1st Canadian Society for Horticultural Science Online Graduate Student Conference

August 27th, 2020

Table of Contents

A Message from the 2019/2020 Canadian Society for Horticultural Science Student Committee

The Canadian Society for Horticultural Science (CSHS) Student Committee is excited to welcome you to the 1st Canadian Society for Horticultural Science Online Graduate Student Conference. With the support of current CSHS board members, the student committee has worked hard to organize this conference and we are thrilled you have decided to join us. This conference provides a unique opportunity for graduate students to present their work to other members of the CSHS, in addition to an opportunity for all members to learn about the valuable and diverse research being conducted by graduate students within the field of horticulture.

Throughout this booklet you will find the schedule for the conference, a diverse range of abstracts for the various oral presentations and posters, as well as copies of each poster.

Please note that the schedule is hyperlinked and by clicking on the presenters' name of the talk or poster you are interested in, you will be taken directly to the session for that presentation. You may also choose to click directly on "Session 1" and/or "Session 2"; more details for joining the conference can be found on Page 8. **Please note Session 1 and Session 2 will run concurrently.** This booklet also contains additional information regarding how to attend the conference, including troubleshooting should you experience technical difficulties. Following the conference, we would appreciate it if you could take the time to fill out a short online survey regarding the conference.

Once again, we are pleased to welcome you to the 1st CSHS Online Graduate Student Conference. We hope you enjoy it.

Sincerely,
The CSHS 2019/2020 Student Committee

A Message from the President of CSHS

We all know that these have been interesting and challenging times, both on the personal and professional level. We all had to adjust to a “new normal”, including when it comes to the activities of the Canadian Society for Horticultural Science.

One of the goals of our society is to promote horticulture research and encourage graduate students to engage in this exciting field. This has taken a whole new meaning this year. This spring, we were all disappointed to have to postpone our CSHS annual conference and especially the fact that our graduate student members would lose an opportunity to present their work this year. However, challenging times can bring the best out of a society and that is exactly what happened! Thanks to a dedicated and highly motivated group of graduate student representatives, lead by Ariana Forand, the 1st CSHS Graduate Student Conference was organized. As the President of the Canadian Society for Horticultural Science and on behalf of the executive board, I am proud to offer my congratulations to the organizing committee for putting together such an impressive program and to offer my sincere thanks for all their hard work in the past few months. At a time where we can all feel isolated, their efforts will bring us together with one common goal: highlight stimulating research performed by graduate students!

I can honestly say that the future of horticulture science in Canada is in very good hands!

Enjoy the conference!

Valérie Gravel
President of the Canadian Society for Horticultural Science

About the CSHS

The CSHS is a scientific society devoted to fostering and promoting horticultural science in Canada since 1956. With a countrywide representation, our members are for a variety of horizons: scientists, educators, students, extension agents and industry personnel involved research, teaching, information and technology related to all horticultural crops.

Current CSHS Executive Board Members

President- Dr. Valérie Gravel, QC (McGill University)

Vice-President- Dr. Youbin Zheng, ON (University of Guelph)

Past President- Dr. Karen Tanino, SK (University of Saskatchewan)

Treasurer- Dr. Diane Edwards, AB (ABI Environmental Services Ltd)

Secretary- Dr. Bourlaye Fofana, PE (Agriculture and Agri-Food Canada)

Western Representative- Dr. Simone Castellarin, BC (University of British Columbia)

Prairie Representative- Dr. Kate Congreves, SK (University of Saskatchewan)

Ontario Representative- Dr. Michael Pautler, On (Vineland Research & Innovation Center)

Quebec Representative- Dr. Shahrokh Khanizadeh, QC (ELM Consulting)

Atlantic Representative- Dr. Vasantha Rupasinghe (Dalhousie University)

Northern Representative- Julie Lajeunesse, QC (Agriculture and Agri-Food Canada)

Student Representative- Ariana Forand, SK (University of Saskatchewan)

Current CSHS Student Committee

Chair- Ariana Forand, SK (University of Saskatchewan)

Co-Chair- Claudio Ignacio Fernandez, NB (University of New Brunswick)

British Columbia Representative- Yifan Yan, BC (University of British Columbia)

Ontario Representative- Meaghan Mechler, ON (University of Guelph)

Quebec Representative- Angela Paul, QC (McGill University)

Nova Scotia Representative- Raphael Ofoe, NS (Dalhousie University)

Newfoundland and Labrador- Arindam Sikdar, NL, (Memorial University of Newfoundland)

Student Committee Member- Vera Amo Larbi, NS (Dalhousie University)

The CSHS Student Committee will be looking for new members this September for the 2020/2021 student committee. If you are interested in joining the committee, please email cshs.student.committee@gmail.com

Stay up to date with the CSHS. Check us out on Twitter, Facebook and Instagram!

@CanadianHortSci

Canadian Society for Horticulture Science- CSHS

@Canadian_horticultural_science

Conference Schedule

Thursday August 27th, 2020 (All times listed in CST)

*Please note this schedule is hyperlinked for your convenience. Feel free to click directly on "Session 1" and/or "Session 2" or directly on the talk you are interested in. More information regarding joining the conference is on Page 8.

	Session 1	Session 2
9:00-9:30am (CST)	**Opening Remarks**	
	PATHOLOGY	**SOIL AND ENVIRONMENT**
9:35-9:45am	**Kendra Thornton** (University of Guelph)	**Vera Amo Larbi*** (Dalhousie University)
9:50-10am	**Beatrice Wausi Gedion** (University of Guelph)	**Raphael Ofoe*** (Dalhousie University)
10:05-10:15am	**Claudio Ignacio Fernández*** (University of New Brunswick)	**Laura Anderson** (Dalhousie University)
10:20-10:30am	**Sara M. Stricker** (University of Guelph)	**Ajwal Dsouza** (University of Guelph)
10:35-10:45am	**Zahra Charkhzarrin** (McGill University)	**Qianyi (Athena) Wu** (University of Saskatchewan)
10:50-11am	**Dieter Kahl** (University of British Columbia Okanagan / Agriculture and Agri-Food Canada)	**HUMAN HEALTH AND CANNABIS** **Roksana Saleh** (Dalhousie University)
11-11:15am	**BREAK**	**BREAK**
	PATHOLOGY (continued)	**HUMAN HEALTH AND CANNABIS (continued)**
11:20-11:30am	**Jinxz Pollard-Flamand** (University of British Columbia Okanagan / Agriculture and Agri-Food Canada)	**Victoria Rodriguez Morrison** (University of Guelph)
11:35-11:45am	**PHYSIOLOGY AND NUTRITION** **Matt MacNeil** (Dalhousie University)	**Tharindu Suraweera** (Dalhousie University)
11:50-12pm	**Soudeh Farzadfar** (University of Saskatchewan)	**Adrian Monthony** (University of Guelph)
12:05-12:15pm	**Olivia Otchere** (University of Saskatchewan)	**BIOTECHNOLOGY**

12:20-12:30pm	**Yuhang He** (Dalhousie University)	**Johannes Duncan Giebelhaus** (University of Alberta)
12:35-12:45pm	**Jaber Husiny** (Univeristy of Guelph)	**Véronique Plante** (Acadia University)
12:50-1pm	**Dengge Qin** (Dalhousie University)	**Karthika Sriskantharajah** (University of Guelph)
1-1:15pm	**BREAK**	**BREAK**
	PHYSIOLOGY AND NUTRITION (continued)	**BIOTECHNOLOGY (continued)**
1:20-1:30pm	**Varinder Sidhu (**McGill University**)**	**Umanath Sharma** (Memorial University of Newfoundland)
1:35-1:45pm	**Min (Kevin) Kim** (University of Guelph)	**POSTER SESSION** **Lauren Plotnik** (Univserity of Guelph)
1:50-2pm	**Ariana Forand*** (University of Saskatchewan)	**Christina Horst** (University of British Columbia Okanagan)
2:05-2:15pm	**POSTER SESSION** **Corynne O'Farrell** (University of British Columbia Okanagan)	**Angela Paul*** (McGill University)
2:20-2:30pm	**Trang Phan** (University of Saskatchewan)	**Madumani Amararathna** (Dalhousie Univeristy)
2:35-2:45	**Nivethika Ajeethan** (Dalhousie University)	**Jennifer Hoogenboom** (University of Guelph)
2:45-3PM	**BREAK**	**BREAK**
3:05-3:15pm	**Jared Hrycan** (University of British Columbia Okanagan / Agriculture and Agri-Food Canada)	**Gurleen Sidhu** (University of Guelph)
3:20-3:30pm	**Yifan Yan*** (University of British Columbia)	**Zahra Charkhzarrin** (McGill University)
3:30-3:50	**BREAK**	
3:55-4:15pm	**Presentation of Awards and Talk by the Canadian Journal of Plant Sciences**	
4:15-4:45pm	**Closing Remarks**	

***Member of CSHS Student Committee.**

Instructions for Joining the Conference

The Conference will begin and end with everyone in the **Session 1** meeting room. After our welcome address, presentations will be split off into two rooms.
You are welcome to attend any sessions and will be able to discreetly enter or leave the meeting rooms throughout the presentations.

