 100µM of melatonin. We then measured growth responses via root initiation, growth, and plant height, as well as chlorophyll content, antioxidant capacity and proline as markers of stress. After five weeks of growth, we found that 100µM melatonin inhibited growth under both temperatures tested. At 35°C, however, 10µM melatonin improved plant growth increasing growth parameters including root initiation, percent survival, and shoot length. Our results suggest that melatonin plays a role in reducing heat stress in *in vitro* grown alpine strawberries.

P30. *A single laboratory validation for kynurenine and related metabolites in St. John's wort (*Hypericum perforatum* L.). Daniel Gaudet[1], Lauren Erland[1,2], Ryan Hayward[3], Pawanjit Sandhu[1], Susan J Murch[1] | *[1] Dept. Chemistry, The University of British Columbia, Syilx Okanagan Nation Territory, Kelowna, BC, Canada; [2] Dept. Agriculture, The University of the Fraser Valley, Ts'elxwéyeqw Tribal Territory, Chilliwack, BC, Canada; [3]Supra Research and Development, Kelowna, BC, Canada* • St. John's wort (*Hypericum perforatum* L.) is a widely used herbal supplement for treating depression and neurological disorders. Bioactive metabolites in its preparations include melatonin and kynurenine, the latter gaining interest as a neuroprotective nutraceutical. Accurate quantification of kynurenine and related metabolites is essential for supporting the development of effective natural medicines. This study describes the development and single-laboratory validation of an ultra-high performance liquid chromatography–high resolution mass spectrometry (UHPLC-HRMS) method for the quantification of kynurenine (KYN), kynurenic acid (KYNA), 3-hydroxykynurenine (3-HK), and 3-hydroxyanthranilic acid (3-HAA) in *H. perforatum* tissues. Two approaches were evaluated: a derivatized method using 6-aminoquinolyl-N-hydroxysuccinimidyl carbamate (AQC), and an underivatized method. Samples were extracted in acidified methanol and separated on a pentafluorophenyl (PFP) column. Both methods were validated following AOAC guidelines for linearity, accuracy, precision, limit of detection (LOD), and limit of quantification (LOQ). The underivatized method quantified KYN, KYNA, and 3-HAA with LOQs of 5.22, 2.52, and 7.57 ng/mL, respectively, and average spike recoveries of 78.7%, 105%, and 94.4%. The derivatized method quantified KYN and 3-HK with LOQs of 4.4 and 5.4 ng/mL, and recoveries of 101.4% and 89.9%. Both methods showed strong linearity ($R^2 > 0.99$) and robust performance. Using the validated method, KYN, KYNA, and 3-HAA were successfully detected in *H. perforatum* tissues at concentrations of 17.33, 25.99, and 6.78 ng/mL, respectively.

P31. *Propagation and conservation of heritage grapevines - *Vitis vinifera* Pinot Gris 'Gray Monk'. B.A. Hall[1], J. Leboe[2], S.J. Murch[1] | *[1]Chemistry, The University of British Columbia, Okanagan, Syilx Okanagan Nation Territory, Kelowna, BC Canada; [2]Andrew Peller Limited, BC, Canada* • Cold temperatures in January 2024 devastated vineyards in the Okanagan and commercial vineyards responded by pulling out damaged vines. Surprisingly, in mid-June latent buds were observed on some of the cold-damaged grapevines. In collaboration with the vineyard team at Gray Monk Winery and Andrew Peller Limited, we are developing and optimizing micropropagation methods for mass propagation of *Vitis vinifera* Pinot Gris 'Gray Monk' heritage vines for conservation and replanting. Micropropagation and shoot regeneration of *V. vinifera* Pinot Gris has previously been published for 2 newer sub varietals but the methods do not exist for the 'Gray Monk" germplasm line. Gray Monk is the English translation of the Austrian name "Grauer Mönch" referring to the varietal now known as Pinot Gris. It is probable that Pinot Gris originated in Burgundy in the 13th or 14th century with the older name for the varietal - "Grauburgunder" - referring to the Burgundian origin. Modern vines have adapted to diverse ecosystems including the Okanagan region where the vines were planted at Gray Monk Estates in 1972. The vines are well adapted to the specific microenvironment of the vineyard but were substantially damaged by the winter freeze events of 2023 and 2024. Replanting of the unique ecotype requires the development of optimized protocols. Micropropagation of plants in tissue culture requires optimization of the culture media, application of the ideal plant growth regulators and development of plants through 5 stages of growth: (Stage 0) selection of the ideal maternal material for explanting, (Stage1) establishment of explants in axenic culture, (Stage 2) induction of de novo regeneration and mass multiplication, (Stage 3) rooting of new shoots or germination of somatic embryos and (Stage 4) ex vitro acclimatization. While some commercial plant tissue culture labs have protocols for Stages 1,3 and 4, Stage 2 induction of mass propagation has not been successful for *Vitis vinifera* 'Pinot Gris' and the source plant materials for Stage 0 from the Gray Monk vineyard has not previously been attempted. There is a high rate of recalcitrance to de novo shoot organogenesis among grapevine varietals caused by species and build-up of toxic phenolics in culture media. Our recent research found that indoleamine plant growth regulators (IPGRS), melatonin and serotonin, induce de novo regeneration in recalcitrant grapevines by antioxidant mechanisms to detoxify ROS and stimulation of cell proliferation. Our work will support resiliency and replanting efforts in Okanagan vineyards.