Ways to participate:

Option 1
Open both meeting rooms at the start of the day and leave them both open throughout the day. To open the meeting rooms, click on the Session 1 and Session 2 links at the top of the schedule. You will be able to toggle between meeting windows to attend your chosen sessions. With this option, you will need to mute your microphone and turn off your video in BOTH sessions. We don't recommend using this option if you are in a rural area or if you believe your internet may be slower as this option requires higher speed internet. If you experience technical difficulties with this option (ie. the session is lagging) we recommend trying Option 2.

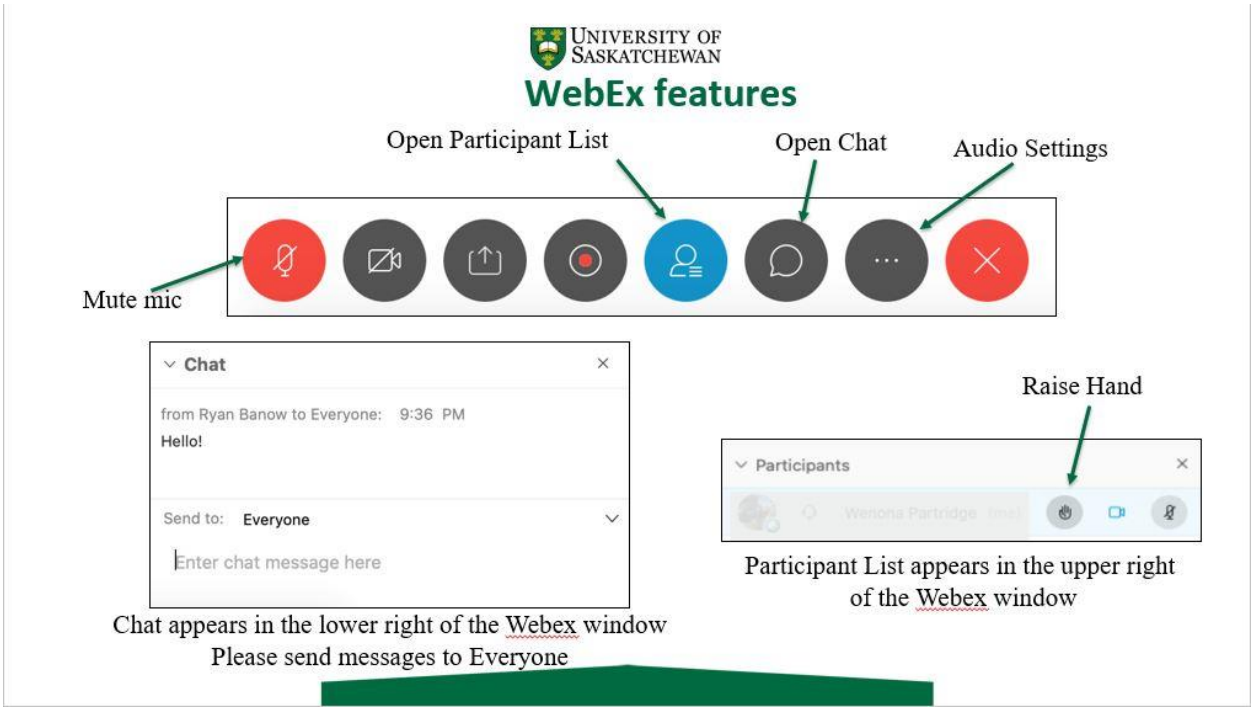
Option 2
Presentation Titles are linked in the timetable. Click on the title of the presentation to enter that meeting room and then click the leave meeting button when the session is over. Keep the daily schedule open on your computer so you can return to the agenda after each session to connect to the next presentation. This option may be best for those in rural areas or if you believe your internet may be slower as this option won't require as high speed internet as Option 1.

Please note for both options we ask that you keep your video turned off and your microphone on mute. Should you have a question for the presenter please type your question into the chat room so all of the delegates along with the presenter can see your question. The presenter will read your question aloud.

House Keeping Rules

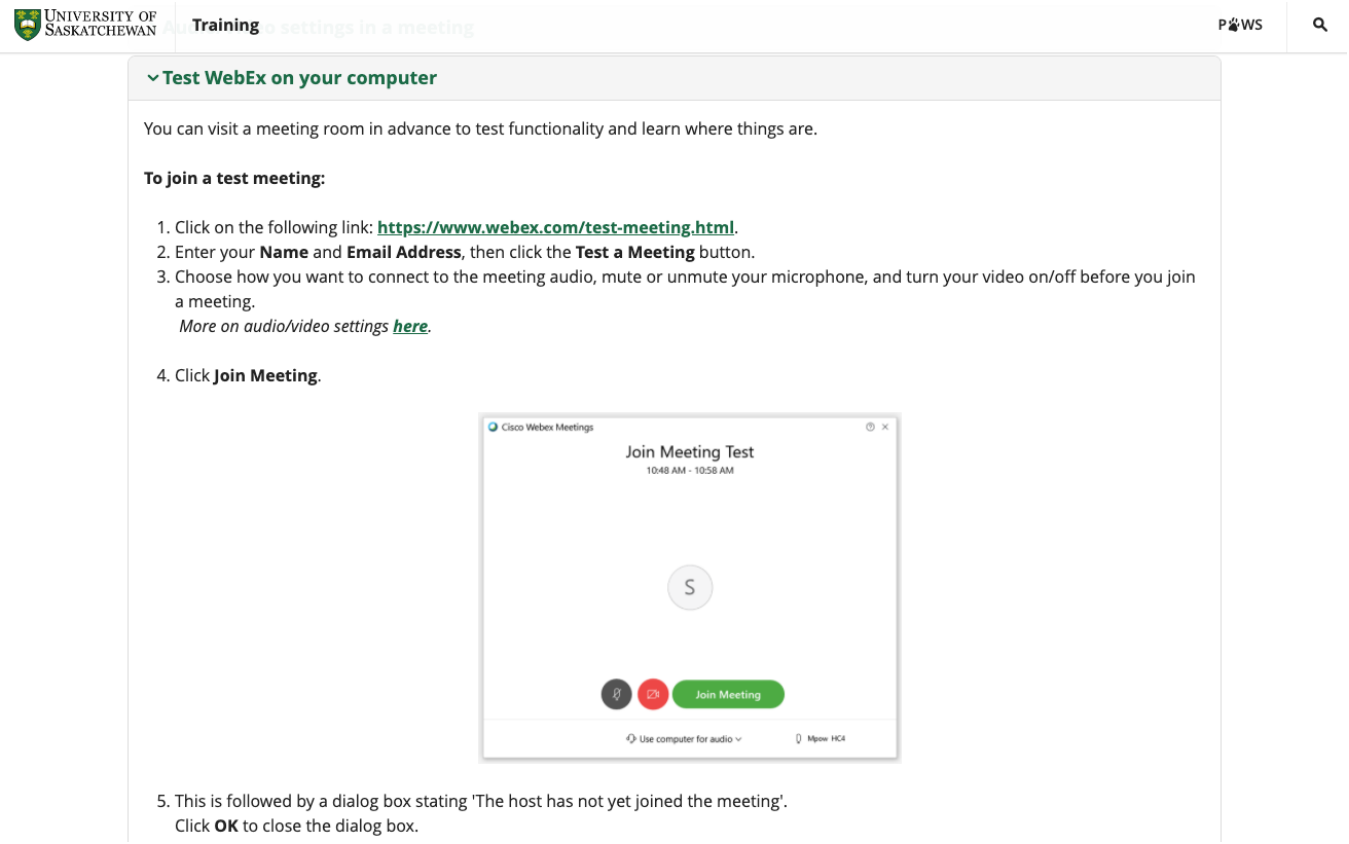
- Please ensure your microphone is muted and your camera is turned off at all times, unless you are presenting.
- If you have a question for a presenter, please type your question into the chat room. We ask that you use the chat room that is visible to everyone.
- Should you experience any technical difficulties within the first hour, we will have a WebEx support staff on hand. You can message them directly through WebEx. You may also direct any questions or concerns to Ariana Forand if you are in Session 1, Claudio Ignacio Fernandez if you are in Session 2 or any of the CSHS Student Committee Members listed on Page 5 who are in your session. WebEx support will continue to be on standby throughout the day as well.

Using WebEx



Testing WebEx on Your Computer

We recognize that not everyone may be familiar with WebEx. Should you like to test WebEx on your computer before the conference we hope these images will help you. This information is also available on www.training.usask.ca/webex.php



University of Saskatchewan Training PAWS

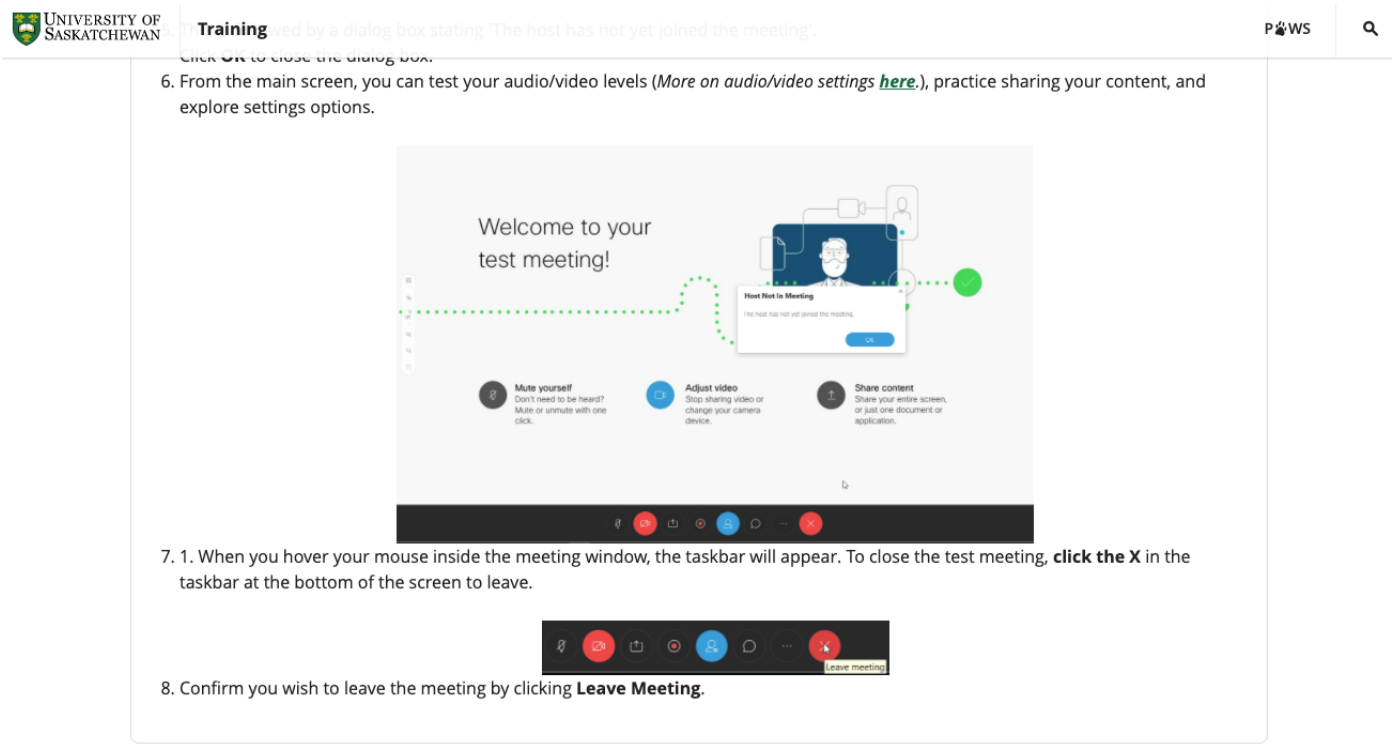
Test WebEx on your computer

You can visit a meeting room in advance to test functionality and learn where things are.

To join a test meeting:

1. Click on the following link: **https://www.webex.com/test-meeting.html**.
2. Enter your **Name** and **Email Address**, then click the **Test a Meeting** button.
3. Choose how you want to connect to the meeting audio, mute or unmute your microphone, and turn your video on/off before you join a meeting.
   *More on audio/video settings **here**.*
4. Click **Join Meeting**.

5. This is followed by a dialog box stating 'The host has not yet joined the meeting'.
   Click **OK** to close the dialog box.



Trouble Shooting

Should you experience any technical difficulties, we hope this section may help you navigate those problems. Please also feel free to direct message the WebEx support staff (within the first hour) and after that you can direct message Ariana Forand (Session 1), Claudio Ignacio Fernandez (Session 2) or any member of the CSHS Student Committee listed on Page 5. All of the information below is also available on traning.usask.ca/webex.php

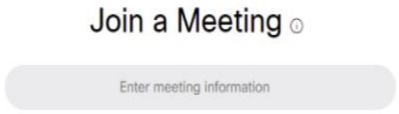
Having Problems with the Hyperlinks on the Schedule?

If you are having problems with the hyperlinks on the schedule you can join the meeting directly from usask.webex.com. The information below will provide you with step-by-step instructions for this. The **9-digit meeting number for Session 1 is 145 958 3844** and the **9-digit meeting number for Session 2 is 145 815 5178**. For **both sessions the password is "CSHS".**

Join a meeting from the WebEx site

1. Go to **usask.webex.com**

2. Click on the **search bar** and enter one of the options to search for the meeting. You can search by Personal Room ID, 9-digit meeting number. (This information can be found in your email invitation.)

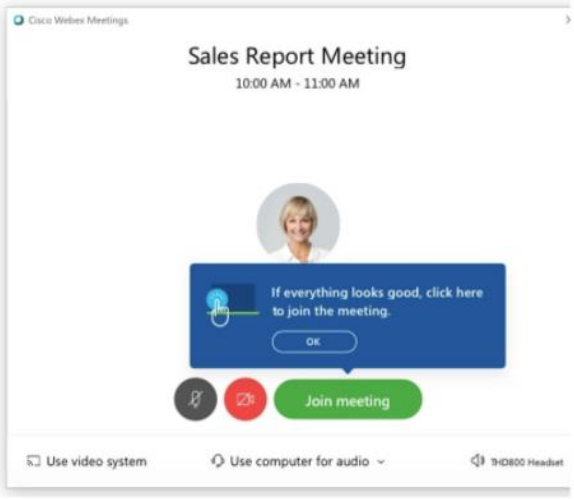


3. Enter the meeting password (from the email invitiation), if necessary, and click **Next.**
**Not every meeting will have a password.

4. Choose how you want to connect to the meeting audio, mute or unmute your microphone, and turn your video on/off before you join a meeting.

*More on audio/video settings **here**.*

5. Click **Join Meeting**



Abstracts

Pathology, Soil and Environment, Human Health and Cannabis, Physiology and Nutrition, and Biotechnology

Pathology

Improving fungicide efficacy for management of Cercospora leaf spot (*Cercospora beticola*) in sugarbeet (*Beta vulgaris*).

K. Thornton[1], A. Schaafsma[1], J. Deveau[2], and C. Trueman[1].

[1]Department of Plant Agriculture, University of Guelph, 120 Main Street East, Ridgetown, ON N0P2C0 Canada

[2]Ontario Ministry of Agriculture, Food and Rural Affairs, 1283 Blueline Road Simcoe, ON N3Y4N5 Canada

*Correspondence: kthorn01@uoguelph.ca

Cercospora leaf spot (CLS; *Cercospora beticola* Sacc.) is a damaging disease of sugarbeet (*Beta vulgaris* L.), resulting in reduced yield and sugar quality. Mancozeb is a contact fungicide that lacks translaminar and systemic properties, thus relying on good canopy coverage in order to be effective. InterLock, a modified vegetable oil-based spray adjuvant (MVO), is designed to improve spray coverage by optimizing spray droplet size. In a previous study, greater application carrier volumes reduced CLS severity when disease intensity was high. The potential of MVO and higher carrier volumes to improve efficacy of mancozeb for CLS management was evaluated in two field trials in Ontario. Trials were arranged in a randomized complete block with four replications. Applications of water, mancozeb, MVO, and mancozeb in combination with MVO using carrier volumes of 115, 235, 350, and 470 L ha^{-1} were made on a 14-day interval. Adding MVO to mancozeb did not reduce disease severity or improve sugar recovery or quality more than applications of mancozeb alone. Carrier volume did not affect disease severity or sugar quality, however recoverable white sucrose per hectare was greater using 350 L ha^{-1} compared to 115 L ha^{-1}. Identifying practices that improve fungicide efficacy will provide growers with useful information to develop disease management programs. Additional trials are being conducted in 2020 to further evaluate effects of MVO and carrier volume on CLS and canopy coverage and deposition.

Improved Sampling and Detection of Mycotoxins in Maize (*Zea mays L.*)

Beatrice Wausi Gedion

Department of Plant Agriculture, University of Guelph, Ridgetown, ON N0P 2C0

Advisor: Art Schaafsma, A. Prof Department of Plant Agriculture, University of Guelph, Ridgetown, ON N0P 2C0

*Correspondence: bgedion@uoguelph.ca

In 2018, Ontario experienced the worst epidemic of gibberella ear rot in maize (Zea mays L.) on record and much of the grain was highly contaminated with the mycotoxin deoxynivalenol (DON). Maize is traded on the basis of DON contamination, and there was no confidence in the sampling or testing throughout the industry, because DON concentrations are heterogeneous, and sampling is difficult. The objective of this project was to identify the sources of variability in the sampling and testing procedures and to develop ways to correct these. There are three key steps in the process that could contribute to variability of results. The first step is taking the grain sample from the truck lot using a grain probe. A 2-kg sample was compared with multiple cup samples taken during truck offloading. Second was selecting a subsample from the probe sample. The original method of grinding a 200-g subsample of whole grain was compared to grinding the whole 2-kg sample. Third was the mycotoxin test procedure. Three main lateral flow DON test kits were compared to liquid chromatography-tandem mass spectrometry (LCMS/MS). Results showed that probe samples were not a significant source of variability. The three commercial test kits were similar in performance compared with LC- MS/MS, except two crosses reacted to other DON-related compounds. The main source of variability was subsampling of the probe sample. Thus, the entire probe sample should be ground and remixed to create a homogenous sample before taking the final sample for DON testing

Using Principal Components and Support Vector Machine for Early Detection Of Cucumber Powdery Mildew

Claudio Ignacio Fernández[1], Brigitte Leblon[1], Ata Haddadi[2], Keri Wang[2], and Jinfei Wang[3]

[1]Faculty of Forestry and Environmental Management, University of New Brunswick. [2]A&L Laboratories Canada Inc., London, Ontario, Canada. [3]Department of Geography, University of Western Ontario.