P32. *Investigating the soil carbon content of urban soils in relationship to the growth and health of *Fraxinus pennsylvanica*. D.T. Harder, K.A. Congreves, K.K. Tanino | *Dept. Plant Sciences, University of Saskatchewan, Saskatoon, Saskatchewan, Canada* • Landscape trees in the urban environment are constrained by various levels of physical, biological, and chemical factors both above and below-ground depending on planting location. We performed a study of 25 paired populations of 'healthy' and 'declining' *Fraxinus pennsylvanica* var. *subintegerrima* (Marsh) in center-medians and boulevards in diverse locations within the city of Saskatoon, SK, to determine which factors of soil and tree health are associated with premature tree

decline. The study population included ten un-paired sites containing either a 'healthy' or 'declining' tree for a total of 60 sample trees. Soil health characteristics of total organic carbon (TOC), electrical conductivity (EC), pH, bulk density (BD), and soil texture were collected at each site. Measurement of branch elongation and diameter for the 2021-2024 growing seasons, leaf fresh weight and dry weight for the 2024 season, and chlorophyll content and reflectance values were collected for the 2024 leaf tissue. Trees in the 'declining' population showed lower chlorophyll reflectance than 'healthy' trees. Soil pH was higher at both soil depths in 'declining' sites, and average branch diameter was lower compared to the 'healthy' population for all years. Mean TOC content and EC were not significantly different between populations at the 0-15 cm and 15-30 cm depths. Mean EC values were higher in the 15-30 cm depth for both populations. Band dendrometer measurements will be used to measure differences in water uptake, paired with the use of soil tensiometers on a population sub-sample in year two.

P33. *Adaptive potential of a massive chromosomal inversion in wild sunflower (*Helianthus annuus*). A.E. Jamaldin, M. Todesco | *Dept. Botany, University of British Columbia, Vancouver, British Columbia, Canada* • Chromosomal inversions are thought to be important contributors to local adaptation and population divergence within species. By suppressing recombination between different orientations, inversions can preserve co-adapted alleles pertaining to a specific environment and climate. In *Helianthus annuus* (common sunflower), inversion 13.01 (inv13.01) spans ~100 Mb and is fixed in populations from Southwest Texas - a region characterized by elevated temperatures and drought, making it one of the most stressful environments in the species' range. To investigate the potential adaptive role of inv13.01, I developed Near-Isogenic Lines (NILs) that differ exclusively at the inversion by repeatedly back-crossing a wild sunflower individual into a cultivated inbred variety. These NILs, along with plants heterozygous for inv13.01, were grown under both control and heat-stressed conditions to isolate inv13.01's effects on phenotype and gene expression. I phenotyped key traits, including flowering time, leaf morphology, and seed production. To explore the underlying molecular mechanisms, I also performed RNA sequencing (RNA-seq) on leaf tissue collected from all treatments. I assessed differential gene expression associated with inversion orientation, treatment, and their interactions. By combining phenotypic and transcriptomic data, this study aims to connect candidate traits and genes that may contribute to the adaptive significance of inv13.01 in hot, dry climates. I additionally considered the possibility for heterozygous advantage, through comparing the mature phenotypes of the heterozygote and homozygous plants.

P34. *Carbon nanofertilizers derived from snow crab waste: Effects of foliar application on growth, yield, and phytonutrients of lettuce grown under controlled environment. Uzma Sharafat[1], Rabia Javed[2], Gurpreet Singh Selopal[3], Lord Abbey[3], Thu Huong Pham[1], Ayesha Rathnayake[1], Raymond Thomas[4], Lakshman Galagedara[1], Mumtaz Cheema[1] | *[1]School of Science and the Environment, Memorial University of Newfoundland; [2]Faculty of Engineering and Applied Sciences, Memorial University of Newfoundland, St John's, NL, Canada; [3]Faculty of Agriculture, Dalhousie University, Truro, NS, Canada. 4 Dept. Biology, Faculty of Science, Western University, London, ON, Canada* • Carbon nanofertilizers (CNFs) have greatly stimulated interest in the field of agriculture because of their small size and high surface area, which enhance nutrient uptake, ultra-high absorption, photosynthesis, plant health and crop yield, decreased frequency of application, and environmental pollution. In this study, a simple and cost-effective hydrothermal process was used to synthesize CNFs from snow crab waste. The experimental treatments were: 1) distil water (control), 2) CNF50: 50 mg/L, 3) CNF100: 100 mg/L, 4) CNF150: 150 mg/L, 5) CNF200: 200 mg/L, 6) CNF250: 250 mg/L. CNFs were applied as a foliar spray weekly throughout the crop cycle. Results showed that 250 mg/L of CNF treatment significantly increased leaf number, leaf area, chlorophyll a & b, root shoot dry weight, and yield, nitrogen uptake compared to control and other CNF application rates. Additionally, mineral concentrations and essential vitamins (B3, D, K1, K2, and K3) were significantly higher at 250 mg/L of CNF application. Total soluble sugars and protein content increased by 66% and 42.13%, respectively, treated with 250 mg/L compared to the control. The applied CNF 250 mg/L has a significant effect on lettuce crops' essential nutrients compared to the control. These findings highlight the potential of CNFs developed from snow crab waste as an innovative and sustainable solution to enhance the growth, yield and nutritional quality of lettuce. This study contributes to eco-friendly agricultural advancements by transforming seafood waste into innovative high-value products, promoting sustainable crop production, and working towards zero waste.

P35. *Shining a light on cannabis metabolism. Karina Jarczeki, Susan J. Murch, Ryan Hayward | *University of British Columbia, Kelowna, BC, Canada* • Since legalization, cannabis (*Cannabis sativa* L.) has become a major sector of the Canadian economy, last valued at $10.8 billion in 2023. Growing cannabis in controlled indoor environments necessitates precise regulation of key factors, such as lighting, to ensure consistent crop quality. There have been significant industry shifts toward LED lighting, but lagging is research in how specific light wavelengths and intensities influence plant development through specialized photoreceptors and hormone signaling pathways. In this experiment, we subjected cannabis explants to three distinct LED lighting treatments *in vitro*: red, blue, and broad (control) spectrum, hypothesizing that cannabis metabolism can be influenced by spectra. We used untargeted liquid chromatography mass spectrometry-based (LC-MS) metabolomics, then leveraged chemometrics, pathway analysis, and hormonomics to detect, quantify, and putatively identify features. We identified significant overexpression of Shikimate-associated metabolic pathways, including flavone and flavonol biosynthesis, phenylalanine metabolism, and phenylpropanoid biosynthesis. In addition, there was Significant overexpression of the diterpenoid biosynthesis pathway, with gibberellins A1, A4, A34, and A51 being detected in blue treatment plants but not in red or control-grown plants. Hydroxymelatonin and cyclic melatonin were putatively identified in the blue treatment plants but not in the other light treatments. N-feruloyl melatonin and melatonin-glutamine were putatively identified in plants grown under control light treatment. These data implicate gibberellins, auxin, and melatonin as key plant hormones involved in light perception in cannabis. Further research should aim to validate these identifications and explore gene expression of light photoreceptors and signaling genes within cannabis, focusing on Shikimate-associated pathways.