*Correspondence: ci.fe@unb.ca

This study assessed the potential of hyperspectral measurements in the red and red-edge spectral regions to detect powdery mildew. Cucumber plants (cv Straight Eight) were grown in a controlled environmental chamber and inoculated manually on marked leaves. Reflectance spectra from 400 to 900 nm were collected using an ASD spectroradiometer before and until seven days post-inoculation (DPI). The spectra were cropped to the red and red-edge regions (660 to 780 nm). Then a principal component analysis was performed to reduce the number of wavelengths to a new smaller set containing most of the variance. A Support Vector Machine (SVM) algorithm was used to classify healthy and infected leaves using either the three first principal component scores or the reflectances corresponding to the central wavelengths of the MicaSense® RedEdge MX Dual Camera Imaging System in the red and red-edge regions (668, 705, 717 and 740 nm) the accuracy of the SVM to sort the data was evaluated using the Specificity, Precision, F1 Score and Overall Accuracy (Morellos et al. 2020). First, three principal components represented over 99% of the total variance from 0 to 7 DPI. The SVM applied to the selected principal component scores (reflectance) sorted infected leaves reaching values 0.88, 0.89, 0.89 and 89.84% (0.87, 0.84, 0.86 and 87.50%) for the Specificity, Precision, F1 Score and Overall Accuracy, respectively, at 4 DPI, i.e. two days before visible symptoms. Disease management could be improved, considering that leaves infected with powdery mildew can be detected 48 h before symptoms.

Keywords— Plant pathology, early detection, spectroscopy.

References:

Morellos, A., G. Tziotzios, C. Orfanidou, X.E. Pantazi, C. Sarantaris, V. Maliogka, T.K. Alexandridis, and D. Moshou. 2020. Non-destructive early detection and quantitative severity stage classification of tomato chlorosis virus (ToCV) infection in young tomato plants using Vis-NIR spectroscopy. Remote Sensing, 12, 1920 doi: 10.3390/re12121920

Fungicide efficacy and timing for the management of *Stemphylium vesicarium* on onion

Sara M. Stricker[1], Bruce D. Gossen[2] And Mary Ruth Mcdonald[1]

1*Department of Plant Agriculture, University of Guelph, Guelph, ON N1G 2W1, Canada*
2*Agriculture and Agri-Food Canada, 107 Science Place, Saskatoon, SK S7N 0X2, Canada*

*Correspondence: strickes@uoguelph.ca

Stemphylium leaf blight (SLB), caused by *Stemphylium vesicarium*, has become an important disease of onion in Ontario, Canada and the north-eastern USA in recent years. The disease presents as elongated lesions on the leaves and severe leaf dieback. The impact on yield is unclear, however, extensive leaf dieback limits uptake of sprout inhibitors that are applied to onion foliage prior to harvest. This can result in high losses in storage. Currently, there are no resistant commercial onion cultivars. Hence, growers apply foliar fungicides at 10–14-day intervals to manage the disease. However, fungicide efficacy and the reduction of SLB severity with several fungicides has declined year to year. Field trials to evaluate disease forecasting models were conducted at the Muck Crops Research Station, Holland Marsh, Ontario in 2018 and 2019. The disease forecasting models reduced the number of fungicide spray applications, however, none of the models, including calendar-based applications, reduced SLB severity. Seed treatments containing penflufen, combined with calendar-based fungicide applications, reduced SLB severity. Fungicide insensitivity assessments of *S. vesicarium* isolates collected in 2018 and 2019 demonstrated that 69% of isolates (n=49) were insensitive to azoxystrobin (QoI fungicide, FRAC 11) and 69% (n=49) were insensitive to pyrimethanil (AP fungicide, FRAC 9), and 4% (n=129) were insensitive to difenoconazole (DMI fungicide, FRAC3). These active ingredients are used extensively on onion in the Holland Marsh but are no longer effective against the population of *S. vesicarium* in the region. Additional studies on the efficacy of seed treatments and fungicide insensitivity are required.

Assessing Effects of Three Biofungicides on Colletotrichum acutatum Causing Strawberry Anthracnose

Charkhzarrin, Z*[1], V. Gravel[1]

1 Department of Plant Science, McGill University, Ste-Anne-de-Bellevue (Quebec), Canada, H9X 3V9

*Correspondence: zahra.charkhzarrin@mail.mcgill.ca

Biological control agents (BCA) have become the center of attention for their antagonistic effects against phytopathogens, and their potential for being employed in managing critical diseases such as anthracnose fruit rot of strawberry caused by Colletotrichum acutatum instead of existing biohazardous methods. Therefore, effects of three registered biofungicides (Actinovate® (Streptomyces lydicus), RootShield® (Trichoderma harzanium), and Rhapsody® (Bacillus subtilis)) in three concentrations were evaluated against 4 strains (S1, S2, S3, S4) of C. acutatum and a complex of all of the strains (Sc). Preliminary in-vitro results showed full restrictive effect of all three BCA against C. acutatum strains. However, when BCAs were applied on inoculated strawberry plants and phenological data of the plants were collected results varied extensively. Adverse effects of each strain targeted a specific part of the plants. S4 reduced the number of leaves the most, S1 and S2 limited flowering the most, while S2 and S3 lowered fruit production the most. In general, the complex of strains did not increase the disease impacts on strawberry plants. Also, based on mode of action, each BCA impacted the plants differently. Actinovate® helped them produce more leaves and fruits, while Rhapsody® increased the number of flowers. Overall, the best concentration of the BCAs was the recommended dose on the packages and higher concentration did not significantly differed. Finally, it can be concluded that a specific concentration of a BCA can-not be recommended for all strains of this pathogen, which is an indication of complicated management of this disease on strawberries.

A simple, rapid, and inexpensive method for the identification of the insect vectors of plant viruses

Kahl, D.

University of British Columbia Okanagan / Agriculture and Agri-Food Canada

*Correspondence: dieter.kahl@canada.ca

The ability of an insect to vector a plant virus is traditionally identified through highly-controlled greenhouse transmission experiments. These glasshouse experiments are notoriously resource and time-consuming, and are often unreliable. This research presents a novel approach for identifying the insect vectors of plant viruses that significantly reduces the time-to-results while also reducing the excessive resource requirements associated with the traditional approach. This novel method employs an artificial transmission setup using a sucrose solution as the virus recipient in place of a living plant. This eliminates the high plant-to-plant variability of inoculativity and limits transmission capability to virus-insect compatibility. To validate this new approach, phloem-feeding insects (n = 391) , including leafhoppers, froghoppers, aphids, and treehoppers, were challenged by the artificial feeding system to determine their ability to vector the emerging grapevine geminivirus, grapevine red blotch virus (GRBV). Test insects were allowed to feed on a potted grapevine infected with GRBV for three days, and then transferred to tubes containing a sucrose solution partitioned by a thin stretched Parafilm membrane. After three days of feeding through the membrane, viruliferous test insects were stored for species identification and the sucrose solutions were tested by conventional polymerase chain reaction for the presence of GRBV DNA. Of all the insects tested, only nine treehoppers of two morphological groups successfully transmitted GRBV to the sucrose solutions, indicating a high-likelihood of vector capability to be validated by glasshouse or field experiments.

Identification, characterization, and implementation of *Trichoderma*-based biological control agents for the management of grapevine trunk diseases in British Columbia.

Jinxz Pollard-Flamand, Julie Boulé, and José Ramón Úrbez-Torres

Agriculture and Agri-Food Canada, Summerland Research and Development Centre, Summerland, British Columbia V0H1Z0, Canada E-mail: joseramon.urbeztorres@canada.ca

*Correspondence: JinxzFlamand@live.com

Grapevine trunk diseases (GTDs) are one of the most important biotic factors limiting grapevine health. Fungal pathogens causing GTD mainly infects vines via pruning wounds. Currently, there are no chemical products nor biological control agent (BCA) registered in Canada for the control of GTD. Species within the *Trichoderma* genus are widely BCA capable of protecting plants by actively antagonizing plant pathogenic fungi, including GTD pathogens, through a wide array of mechanisms. Accordingly, the objectives of this research were i) to characterize *Trichoderma* spp. from the Okanagan Valley in British Columbia (BC) by means of morphological, biological, and molecular studies and ii) to screen for isolates that can be used as BCA against the *Diplodia seriata* and *Neofusicoccum parvum*, two of the most prevalent GTD fungi found in BC. In total, 29 *Trichoderma* isolates were obtained from grapevines in BC. Molecular analyses of the ITS and TEF 1-alpha loci allowed the identification of seven species, including one novel *Trichoderma* sp.The optimum temperatures for mycelial growth and conidial germination were determined and the antagonistic abilities of *Trichoderma* isolates against *D. seriata* and *N. parvum* were screened in vitro via dual culture assays and in the greenhouse via detached cane assays. The best performing *Trichoderma* isolates were then tested in an experimental vineyard alongside commercial pruning wound protectant products. Comparison between pathogen re-isolation from negative controls and treated wounds showed *Trichoderma*-based treatments from BC to provide >90% reduction of infection from 1d to 60d post-treatment. This research represents the first steps towards developing BCA for management of GTD in Canada.