P36. Establishment of *in vitro* systems in *Ochrosia elliptica* (Bloodhorn) for sustainable accessibility of an anti-cancer compound, ellipticine. Reo Zukoshi | *University of British Columbia, Kelowna, BC, Canada* • Ellipticine, a specialized metabolite possibly derived from the monoterpene indole alkaloid strictosidine, was first isolated from Bloodhorn (*Ochrosia elliptica*) in 1959. It can intercalate into DNA, inhibiting topoisomerase II activity and making it a promising anticancer drug. However, its elusive biosynthetic pathway and tissue-specific bioaccumulation in vital organs make it challenging to access. Therefore, an alternative system is needed to access ellipticine sustainably for elucidating the biosynthetic pathway or drug development. This work aims to establish an *in vitro* system, such as hairy roots, for improved accessibility to ellipticine, as hairy roots are well known for their high accumulation of specialized metabolites. Moreover, hairy root culture could be employed to produce unnatural ellipticine analogs through feeding or further engineering of the metabolic pathway. Mature and young leaf petioles exhibited the highest hairy root emergence compared to stems, with an induction time of 30 days following the infection. In addition, leaf calli from Bloodhorn demonstrated enhanced ellipticine production without the use of elicitors. Future work will involve feeding substrates to the calli to showcase their potential to generate non-natural ellipticine analogs. The Bloodhorn *in vitro* system thus provides a simplified and sustainable approach to accessing ellipticine for drug development.

CSHS Professionals Poster Presentations

P37. Diversity and abundance of carotenoid compounds in cultivated strawberry. Beatrice Amyotte[1], Shawna MacKinnon[1], McKenna Batstone[2], Clay Elzinga[2], Zoe Migicovsky[2] | *[1]AAFC Kentville RDC, Kentville, NS, Canada; [2]Acadia University, Dept. Biology, Wolfville, NS, Canada* • Strawberry is a major horticultural crop in Canada that is widely enjoyed for its flavour and nutritional value. Strawberries are a source of carotenoids which are antioxidant compounds providing human health benefits ranging from anti-cancer to neuroprotective effects. Strawberry carotenoid content can be improved by breeding with diverse germplasm. The Agriculture and Agri-Food Canada small fruit germplasm development program in Kentville, Nova Scotia recently conducted a phenotypic evaluation of 215 diverse *Fragaria ×ananassa* accessions to identify potential new breeding parents. Fruit characteristics such as size and colour were found to vary significantly among accessions, with the largest berries reaching 30 g and colours ranging from red to orange to white. Carotenoid pigments including lutein, violaxanthin and zeaxanthin were detected in concentrations as high as 3.3 μg mg-1, however the majority of accessions had undetectable levels. In particular, wild accessions were found to have elevated carotenoid concentrations compared with cultivars and breeding selections. These findings suggest that dedicated breeding efforts are required to improve carotenoid content in cultivated strawberry while maintaining size and colour standards for fresh markets. The relationships among these traits and implications for breeding selection will be discussed.

P38. CANberries: Developing sustainable out-of-season raspberry production in controlled environment. M. Aoun | *Bishop's University, Sherbrooke, QC, Canada* • The CANberries project addresses a critical gap in Canada's berry supply chain: the lack of sustainable, year-round local raspberry production. Raspberries, though well adapted to Canadian climates, are highly perishable and underdeveloped in controlled-environment agriculture (CEA) compared to crops like strawberries. CANberries aims to develop an energy-efficient, multi-cycle production system to deliver high-quality raspberries outside the traditional growing season. During the Shepherd Phase, a 100 m² prototype greenhouse was established to evaluate key variables including cultivar selection, cropping strategies, integrated energy systems, and pollination under CEA conditions. Two production cycles were completed using both floricane- and primocane-type cultivars. Environmental parameters, yield, fruit quality, and pollination efficiency were continuously monitored and optimized with lighting and biological control strategies. Technical, environmental and economical key performance indicators (KPIs) were monitored throughout the production cycles. The data served to develop a scalable simulation model, validated with field results, and to inform the technical design for a 1,000 m² scale-up greenhouse. The project integrates agrivoltaics, thermal battery storage, and precision climate control to reduce operational costs and carbon emissions. Results from the Shepherd Phase confirmed technical feasibility and commercial relevance, positioning CANberries for a broader rollout in collaboration with established industry partners.

P39. Identifying optimal harvest periods for three haskap cultivars in Quebec. Mohit Sharma[1,2,3], Rani Puthukulangara Ramachandran[4], Arturo Duarte Sierra[1,2,3] | *[1]Food Science Dept., Laval University; [2]Centre de recherche et d'innovation sur les végétaux (CRIV), Laval University; [3]Institute on Nutrition and Functional Foods (INAF), Laval University, Quebec, QC, Canada; [4]AAFC Saint-Hyacinthe RDC, Saint-Hyacinthe, QC, Canada* • Haskap (*Lonicera caerulea* L.), also known as honeyberry, swamp fly honeysuckle, or blue honeysuckle, exhibits a very short life cycle, constitutes high cold tolerance, and is prominently adapted to the extreme northern hemisphere climate. The determination of the optimum harvest time for marketing purposes is a challenge due to its rapid ripening phenology. For the objective of this study, the haskap cultivars 'Indigo gem', 'Tundra', and 'Aurora' were selected at three different times. The study aimed to compare the different cultivars and to establish the most suitable time for harvesting. Quality traits, including size and shape dimensions, sugar, acidity, firmness, and colour values, were determined. Firmness in Indigo gem fell within the range of 0.59 to 0.86 N, Tundra from 0.67 to 1.78 N, and Aurora from 0.89 to 1.69 N, respectively. Among all cultivars, Indigo Gem was the least firm cultivar, Aurora was the firmest cultivar, and Tundra was the second firm cultivar. Early-season Indigo Gem and Tundra had the highest sugar- to-acid ratio. Whereas a high sugar-acid ratio was observed in the mid-season and late season of Aurora. Principal component analysis revealed a positive correlation between sugar levels and firmness during the early harvest season of Indigo Gem. In contrast, Aurora exhibited strong positive correlations between sugar-acid ratios and firmness in the mid-harvest season. These findings provide valuable insights into optimal harvesting practices for haskap, enabling commercial producers to make more informed decisions when aiming to balance key fruit quality traits.

P40. Smoke Signaling: Volatile terpenes released in burning *Artemisia tridentata* Nutt. are accumulated in grapevines. A. Greene[1,2], R. O'Brien[2], L.A.E. Erland[3], S.J. Murch[1] | [1] *Dept. Biology, University of British Columbia (Okanagan), Kelowna, BC, Canada;* [2]*Supra Research and Development, Kelowna, BC, Canada;* [3]*University of the Fraser Valley, Abbotsford, BC, Canada* • Plants, like humans, communicate with their relatives. *Artemisia tridentata* (Nutt.), commonly known as big sagebrush or *cq'ʷas'q'lstn* (nsyilxcen), engages in kin communication by releasing volatile organic compounds (VOCs), which can induce physiological responses in neighbouring plants. In the South Okanagan, where A. tridentata is especially prevalent, it often coexists with vineyards, raising questions about potential ecological interactions. Our study explores the hypothesis that VOCs released passively through co-culture of species, or through burning of *Artemisia tridentata* can accumulate in grapevines (*Vitis vinifera* L. cv Cabernet Franc 327). To investigate this hypothesis, we had four key objectives: (1) To validate a gas chromatography mass spectrometry method for determination of sagebrush VOCs in grapevine leaves; (2) to use this method to monitor the accumulation of *A. tridentata* VOCs in grapevines grown passively with *A. tridentata* in a controlled environment; and (3) to monitor accumulation of A. tridentata VOCs following exposure to smoke derived from dried *A. tridentata*. If wine grapes can accumulate sagebrush-derived VOCs these compounds could impact both plant growth and fruit development, with potential consequences for wine quality. Interest in the impacts of volatiles on wine grapes and finished wines is increasing with increased incidence of smoke taint in wines. VOCs also contribute to the flavour profiles of wines, including wines from grapes grown in sagebrush ecosystems being described as having tasting notes of sagebrush. Our results have implications for vineyard management and provides new insights into plant volatile communication mechanisms and the meaning of terroir.

P41. Using electrically heated cable against deep freeze and frost damage in vineyards. Andréanne Hébert-Haché, Steve Lamothe | *Centre de recherche agroalimentaire de Mirabel, Mirabel, Québec, Canada* • Cold temperatures are a major threat to grape growers, both in winter and spring. In winter, the cold hardiness of commonly cultivated grapevine cultivars is often insufficient to prevent primary bud damage and yield loss. In spring, bud break can coincide with late frosts, causing damage that further reduce yields. These events have affected vineyards across all Canadian grape-growing provinces in recent years and are expected to become more frequent with climate change. Current protection methods offer limited protection and are specific to certain weather events. In this context, the goal of this research project was to adapt and install a heating cable system originally developed in New York State, and to evaluate its effectiveness against cold temperature in the winter and during frost events. The generator-powered system was built using commercially available hardware material and heating cables designed to prevent pipe freezing. Four twenty-meter section hybrid sp. 'St-Pépin' and V. vinifera 'Chardonnay' were protected with the heated wire and compared to unheated control rows. In 'Chardonnay', the system was installed under geotextile covers to assess the combined effect of both technologies. Temperature loggers were installed throughout the treatments. Data collection will include bud survival, frost damage, and yield parameter. As this is the first year of a three-year project, preliminary results on energy consumption and temperature gains near the wires will be presented. If successful, the system may help reduce cold-related yield losses and improve the long-term resilience of cold-climate vineyards.

P42. Extensive chromosomal structural variation between male and female of stinging nettle. Kaede Hirabayashi[1], Quentin Cronk[2,3,4], Michael K. Deyholos[5], Marco Todesco[1,2,3,5] | [1]*Michael Smith Laboratories, University of British Columbia;* [2]*Botany Dept., University of British Columbia;* [3]*Biodiversity Research Centre, University of British Columbia;* [4]*Beaty Biodiversity Museum, University of British Columbia, Vancouver, BC, Canada;* [5]*Biology Dept., University of British Columbia, Kelowna, BC, Canada* • Stinging nettles (*Urtica* spp.) are emerging multi-functional crops, commonly recognized by their 'sting' hairs which are modified trichomes present all over their stems. While the mechanisms and chemical composition of their 'sting' hairs have been studied extensively, the genomics of the family is understudied, partly due to their complex karyotypic diversity. The common stinging nettle (*Urtica dioica*) is also interesting for a different reason; the European subspecies (ssp. *dioica*) is dioecious with separate male and female plants, whereas the North American subspecies (ssp. *gracilis)* is monoecious. Since the sex chromosomes of the dioecious subspecies have not yet been identified, our project aimed at determining the putative sex determining region (SDR) of this species. We generated high-quality phased reference genomes for both female and male diploids using PacBio HiFi (~85 – 113X) and Hi-C (~50X). The male genotype used in this study is a biological son of the female; thus, we assembled three complete haplotypes for ssp. *dioica*. Despite a relatively small genome size (~550 Mbp), we detected a high proportion of repetitive elements (~68%) and a surprisingly high frequency of structural variants between haplotypes. Noticeably, we identified a massive 18 Mbp inversion within female haplotypes, and a highly repetitive block that was seemingly male-haplotype specific. While we propose that chromosome 8, which harbours these variants, as the potential candidate for the XY chromosome, additional sequencing of males and females will be needed to confirm the location of the SDR in *Urtica dioica*.