Soil and Environment

Composition of Amino Acids and Growth Response of Sweet Onion in Three Types of Compost

Vera Amo Larbi and Lord Abbey (Supervisor)

Department of Plant, Food, and Environmental Sciences, Dalhousie University, Faculty of Agriculture, 50 Pictou Road, P.O. Box 550, Truro B2N 5E3, Nova Scotia, Canada

*Correspondence: Vera.AmoLarbi@dal.ca

Growing medium amino acids stimulate rhizosphere activities and plant growth but their abundance in compost is understudied. A greenhouse experiment was performed to compare amino acid profiles of seafood waste compost (SFWC), municipal solid waste compost (MSWC), and vermicompost (VC). The control was Promix-BX alone. The efficacies of the different composts were also tested on onion (*Allium cepa* L. “Sweet Utah”). The MSWC, SFWC, and VC were composed of a total of 36.4, 48.3, and 67.5 mg amino acids/100 g dry weight, respectively. Glutamic acid, aspartic acid, and glycine were the highest, while methionine, histamine, and cysteine were the least in all the amendments. In terms of plant growth, The MSWC had significantly ($P<0.05$) the highest leaf chlorophyll contents followed by the VC treatment. The MSWC significantly ($P<0.05$) increased anthocyanin content while the control recorded the least. The maximum quantum yield of photosystem II (Fv/Fm) and the potential photosynthetic capacity (Fv/Fo) were least in the VC treated plants. Dry matter content of the onion was not significantly ($P>0.05$) affected by the type of compost amendment. Overall, plant growth was improved by the MSWC. Future research should investigate the effects on secondary metabolites.
Keywords: municipal solid waste compost, seafood waste compost, vermicompost, *Allium cepa*

Municipal Solid Waste Compost Modulates Metabolites Composition in Vegetables

Raphael Ofoe, Lokanadha R. Gunupuru, Mercy Ijenyo and Lord Abbey

Department of Plant, Food, and Environmental Sciences, Dalhousie University, Faculty of Agriculture, 50 Pictou Road, P.O. Box 550, Truro B2N 5E3, Nova Scotia, Canada

*****Correspondence**:** Raphael.Ofoe@dal.ca

Plant biofortification is becoming an important topic in agrifood research. Although compost application affects plant growth and nutrient composition, little is known of its influence on plant metabolic profile. This study investigated the effect of a 5-year variable frequency of Compost Quality Alliance (CQA) tested municipal solid waste (MSW) compost application on the metabolic profiles of four vegetable plants; namely, lettuce (*Latuca sati*va cv. Grand Rapids), beets (*Beta vulgaris* cv. Detroit Supreme), carrot (*Daucus carota* cv. Nantes) and green beans (*Phaseolus vulgaris* cv. Golden Wax). The experimental treatments were annual, biennial and no (control) compost applications to each plant species. The annually applied MSW compost enhanced total amino acids in lettuce, carrot, beets and green beans by *ca*. 323%, 109%, 94% and 18%, respectively. Total phospholipids were mostly enhanced in all the plants by the biennially applied MSW compost compared to the annual or control. Total organic acids in lettuce, green beans and beets were altered by the annual and biennial MSW compost applications by *ca*. 35% and 23%; 22% and 65%; and 6% and 6.4%, respectively. The annually applied MSW compost increased total acylcarnitine in lettuce, beets and green beans compared to the biennial application and control. A 2-dimensional principal component analysis revealed a positive association between MSW compost application frequency and soil fertility enhancement on plant metabolites. These results shed light on plant biofortification using MSW compost, which offers cheaper and environmentally sustainable means of improving plant nutrients density and functional properties to improve human health and wellbeing.

Wick Weeding: An investigation into alternative weed control strategies in Atlantic potato production systems

Laura Anderson

Dalhousie University

*Correspondence: andersonmarielaura@gmail.com

The rope-wick application of glyphosate may provide an effective means of lamb's quarters (*Chenopodium album* L.) control in potato production systems. Wick application is an alternative integrated weed management (IWM) strategy whereby non-selective herbicides are applied in-season, while minimizing off-target applications to the crop species. Potatoes are the highest value horticultural crop in Canada, generating over $1.18 billion in 2017. Potato production systems and intensively managed and rely heavily on early season triazine and substituted urea herbicide applications. Unmanaged and resistant weeds can cause yield losses of up to 80% abd impact tuber size and quality. The potato producing region of Prince Edward Island (PEI) and New Brunswick (NB) account for 37% of Canada's production. Recent PEI reports show reduced efficacy of metribuzin at controlling lamb's quarters, the most economically significant weed in potatoes. Recent studies confirmed resistance in 46% of lamb's quarters populations sampled across the potato producing regions of PEI and NB. The present study was conducted in 2019 in Harrington, PEI to determine the effect of wick-applied glyphosate (66% v/v) via Vogel's 15' loader model wick weeder on lamb's quarters control and potato yield and quality when applied at 6 and 7 weeks after hilling (WAH). Preliminary findings indicate wiping provided equivalent marketable yield across treatment timings. A reduction in lamb's quarters harvest index was observed with wick applications at 6 WAH suggesting that rope wick applicators may provide a viable IWM strategy for disrupting resource allocation in lamb's quarters over-topping the potato canopy.

Keywords- plant metabolite, vegetables, compost, municipal solid waste, organic soil amendment, plant biofortification

Closed-loop Vertical Farming

Ajwal Dsouza

Controlled Environment Systems Research Facility
School of Environmental Sciences, University of Guelph.

*Correspondence: ajwal@uoguelph.ca

High intensity urban agriculture, colloquially referred to as ‘Vertical Farming’, has a significant role to play in agri-food landscape, by providing fresh and nutritious food, improving sustainability, and economic activity in the urban environment. Although these urban farms are a significant improvement over traditional farming in terms of sustainability and resource use efficiency, they still produce waste in the form of crop residues, the management of which poses challenges in an urban environment. Typically, these wastes end up in landfill where it decomposes anaerobically producing greenhouse gases like methane. Vertical Farms still follow a linear pattern of resource use. The waste biomass contains a significant portion of resources invested which gets lost in the landfill. Implementing a closed-loop approach is necessary to increase the sustainability of Vertical
Farms.

This project aims at closing the crop production resource loop through techniques like composting and organic hydroponics. These techniques allow to recover carbon dioxide (CO_2), water and nutrients which can be recycled/reused, reducing the resource loss. Composting stabilises the biomass and produces CO_2, that can be used for CO_2 enrichment. Through organic hydroponics, we can extract nutrients from compost to be used as hydroponic nutrient solutions. It provides an opportunity to source and incorporate urban bio-waste externally from cafes, restaurants, gardens, and grocery stores to name a few, making High Intensity Urban Farming sector more efficient by lowering their carbon footprint. The developed system will help to increase productivity, meet the sustainability goals, mitigate waste issues and reduce urban food insecurity.

Developing a soil health testing protocol for Saskatchewan cropping systems

Qianyi Wu[1], Rich E. Farrell[2], J. Diane Knight[2], and Kate A. Congreves[1]

[1]Department of Plant Sciences, [2]Department of Soil Science, University of Saskatchewan

*Correspondence: qiw526@mail.usask.ca

Maintaining and building soil health is an essential component of long-term sustainable agriculture. Vegetable production usually requires disturbing soil to seed, manage weeds and harvest, and those activities could affect soil health status as well as depress the soil's biological activities. Building healthy soil is the key to continue intensive cropping but maintain the high yield and quality of vegetables. Soil health is defined as the capacity of a soil to function, which reflects biological productivity, environmental quality, and plant health. Farmers are looking for appropriate tools and methods for assessing and interpreting the health status of their soils; however, there is no standardized and prairie-based soil health test available. As such, we are focusing on developing a soil health testing protocol for Saskatchewan (SK) cropping systems by building off of the Cornell soil health assessment framework. In Sept and Oct 2018, soil samples from the 0-15, 15-30, and 30-60 cm depths were collected from 55 fields across SK. The selected sites are representative of SK agriculture as most sites were previously cropped with wheat or canola, while other sites had barley, chickpea, lentil, field pea, soybean, potato, and green manure. Native prairie samples were also collected for comparison. Various soil attributes were measured, including active carbon, wet aggregate stability, texture, pH, EC, total and organic carbon, total and inorganic N, field capacity, soil respiration, soil protein and nutrients etc. Different attributes have different scoring shapes, i.e., i) more is better, ii) optimum is best, and iii) less is better. The next step is to produce an integrated soil health score. The relationships among soil attributes are being determined via correlation analyses—the results of which will be used to determine how to weigh the scores of several attributes when integrating the final, wholistic soil health score.