P43. An efficient method to screen onion cultivars for susceptibility to *Stemphylium vesicarium*. E. McFaul[1], B.D. Gossen[2], M.R.McDonald[1] | [1] *Dept. Plant Agriculture, University of Guelph, Guelph, ON, Canada;* [2]*AAFC, Saskatoon, SK, Canada* • Stemphylium leaf blight (SLB), caused by the fungus *Stemphylium vesicarium*, is a serious foliar disease of onion and results in premature leaf dieback and reduced onion yield and quality. No onion cultivars are resistant to *S. vesicarium*, but cultivars exhibit varying degrees of susceptibility. Identifying cultivars that are the least susceptible to SLB could improve disease management. Previous studies suggest that Stemphylium toxins play a key role in the initial colonization of susceptible cultivars and contributes to the virulence and aggressiveness of isolates. Assessing the reaction of onion cultivars to phytotoxins could identify least susceptible cultivars. The hypotheses were: a) phytotoxins produced by *S. vesicarium* cause leaf dieback, and b) cultivar susceptibility to SLB is related to differences in response of onions to phytotoxins of *S. vesicarium*. Three isolates of *S. vesicarium* were grown in potato dextrose broth for 21 days and the solution was filtered and autoclaved. The three oldest leaves of plants at the 5-6 leaf stage were injected with I ml of filtrate. Leaf dieback was assessed at 7, 14 and 21 days. There were five onion cultivars and four replicate plants per cultivar. Checks were autoclaved non-inoculated broth and no injection. The experiment was repeated. Onion cv. Highlander had more dieback (15%) compared to La Salle (5%) and Traverse (4%) at 21 days post injection which was consistent with earlier field trials. This simple method of preparing toxin solution and injecting onion leaves is an efficient method to assess onions for susceptibility to SLB.

P44. Low light tolerant fruit and vegetable plants for year-round indoor gardening in homes, offices and schools. M.P.M. Nair, Karen Tanino | *Dept. Plant Sciences, University of Saskatchewan, Saskatoon, SK, Canada* • There are more reasons to support the development and growth of our own Low Light Tolerant fruit and vegetables: declining global soil, air and water quality, more extreme weather conditions, higher costs of fresh fruit and vegetable crops, poor quality of fresh produce in the north, and the current trade wars. Furthermore, the limiting factor to producing plants year round indoors on home, office and school windowsills is not heat, but light. Vegetable and fruit cultivars have been traditionally bred and selected under high light conditions in the greenhouse or under full sun conditions in the field. Nevertheless, there appears to be a large genetic variation for adaptation to low irradiance conditions within existing commercial vegetable cultivars. Over 55 crops/cultivars were screened for potential production. Several crops show promise including a cool temperature adapted Mizuna (Brassica rapa var. japonica), Amaranthus, Swiss Chard, etc. An epigenetic component should also be explored. Furthermore, after 38 years of breeding, a Low Light Tolerant lemon and lime were developed and awarded US patents: 'First Canadian' lemon and 'First Canadian Golden' lime, producing up to 12 – 15 commercial size lemon fruits/plant in a 15-cm pot on the windowsill. Microgreens are also an important first step introducing growing and consuming fresh greens to children in schools. Collectively, these plants and others have potential to begin the road to increased self-sustainability.

P45. Enhancing resiliency and productivity through intercropping hazelnut and berries with annual and perennial crops. C. Bell[1], A. Svara[1], F. Akhter[2], K. Tanino[1] | *[1] Dept. Plant Science, University of Saskatchewan, Saskatoon, SK, Canada; [2]AAFC, Indian Head, SK, Canada* • The predominance of monoculture cropping in agriculture has resulted in a loss of biodiversity that has contributed to increased pressures from pests and disease. Intercropping with hazelnut (*Corylus* spp.) and other fruit shrubs could increase crop resilience and productivity by altering microclimate, increasing pollination and natural predation, and improving soil health. Furthermore, intercropping with hazelnut and fruit shrubs could facilitate production on Canada's nine million hectares of marginal land. Currently, the ecological and economic impacts of intercropping with hazelnuts and fruit shrubs are not fully comprehended. Thus, a partnership between Agriculture and Agrifood Canada and the University of Saskatchewan was formed in 2023 to quantify these impacts. This partnership began by making advanced hazelnut selections and collecting data on soil nutrients, microbiome, and population as well as diversity of beneficial insects such as pollinators (Hymenoptera) and natural predators (Coleoptera) from established trials (seabuckthorn and buffaloberry intercropped with annual [canola-wheat-pea in rotation] and perennial alfalfa crops) in 2023 and 2024. Next steps include optimizing hazelnut propagation, establishing hazelnut field trials in 2025 at Agriculture and Agri-Food Canada's Indian Head Research Farm and McCord Farm (producer site) in Saskatchewan, as well as further data collection and analysis. Ultimately, this project aims to ascertain how intercropping with fruit shrubs can affect crop productivity, above- and below-ground biodiversity and soil health, influence carbon sequestration, nutrient cycling and N2O emissions as well as assess economic viability compared to monocropping.