Human Health and Cannabis

Natural Growing Medium Amendment and Altered LED Light Spectrum effects on Indoor Plant Production with Enhanced Antidiabetic Activities

Roksana Saleh*
Supervisor: Lord Abbey

Department of Plant, Food, Environmental Sciences, Faculty of Agriculture, Dalhousie University, 50 Pictou Road, Truro B2N 5E3, Nova Scotia, Canada

*Correspondence: Roksana.Saleh@dal.ca

Preharvest factors such as genotype, growing media properties, climatic factors, and management practices influence plant growth and phytochemistry. It is confirmed that natural substrates such as sawdust, vermicast, and compost enhance plant growth factors and productivity through the improvement of bio-physicochemical properties and microbial composition of the growing media. Moreover, climatic factors such as light has either stimulatory or inhibitory effects on plant growth and development as well as the biosynthesis of plant primary and secondary metabolites and therapeutic properties. Environmentally, many studies have provided convincing evidence that variations in the ratio of blue/red LED light and light intensity significantly influence plant growth and development. In the last decade, the use of alternative medicines and herbal plants have dramatically increased with the therapeutic properties ascribed to phytochemicals. Antioxidant activities have potent inhibitory effects against inflammation leading to insulin resistance and oxidative stress suppression that are strongly correlated with reduced diabetes. Most of these phytochemicals in plants can be altered by modulation of preharvest conditions. This review looks for a cost-effective way to improve global food security with health promoting compounds and to enhance antidiabetic properties through the application of environmentally friendly amendments and modulation of grow light conditions. Likewise, T2DM would be managed by an inexpensive and effective way compared to using chemical medications and insulin injection. Taking these into consideration, this review will help identify gaps for future research in phytomedicine and functional foods.

Keywords- antidiabetic, secondary metabolites, natural amendment, preharvest factors, Kale, Mexican mint

Increasing light intensity improves the yield and quality of drug-type cannabis in an aquaponic production system.

V. A. Rodriguez Morrison, D. Llewellyn, and Dr. Y. Zheng.

School of Environmental Science, University of Guelph, Guelph, Ontario, Canada N1G 2W1.

Correspondence: vrodri01@uoguelph.ca

Since legalization of cannabis (*Cannabis sativa* L.) in Canada, there has been high demand for research to improve cannabis yield and quality. With the paucity of scientific literature on the topic, this study investigated the relationships between canopy-level photosynthetic photon flux density (PPFD) and inflorescence yield and quality of the aquaponically-grown cannabis cultivar 'Stillwater'. After growing for 2 weeks under PPFD of ≈400 $\mu mol \cdot m^{-2} \cdot s^{-1}$ and 18-h light/6-h dark, clones were grown for 12 weeks in a 12-h light/12-h dark 'generative' photoperiod under canopy-level PPFDs ranging from 120 to 1800 $\mu mol \cdot m^{-2} \cdot s^{-1}$ (provided by light emitting diodes). Leaf-level light response curves varied both with canopy-level PPFD and temporally, throughout the generative cycle. Therefore, it was concluded that the leaf-level light response is not a reliable predictor of whole-plant responses to light intensity, particularly on crop yield. This was especially evident given that dry inflorescence yield (g/plant) increased linearly, without saturation, with increasing canopy-level PPFD up to 1800 $\mu mol \cdot m^{-2} \cdot s^{-1}$; however, leaf-level light saturation points were reached far below 1800 $\mu mol \cdot m^{-2} \cdot s^{-1}$ in plants grown under lower light levels. Under higher light levels, apical inflorescences were larger and denser, but there were no PPFD treatment effects on cannabinoid and terpene potency (mg/g dry inflorescence). Commercial cannabis growers can use these light response models to determine the optimum PPFD for their production environment to achieve the best economic return, based on their input costs versus the commercial value of their cannabis products.

Apple flavonoids exert cancer-preventive properties: Evidence from a cell model of carcinogen induced DNA damage

Tharindu L. Suraweera[1]*, Jose Merlin[1], H.P. Vasantha Rupasinghe[1]

[1]Department of Plant, Food, and Environmental Sciences, Faculty of Agriculture, Dalhousie University, Truro, NS B2N 5E3

Correspondence: th992644@dal.ca

Cancer is one of the most common causes of mortality worldwide. Lung cancer has shown the highest mortality rates compared to other types of cancers in Canada. Chemotherapy and radiotherapy are currently providing the basis for cancer therapies, although both are associated with significant side effects. Therefore, it is important to identify dietary approaches and food bioactives that can prevent or reduce initiation of cancer. We investigated the ability of apple peel flavonoids (AF4) and its major constituent quercetin to reduce the DNA damage in vitro. Human bronchial epithelial cells (BEAS-2B) were subjected to a known carcinogen 4-[(acetoxymethyl)nitrosamino]-1-(3-pyridyl)-1-butanone (NNKOAc) to induce DNA damage. MTS assay was performed to monitor the cell viability for determining the sub-toxic concentrations of quercetin, quercetin-3-O-glucoside (Q3G), AF4, and NNKOAc to be used in the studies. Measurement of intracellular ROS was performed using DCFH-DA assay. The DNA damage was measured using DNA fragmentation by ELISA and Comet assay. Interestingly, pre-exposure to AF4 (50 µg/mL), quercetin (50 µM), and Q3G (50 µM) followed by NNKOAc (100 µM) challenge, significantly decrease the ROS level and DNA damage in BEAS-2B cells compared to the control. The results demonstrate that apple flavonoids and quercetin have the ability to reduce chemical carcinogen-induced DNA damage.

Keywords- Apple, cancer, chemoprevention, DNA damage, quercetin

Using *Cannabis sativa* Inflorescences to Develop an *in Vitro* Tissue Culture System.

Adrian S Monthony[1*], Sara Bagheri[2] and A. Maxwell P. Jones[1].

[1]Department of Plant Agriculture, University of Guelph, 50 Stone Road East, N1G 2W1, Guelph, Ontario, Canada.
[2]Department of Horticulture, College of Aburaihan, University of Tehran, Pakdasht, Tehran, Iran

*Correspondence: monthona@uoguelph.ca

The legalization of recreational cannabis (*Cannabis sativa L.*) in North America has driven the need for large-scale propagation of disease free, chemically defined clones. Currently, cannabis is propagated using stem cuttings from mother plants, which can occupy up to 15% of commercial production space and are susceptible to pests and diseases. *In vitro* growth of cannabis allows for rapid clonal propagation of clean plants for research and germplasm storage, but published methods are few and multiplication rates can be low. Stem cuttings and traditional *in vitro* techniques are not suitable for the propagation of day-neutral cultivars, which cannot be maintained in perpetual vegetative states. Using cannabis inflorescences, we developed an *in vitro C. sativa* micropropagation system. As cannabis inflorescences represent a meristem-dense region with a high multiplication potential, we hypothesized that floral reversion in *C. sativa* can occurs from these existing meristems and enhance multiplication rates compared to existing *in vitro* methods. The effects of plant growth regulators, floret number and cultivar on floral reversion were tested and floret number was shown to have a significant impact on the success of reversion, with pairs of florets more frequently reverting and producing healthier explants. Multiplication rates from the developed floral reversion protocol were higher than those obtained from traditional nodal cultures in our lab. This study shows that *C. sativa* floral reversion is achievable and our findings will help overcome the challenges associated with tissue culture of day-neutral cannabis cultivars, while helping develop an effective inflorescence-based micropropagation systems in *C. sativa.*

Physiology and Nutrition

Pyroligneous Acid alteration of Female/Male Sex Ratio and Fruit Yield of Cucumber (*Cucumis sativus L.*)

Matt MacNeil
Supervisor: Lord Abbey

Department of Plant, Food, and Environmental Sciences, Faculty of Agriculture, Dalhousie University, 50 Pictou Road, Truro, Nova Scotia B2N 5E3, Canada

*Correspondence: Matt.MacNeil@dal.ca

The development of cucumber flower is typically skewed towards maleness, which can limit the potential fruit count and yield of the plant. A field study was carried out to determine the effects of varying concentrations (0%, 2.5%, 5%, 10%) and frequencies (biweekly and monthly) of foliar applications of pyroligneous acid (PA) on cucumber (*Cucumis sativus L.* cv. Straight Eight) plant growth, female/male sex ratio, fruit count and fruit yield. All the PA treatments increased female flower development compared to the 0% control treatment. The 2.5% and the 5% monthly PA treatments led to a significantly ($P<0.05$) greatest female/male flower ratios of 41.7% and 40.1%, respectively. This was an approximately 10 to 17% increase in female flowers compared to the control treatments. The increase in the formation of more female flowers increased fruit count and yield. On the average, the 2.5% monthly PA treatment gave the highest fruit count of 13 per plot, which was significantly ($P<0.05$) higher than the control treatment. This, along with the 5% monthly treatment translated to highest yield values, both over 15,000 kg/ha. In this study, PA did not cause any significant difference in plant growth irrespective of the rate and frequency of application. Based on the acquired results, the overall recommendation as a starting point for further research or growers searching for a method to increase the yield potential of their cucumber plants would be 2.5% foliar application of PA every month.

Keywords- cucurbits, biostimulant, cucmber femaleness, sex determination, pyrolysis

Nitrogen fertilization and cover cropping influence crop yield and soil nitrogen cycling in three common prairie vegetable crops

Soudeh Farzadfar[1], Jamie. M. Taylor[1], J. Diane Knight[2], and Kate A. Congreves[1]

[1]Department of Plant Sciences, [2]Department of Soil Science, University of Saskatchewan

*Correspondence: soudeh.farzadfar@usask.ca

Cover crops (CCs) have the potential to immobilize nitrogen (N), that would otherwise be lost during post- or pre-harvest periods, leading to improved N management. However, information on how CCs influence N management are scarce. This study aims to determine how an overwintering rye CC impacts crop yield and N cycling, for three common prairie vegetable crops. From 2017 to 2019, a fully phased broccoli-sweet corn-carrot sequence was conducted, with each crop type receiving five N fertilizer treatments (ranging from 0 to 300 kg N ha^{-1}). After harvest at each year, sub-plots were established with vs without a rye CC, and the effect was followed into the subsequent growing season. In most of cases, both the N fertilizer rate and rye CC affected crop yields, N uptake efficiency (NUpE) and Apparent N recovery (ANR), pre- and post-harvest nitrate (NO_3^-) and ammonium (NH_4^+) contents of soil. Depending on the crop, increasing rates of N increased crop yields and post-harvest soil NO_3^- and NH_4^+ levels. However, increasing N rates reduced NUpE and ANR for all three vegetable crops. Rye also increased crop yields and post-harvest NO_3^- and NH_4^+ soil contents, but decreased pre-harvest soil NO_3^- and NH_4^+ levels. These results indicate the importance of adjusting N fertilizer rates based on soil N levels to minimize the potential for N losses. We also suggest that rye during the shoulder-season can enhance retention of soil N levels which could be available for the following vegetables and help growers to avoid excessive N application.

Keywords- Nitrogen use efficiency, Rye cover crop, Soil nitrogen, Vegetable crops, Yield

The Impact of Cover Cropping on Soil Nitrogen Availability and Crop Nitrogen Use in a Potato Production System on the Canadian Prairies

Olivia Otchere[1], Rich E. Farrell[2], Melissa M. Arcand[2], Bill Biligetu[1], Yvonne E. Lawley[3], and Kate A. Congreves[1]

[1]Department of Plant Sciences, University of Saskatchewan
[2]Department of Soil Science, University of Saskatchewan
[3]Department of Plant Science, University of Manitoba

*Correspondence: olo049@mail.usask.ca

Nitrogen supply is a critical component of potato production which influences growth, yield and quality; thus, must be carefully managed. Cover cropping might help to better manage soil nitrogen (N) availability and reduce losses, but research is needed to test this hypothesis. As such, we designed a study to test the influence of cover crops on soil inorganic N (SIN) availability and crop N use by comparing a 4-yr rotation of wheat-canola-potato-pea without cover crops to one with cover crops: wheat(red clover)—canola(oat and berseem clover)—potato(fall rye)—pea(tillage radish). The experiment was initiated in 2018 on sandy loam Dark Brown Chernozem, with the fully phased rotation treatments arranged in a RCBD with four replicates. At harvest, crop yield and N use efficiency data were collected; in fall, soil inorganic N levels and cover crop biomass were monitored. During the 2020 growing season, SIN level continued to be monitored, in addition to frequency SPAD meter readings to measure plant tissue-N. This presentation will focus on potato production. In 2019, results show no significant difference in potato yields grown with or without cover crops. The cover crops also did not have any significant impact on apparent N recovery and N uptake efficiency. Rate of supply of SIN in fall was also not significantly different for potato grown with or without cover crop. In 2020, a steady decline in SPAD meter readings ranging from 46-53 SPAD units were observed for potato grown with or without cover crop. Overall, cover crop grown in 2018 did not significantly influence potato yields and N availability however, this study is still in progress to trace cover crop effects in potato production.

Plant Response to Hydrothermal Carbonization Processed Liquid Extracted from Different Biomass

Yuhang He[1]*
Supervisors: Dr. Lord Abbey[1] and Dr. Bishnu Acharya[2]

[1]Department of Plant, Food, and Environmental Sciences, Faculty of Agriculture, Dalhousie University
[2]Department of Engineering, University of Prince Edward Island

*Correspondence: yh442593@dal.ca

Hydrothermal carbonization processed liquid (HTCPL) is a waste product of hydrothermal carbonization of biomass, which can be used as a bio-fertilizer. A study was performed to evaluate the chemical composition and efficacies of HTCPL obtained from three biomass feedstock, namely; willow (*Salix babylonica*), buckwheat (*Fagopyrum esculentum*) and seafood compost (SC) by using two extraction temperatures (180℃ and 200℃). Analysis of mineral elements showed that the contents of phosphorus and potassium in the willow and buckwheat HTCPLs were more than 20-fold compared to that of the SC HTCPL. The contents of magnesium, electric conductivity, sulfate and alkalinity of the buckwheat HTCPLs were significantly higher than that of the willow and SC HTCPLs. The willow HTCPL had the lowest pH value at 3.98 for the 180℃ and 3.73 for the 200℃ extraction temperatures. Pea (*Pisum sativum*), sunflower (*Helianthus annuus*), pac choi (*Brassica rapa subsp. chinensis*), kale (*Brassica oleracea var. sabellica*) and lettuce (*Lactuca sativa*) seeds germination and seedlings growth establishment in concentrations of 5% or 10% of the individual HTCPLs extracted at 200℃ were evaluated. Both the 5% and the 10% of the willow HTCPLs showed negative effects on the germination of seeds and growth of seedlings. Compared with the controls (water), the SC HTCPLs and buckwheat HTCPLs had no significant positive effect on seed germination and seedling growth irrespective of the extraction concentration. Depending on this study, HTCPL cannot significantly promote seed germination and seedling growth. More tests will be required to confirm the results and efficacy of HTCPL.

Keywords- waste product, HTCPL, bio-fertilizer, seed germination, seedling growth

Effectiveness of Prohexadione Calcium as a Plant Growth Regulator When Compared to Trinexapac-Ethyl on a Mixture of Creeping Bentgrass and Annual Bluegrass Turf Canopy

Jaber Husiny[1] , John R. Watson[1, 2] , Eric M. Lyons [1, 3]

[1]University of Guelph, Guelph Campus. 50 Stone Road East, Guelph, ON N1G 2W1.

[2]Research Technician in the Ontario Agricultural College at the University of Guelph, E.C. Bovey Building, 50 Stone Road East, Guelph, ON N1G 2W1. The Guelph Turfgrass Institute, 328 Victoria Rd S, Guelph, ON N1H 6H8.

[3]Associate Professor in the Ontario Agricultural College at the University of Guelph, E.C. Bovey Building and the director of the Guelph Turfgrass Institute.

*Correspondence: jhusiny@uoguelph.ca

Plant growth regulators (PGRs) are commonly used to manage turfgrass growth on golf courses. Growing degree day (GDD) models predict the need for foliar application and re-application of PGRs, such as trinexapac-ethyl (TE) and paclobutrazol. Optimal GDD models for application of prohexadione calcium (PC), a late-stage gibberellin inhibitor, on fairway-height turfgrasses are currently unknown, resulting in potential loss of regulation. The impact of PC and TE on plant growth and stand health were evaluated over two years on mixed stands of creeping bentgrass (Agrostis stolonifera L.) and annual bluegrass (Poa annua L.) maintained at 9mm height at the Guelph Turfgrass Institute. Six treatments (control, PC 2.8g/100m2 , PC 5.6g/100m2 , PC 8.4g/100m2 , and two TE 8.0mL/100m2) were organized in a randomized complete block design with 4 replications each year. PC and TE treatments were applied based on a label rate GDD schedule, with a second TE treatment applied every 4-weeks. Plant dry weight (DW; taken 4-10 days after treatment), visual colour ratings and normalized difference vegetative index (NDVI) were assessed at varying timepoints during the growing season. Most PC and TE treatments effectively reduced DW and had a positive effect on visual colour and NDVI. A linear relationship was observed between PC application rates, suggesting that higher application rates allow for greater regulation of plant growth. A rebound effect was noted when application date exceeded 350 GDD for all treatments. The development of optimal GDD models for PC will assist in the effective regulation of turfgrass growth and improved stand health.

Growth Response of Shallots (*Allium ascalonicum*) to Two Types of Seaweed Amendments

Dengge Qin
Supervisor: Dr. Lord Abbey

Department of Plant, Food, and Environmental Sciences, Faculty of Agriculture, Dalhousie University, 50 Pictou Road, Truro B2N 5E3, Nova Scotia, Canada

*Correspondence: dn376773@dal.ca

The use of seaweed extracts as biostimulants in agriculture is rising although there is some concern regarding its recommended agronomic applications. A greenhouse study was conducted to determine the growth response of shallots (*Allium ascalonicum* L.) to *Ascophyllum nodosum* (ANE) and Sea lettuce extracts (SLE). The extracts were applied as foliar spray at five different concentrations (i.e. 0%, 0.5%, 1%, 2% and 5%). To some extent both ANE and SLE increased shallot plant growth rate irrespective of the concentration. However, the highest effects on growth rate were recorded by the 5% ANE and the 2% SLE. There was a substantial increase in the number of leaves due to the SLE treatments, the number of leaves increased by 25% in the 0.5% concentration and by 31% in the 1% concentration. On the other hand, the number of leaves were decreased by 38% in the 1% ANE treatment. The application of seaweed extracts significantly affected leaf length. Leaf length was increased by 18% in treatment 2% SLE followed by 13% in treatment 1% ANE as compared to the control. The highest and least number of shoots were achieved in the 1% SLE and 2% SLE, respectively. Overall, the 1% ANE application reduced the numbers of shoots by about 45%. Our results suggested that 1% ANE and 2% SLE seemed to be the best concentration for shallots plant growth. However, further studies on shallots response to seaweed extract will be required prior to recommendation.