P46. Antioxidant and anti-hypertensive potentials of Saskatoon berries. Chamali Kodikara[1], Bob Hamlin[2], Chris Siow1, Thomas Netticadan[1], Sijo Joseph[1], Champa Wijekoon[1] | *[1]AAFC Morden Research and Development Center, Morden, MB, Canada; [2]Purple Fit, Warren MB, Canada* • Saskatoon berries (*Amelanchier alnifolia*) are a versatile and hardy fruit native to North America, particularly popular in the Canadian Prairie Provinces. Various cultivars of Saskatoon berries have been developed to enhance their flavor, yield, and resistance to diseases. Among the most notable cultivars are 'Honeywood,' 'Northline,' and 'Smoky.' Hybrid varieties of Saskatoon berries have also been developed to combine the best traits of different cultivars, resulting in improved fruit quality and resilience. These hybrids often exhibit enhanced growth habits, larger berries, and robust disease resistance. *In vitro* antioxidant activity assays and anti-hypertensive activity assays are important tools in scientific research for the development of new antioxidant compounds and formulations as well as in screening and identifying compounds with potential anti-hypertensive effects. In this project, we looked into the antioxidant and anti-hypertensive potentials of eleven Saskatoon berry varieties/cultivars provided by "Purple Fit" modern orchard in Manitoba. "Northland" cultivar showed the highest content of antioxidant activity. The anti-hypertensive potential of the most Saskatoon berry cultivars are high while "Parkhill" variety showed the lowest. Overall, the diverse cultivars of Saskatoon berries offer unique qualities that may cater to both home gardeners and commercial producers, enriching the berry-growing experience with their distinct flavors combined with the health benefits.

P47. The use of acetic acid herbicide affected apple rootstock responses to water deficit and subsequent infestation of fungal pathogen *Diplodia seriata*. Hao Xu, Dan O'Gorman, Melanie Walker, Danielle Ediger | *AAFC Summerland RDC, Summerland, British Columbia, Canada* • Weed control is important for sustainable management of new plantings in orchards. Commonly used systemic herbicides can detriment tender bark and low branches, compromising tree health and resilience against stresses. In this greenhouse trial of 'Ambrosia' apple (Malus domestica var. Ambrosia) grafted on G.935 and M.9NIC29 rootstocks, we investigated the effects of Roundup® Advanced Weed Control Spray (62.5g/L acetic acid), a contact herbicide, on weed control and on plant responses to water deficit and subsequent infestation of *Diplodia seriata*, a fungal pathogen causing cankers on apple tree (Rapid Apple Decline Sample No. 995, Plant Pathology Lab, Summerland, AAFC). The acetic acid spray led to tissue discoloration and permanent wilting of weeds around potted apple trees in 2 hours. Water deficit cycle was imposed on selected trees to reduce soil volumetric water content by 50%. The inoculation of *D. seriata* mycelial plug to rootstock xylem at 3 cm below graft union led to lesion development in phloem tissue of rootstock stem in both rootstocks; G.935 demonstrated more variation in lesion length 24 days after the inoculation, whereas M.9NIC29 did not develop severe lesion. The infestation did not cause noticeable damage on xylem, nor did it decrease photosynthetic rate or leaf chlorophyll concentration in the limited duration of this study. Water deficit reduced scion photosynthetic rate and leaf fresh weight on both rootstocks, and reduced leaf chlorophyll concentration in G.935, however, it did not aggravate the lesion development in either rootstock. Acetic acid herbicide treatment alleviated the photosynthetic rate reduction under water deficit and reduced the incident of severe lesion.

END ABSTRACTS.

Canadian Society for Horticultural Science
Société Canadienne de Science Horticole

About the Society

Founded in 1956, the **Canadian Society for Horticultural Science – Société Canadienne de Science Horticole (CSHS-SCSH)** is a professional society devoted to fostering, promoting and encouraging research and education in all branches of horticultural science in Canada. With a countrywide representation, our members are from a variety of horizons: scientists, educators, students, extension agents and industry personnel involved in research, teaching, information and technology related to all fields of horticulture.

Current Executive Board (2023-2025)

Due to the diversity of horticulture production in Canada, one of the priorities of the CSHS is to have a pan-Canadian representation on its board of directors.

President
Bourlaye Fofana, PE
Agriculture and Agi-Food Canada

Past-President
Youbin Zheng, ON
University of Guelph

Vice-President
Lord Abbey, NS
Dalhousie University

Treasurer
Beatrice Amyotte, NS
Agriculture and Agi-Food Canada

Secretary
Champa Wijekoon, MB
Agriculture and Agi-Food Canada

Western Representative
Simone Castellarin, BC
University of British Columbia

Prairie Representative
Jazeem Wahab, SK
Agriculture and Agi-Food Canada

Communication Officer
Raphael Ofoe, NS
Dalhousie University

Student Representative
Sarah Drury, QC
Université de Sherbrooke

Quebec Representative & Web-master, QC
Shahrokh Khanizadeh
ELM Consulting

Ontario Representative
Melanie Kalischuk, ON
University of Guelph

Atlantic Representative
Vasantha Rupasinghe, NS
Dalhousie University

Northern Representative
Julie Lajeunesse, QC
Agriculture and Agi-Food Canada

While we practice a progression within the board based on need, our members are encouraged to submit their candidacy to any currently position available. In fact, CSHS will renew its board members at its 2025 AGM in Kelowna, BC, and the roles of President, Vice-President, Secretary, and Northern representative will be renewed. Therefore, the board is looking for candidates to cover the roles of Vice-President, Secretary, and Northern representative. Terms are for 2 years with the possibility of 2 consecutive terms in the same position. Please contact the CSHS secretary (champa.wijekoon@agr.gc.ca) if you are interested in any of these positions or any upcoming vacant positions in 2026.

CSHS Annual Conferences

The CSHS also prioritizes travelling around the country for its annual meetings. Since 2016, CSHS held its annual meetings as standalone or joint-meeting in Montreal (CSHS-CSA 2016), Vancouver (CSHS-CSPB 2017), Niagara Falls (CSHS 2018), Guelph (Plant Canada 2019), as virtual conferences in 2020 (CSHS student conference) and 2021 (CPS-CSA-CSHS), Halifax (CSHS 2022), Ottawa (CPS-CSA-CSHS 2023), and most recently in Winnipeg where CSHS held its annual meeting as part of the Plant Canada 2024 Conference with all of the Canadian Plant Societies.

The **Plant Canada 2024** conference covered the topic "*Plants: Adapting to Changing World*", and was co-chaired by Drs. Fernando and Fetch, with Dr. Geoffrey Wasteneys as President of Plant Canada. CSHS organized and chaired two symposia on Cannabis and three concurrent sessions on root crops, fruits, and vegetables, and its members presented and chaired for many other sessions. Drs. Fofana, Abbey, Wijekoon, Amyotte, Kalischuk, Subramanian actively contributed to the conference board, organizing and Scientific committees, as well as judging student's oral and poster presentations. The CSHS was proud to be part of the 2024 Plant Canada Conference, July 7-10, 2024, in Winnipeg, MB.

CSHS at Plant Canada – Winnipeg, 2024

Tri-Society (CSHS-CPS-CSA) – Ottawa, 2023

CSHS & CSA – Kelowna, 2025

In 2025, CSHS annual meeting will be held in the west coast region, in Kelowna, BC as part of the CSHS-CSA joint conference, with Drs. Simone Castellarin and Kui Liu as Chairs. The CSHS-CSA joint conference organizing committee, including the two co-chairs, Drs. Amyotte, Fofana, Glover, and Randhawa, has put together an exciting program for the attendees.

CSHS – Halifax, 2026

In 2026, CSHS annual meeting will be held in the East coast region, in Halifax, with Dr. Beatrice Amyotte as the chair. If you are interested in participating in the national or local conference organizing committees, please contact the current CSHS secretary (champa.wijekoon@agr.gc.ca).

CSHS Student Committee

Students are an integral part of the CSHS, and their involvement in the Society is important and valued. A Student board was implemented in 2016 within the Society to support students' initiatives and the Student Committee has so far been very busy.

The CSHS student committee currently chaired by **Sarah Drury** has brilliantly organized a student Virtual Conference on March 20, 2025, with 12 great presentations. Talents from the Student committee members are now sought within the CSHS Annual Meeting organizing committees. Please forward your interest to the President or Secretary. The CSHS student committee and its CSA peer will organize the student social events at the CSHS-CSA 2025 joint Conference in Kelowna. We are encouraging all students to participate in these fun events, which will include motivational talks, time to network with other students, and a writing context!

Other events are planned for the upcoming year so follow their activities on the CSHS on-line platforms, including the CSHS website (www.cshs.ca), Facebook page and Instagram account!

We invite CSHS student members to become involved in the Committee. If you are interested, contact the Student Committee Chair, Sarah Drury (sarah.drury@usherbrooke.ca).

Becoming a member of the CSHS offers numerous benefits

- Significantly reduced registration fees at CSHS and conference registrations
- Take advantage of reduced memberships with combined registrations with multiple societies
- Reduced page charges to publish in the Canadian Journal of Plant Science
- Timely direct mail alerts to jobs, grant opportunities, etc.
- Eligibility for the CJPS Best Paper Award for horticulture, which comes with an invitation to be a conference speaker

In addition, for students, benefits also include

- Eligibility for Presentation Awards for the best oral and poster presentations
- Eligibility for Travel Awards to annual conferences
- Community & Extension Funding, which supports students activities in their communities
- Networking opportunities between members, and sharing the experience of study and research

For more information and to become a member: www.CSHS.ca

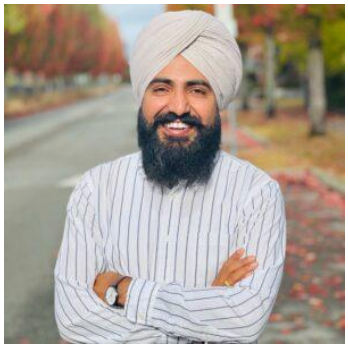
Canadian Society of Agronomy
La Société Canadienne d'Agronomie

The Canadian Society of Agronomy (CSA) is a non-profit, educational and scientific society affiliated with the Agricultural Institute of Canada. The CSA was formed in 1954, building on the historic Western Canadian Society of Agronomy (established 1919) and the Eastern Canadian Society of Agronomy (established 1949). The CSA is dedicated to enhancing cooperation and coordination among agronomists, to recognizing significant achievements in agronomy and to providing the opportunity to report and evaluate information pertinent to agronomy in Canada. Our goals are to provide opportunities for interaction among members and to act as a conduit for interacting with members of other professional organizations, to provide our members with a united voice for making agronomic concerns known to the public and to other organizations, and to provide opportunities for members to communicate news and scientific findings to the scientific community. More information can be found at www.agronomycanada.com.

2024-2025 CSA Executive Committee

Kui Liu
President

Harpinder Singh Randhawa
Past-President



Gurcharn Brar
President-Elect

Kathleen Glover
Secretary/Treasurer

Hiroshi Kubota Western Director

Linda Gorim
Western Director

Laura Van Eerd Eastern Director

Joshua Nasielski Eastern Director

Jagroop Gill Kahlon Industry Representative

Ben Thomas CJPS Representative

Jeremy Irvine Student Representative

2024-2025 CSA Activities

Over the 2024-2025 year, the CSA executive committee held five meetings to advance society's goals and initiatives. Notably, through the dedicated efforts of Kathleen Glover and the Sponsorship Committee, CSA has been successful in securing sponsorship funding for graduate student presentation awards. In 2024, several crop- and discipline- specific graduate student presentation awards were established and will be offered again at the 2025 Annual Meeting.

In January 2025, CSA welcomed Jennifer Mitchell as a new Executive Director. Since joining, she has made substantial contributions to the society, playing a key role in supporting daily operations and coordinating CSA events. Under her leadership, the CSA website has been fully updated to reflect the current information and activities. As part of efforts to enhance member engagement, CSA resumed publication of its newsletter, with two issues released in January and May 2025. Special thanks are extended to Linda Gorim and Joshua Nasielski for their contributions to drafting these newsletters. In addition, one graduate student delivered a presentation as part of the virtual graduate "Green Bagger" presentation series. CSA membership is also showing positive growth this year, driven by CSA membership campaign.

The 2024 CSA annual meeting was held in Winnipeg in conjunction with Plant Canada, with 51 CSA member participants. CSA members contributed 27 oral presentations and 24 posters to the scientific program. The following CSA members contributed to organizing the 2024 Plant Canada conference: Harpinder Randhawa, Jamie Larsen, Kui Liu, Mumtaz Cheema, Andrew Burt, Sheri Strydhorst, Jaswinder Sigh, Hiroshi Kubota, Jagroop Kahlon, Ritesh Yadav, Albert Tenuta, Mario Tenuta, Santosh Kuman, Malinda Thilakarathna, Ahmad Sharjeel, Emma McIlveen, Bill Biligetu, Baillie Lynds, and Jedida Chirchir. Marcie Wilson also made valuable contributions to the success of the 2024 Plant Canada meeting.

CSA Membership

The Canadian Society of Agronomy provides its members with a variety of benefits

- Editorial functions of world-class scientific journal
- Networking opportunities with agricultural professionals and students
- Stay informed on the latest research and agronomic advancements
- Recognition by peers through CSA awards program
- Presentation of scientific results at annual meetings
- Competitive awards for graduate students
- Receive the CSA society newsletters
- Access to job opportunities, career resources, and seminars
- Complimentary access to the Canadian Journal of Plant Science
- Participation in international projects
- Representation on various national expert committees
- Reduced registration fees for CSA annul conference

2024-2025 CSA Membership

- As of June 16, 2025, the Canadian Society of Agronomy has 149 active members, including 7 CJPS associate editors, 46 students, 12 post-doc fellows, 73 regular members, and 11 retired members.

Contact Information

For more information on CSA Membership or our awards program contact **Jennifer Mitchell** 519-803-1144, CSAgronomy@gmail.com or visit our website at www.agronomycanada.com and follow us on X (formerly Twitter) @agronomycanada, Facebook and LinkedIn.

2024 CSA Awards

The 2024 CSA awards committee members were: Jamie Larsen, Laura van Eerd, and Joshua Nasielski.

CSA Graduate Student Awards

The Canadian Society of Agronomy Graduate Student Awards include:

- **Ali Navabi Grad Student Travel Awards** were established in 2013 to encourage student attendance at the CSA annual meetings and are available to any graduate student CSA member. The Student Travel Award is $500 with a maximum of 5 awarded annually.
- **Pest Management Award** includes an award of $500 available to a graduate student enrolled at a Canadian University with research programs relevant to pest management. The award is accompanied by a grant of up to $1000 to attend the annual conference and present on his/her research project.
- **Graduate Student Oral and Poster Presentation Awards:** A number of awards are awarded at the CSA annual meeting to CSA graduate student members for the best oral and poster presentations. In 2024 several crop or discipline specific graduate student presentation awards were initiated. The awards are presented after an assessment conducted by a panel of judges. Up to $1,000 is awarded for a graduate student oral presentation and $750 for a poster presentation. Graduate students responded favorable to the opportunity to compete for these awards and for the opportunity to meet with industry representatives sponsoring the awards.

Below are the 2024 Graduate Student Award Winners

- **2024 Ali Navabi Grad Student Travel Awards**

  Jedida Chirchir
  Emma Mcilveen
  Sharjeel Ahmad
  Simranjeet Kaur
  Baillie Lynds
  Chathuranga De Silva

- **2024 Pest Management Award**

  Simranjeet Kaur

- **2024 Graduate Student Oral and Poster Presentation Awards**

Nutrien - Nutrient Management-Best Oral Presentation	Tristan Chambers
Pulse & Soybean Best Oral Presentation	Emma McIlveen
Pulse & Soybean Best Poster Presentation	Larissa Cottick
Wheat Best Oral Presentation	Ritesh Yadav
Wheat Best Poster Presentation	Manawahinghe Kalhari
Forages Best Oral Presentation	Mohammed Musthafa Mukthar
Forages Best Poster Presentation	Oshadhi Athikorala Arachchinge
Agronomy Best Oral Presentation	Emily Mantin
Agronomy Best Poster Presentation	Prerana Upretee
Canola Best Poster Presentation	Ruchini Sovis

CSA Professional Awards

The CSA professional awards are an important peer recognition benefit. Professional Awards include:

- **Early Career Agronomist** is intended for individuals actively engaged in research, teaching, extension or administration within 10 years of starting their career or earning their last degree.
- **CSA Fellow** is intended for individuals actively engaged in research, teaching, extension or administration for at least 10 but less than 20 years of their career.
- **Distinguished Agronomist** is intended for individuals actively engaged in research, teaching, extension or administration for more than 20 years of their career.

Nominations for the above awards can be made by any active member of CSA who has had continuous active membership in CSA for at least five years.

Below are the Professional Award winners for 2024

2024 Early Career Agronomist	Not awarded
2024 CSA Fellow	Dr. Mumtaz Cheema
2024 Distinguished Agronomist	Dr. Dean Spaner

Acknowledgements

Bayer Canada provides financial support for the Pest Management Award. The CSA is grateful to Bayer for their support.

A sincere thank you to our hosts, sponsors, organizers, volunteers and participants!

This is your conference and we owe our success to your dedicated involvement in Canadian horticultural and agronomy science.

Wishing you a productive meeting and safe travels home.