Keywords- Alliums, Ascophyllum nodosum, Sea lettuce, biostimulants, seaweed

Light Quality and Night Interruption Control Flower Bud Induction in Day-neutral 'Albion' Strawberry.

V. Sidhu and V. Gravel

Department of Plant Science, McGill University, Ste-Anne-de-Bellevue, QC, Canada.

*Correspondence: varinder.sidhu@mail.mcgill.ca

Light quality, referring to wavelength, and night interruption (NI) are the key factors regulating the strawberry flowering time, phenological growth and consequently, fruit production. 'Albion' is a widely grown cultivar in Quebec that has potential to increase off-season production. However, it lacks systematic evaluation of appropriate light conditions during nursery stage. In this current study, we determined how light quality and NI controls flower bud induction during transplant production for 'Albion' strawberry. Our results affirm that combination of far-red (FR; 720nm) and blue (450nm) light emitting diodes (LEDs) directed transplants to function efficiently and dominant blue (1:5) LEDs showed a significant increase in flower bud induction compared to dominant FR (5:1) and 1:1. Plant grown under dominant blue light during NI produced 8 (per plant) flower buds, the highest among all treatments and enhanced flower development outside the crown compared to day-time application. Furthermore, 1:5 supplemented plants showed comparatively advanced flowering, having emerged flowers outside the crown within 10 days after treatment, compared to 24 days for 5:1 and 38 days for 1:1 and the control. Results indicate that scheduling of light supplementation may alter the mode of action of light spectrum that controls flowering time. This study suggested that dominant blue in combination with far red LEDs could be potential light sources to induce flower bud induction during transplanting stage. Apart from flower bud induction, blue light dominance indicated that it could be useful during growing season to encourage floral development and extend harvesting season in 'Albion' strawberry.

Is It Time to Retire the Penetrometer?

Min Sung (Kevin) Kim[1,2], Lisa Duizer[2], Alexandra Grygorczyk[1]

[1]Vineland Research and Innovation Centre, Vineland Station, ON, Canada
[2]University of Guelph, Guelph, ON, Canada

*Correspondence: Minsung.Kim@vinelandresearch.com

The penetrometer is the most widely used instrument in the horticulture industry to predict texture in fruits and vegetables, primarily measuring firmness. Firmness has traditionally been used as a quality indicator, however, research has shown that consumer liking of produce texture is also highly influenced by other textural characteristics other such as crispness, juiciness, and lack of mealiness in fruits such apples. Unfortunately, as the penetrometer is a unidimensional instrument measuring firmness, it is often a poor predictor of these other complex textures. Thus, other instruments should be considered to capture these texture attributes. Recently, our research has shown that tribology, used to measure the friction coefficient of apple flesh, is very effective in predicting crispness, juiciness, and mealiness. However, tribometers are expensive and are not always available to the horticulture industry. Therefore, the purpose of this research was to investigate if the texture analyzer, an instrument which many horticulture organizations already have in-house, equipped with a friction rig attachment could be used to predict texture attributes of 29 apple varieties by means of friction measurements.

Results from our study showed significant correlations ($p<0.05$) between friction measurements and crisp ($r=0.80$), juicy ($r=0.80$), and mealy perceptions ($r=-0.73$). Correlation were stronger than penetrometer measurements on the same apples (crisp: $r= 0.61$, juicy $r=0.38$, mealy$=-0.47$). Results from this research may not only help apple breeders screen for apples with improved textures beyond firmness but may also be applicable to other horticultural products.

Investigating How the Influence of Calcium Translates to Abiotic Stress Resistance

Ariana Forand
Supervisor: Dr. Karen K Tanino

University of Saskatchewan, Department of Plant Sciences

Correspondence: adf472@usask.ca

The cell wall is a key distinguishing feature between plants and their animal counterparts. Pectin is a critical component of the cell wall in its' function as a barrier to abiotic and biotic stress, comprising approximately 30-50% of the cell wall composition[1]. Homogalacturonan (HG), the most common and structurally simplistic form of pectin will be the focus of this talk as it is the most predominant form in plants[2]. However, select results pertaining to rhamnogalacturonan II (RGII) will also be presented. Calcium and boron have been found to interact with HG and RGII resulting in the formation of "egg-box" structures and RGII dimers, respectively[3,4]. These structures influence the integrity of the cell wall[3,4]. Given the role of the cell wall and the influence of calcium and boron, the objective of this research was to understand the influence of calcium and boron *in situ*, and how those results translate to reducing cellular water loss in two onion species: 1) *Allium fistulosum* (*A. fistulosum*), and 2) *Allium cepa* (*A. cepa*). Various techniques including texture analysis, rheology and experiments designed to measure perecent water loss were conducted. In brief, calcium and boron were shown to increase viscosity *in situ*, while calcium influenced the rate of water loss in the aforementioned species. Changes were also observed with the respect to the force required to shear *A. fistulosum*, further suggesting the changes observed *in situ* with respect to viscosity translate to pectin within the cell wall. Moving forward, this research project will seek to investigate how the principles of cross-linking within pectin, specifically with respect to RGII and boron, translate to biotic stress resistance.

1. Cosgrove, D. J. & Jarvis, M. C. Comparative structure and biomechanics of plant primary and secondary cell walls. *Front. Plant Sci.* **3**, 204 (2012).
2. Mohnen, D. Pectin structure and biosynthesis. *Curr. Opin. Plant Biol.* **11**, 266–277 (2008).
3. Braccini, I. & Pé Rez, S. Molecular Basis of Ca 2+-Induced Gelation in Alginates and Pectins: The Egg-Box Model Revisited. (2001). doi:10.1021/bm010008g
4. O'neill, M. A., Ishii, T., Albersheim, P. & Darvill, A. G. RHAMNOGALACTURONAN II: Structure and Function of a Borate Cross-Linked Cell Wall Pectic Polysaccharide. *Annu. Rev. Plant Biol* **55**, 109–148 (2004)

Biotechnology

Gibberellin Regulation of Protein Accumulation in Developing Pea Seeds

J. Duncan Giebelhaus, Jocelyn A. Ozga, and Dennis M. Reinecke

Plant BioSystems Division, Department of Agricultural, Food, and Nutritional Science, University of Alberta, Edmonton, Alberta, Canada, T6G 2P5

*Correspondence: jgiebelh@ualberta.ca; jocelyn.ozga@ualberta.ca; dennis.reinecke@ualberta.ca

Many field pea varieties have a mutation in the *PsGA3ox1* gene which causes a decrease in bioactive gibberellins (GAs), a plant hormone class that regulates plant growth and development. This mutation in field pea leads to lower GA levels, producing shorter stemmed plants useful for cultivation; however, its effects on seed composition are not well understood. This study tests the hypothesis that part of GAs effect on seed development is through modulation of protein accumulation in the developing seeds. Using GA overproducing and isogenic null control lines, changes in seed tissue free amino acid and total nitrogen content were determined to identify potential GA-induced effects on processes that affect protein accumulation during seed development. Preliminary results indicate that cotyledon nitrogen content per seed was elevated in the GA overproducing line during mid-development, and was either the same or greater at maturity compared to the null line. Developmental variation in the profiles of key free amino acids involved in seed nitrogen transport and storage in seed coat, endosperm, and cotyledon seed tissues indicate that GA could potentially regulate amino acid transport and metabolism within developing seeds. These modifications, in turn, could influence the rate of storage protein synthesis in the cotyledons with possible implications on final seed protein content. The knowledge gained on GA regulation of storage protein production during seed development can be used to improve protein content in conventional field pea varieties, which could be used to address issues faced by global agriculture and the plant-protein industry.

In vitro elimination of raspberry viruses from virus- infected raspberry plants using a combination of thermotherapy and cryotherapy as well as dsRNA-induced gene silencing

Véronique Plante
Supervisors: Dr. Shawkat Ali and Dr. Allison Walker

Acadia University
Kentville Research and Development Center

*Correspondence: v.plante04@gmail.com

Red raspberries (*Rubus idaeus*) are best known for their production of small berries packed with healthy nutrients that can prevent certain diseases in human beings. Raspberries are one of the most important berries produced in Canada along with blueberries, cranberries and strawberries. These plants are constantly under attack by various pathogens including insects such as aphids. Current pathogen control relies on the application of chemical pesticides; however, these chemicals cause damage to the environment and to public health. In addition, chemical pesticides have no direct effect on viruses as they can only control some of the viral vectors. The large raspberry aphid, *Amphorophora agathonica,* has been linked to the transmission of four important raspberry viruses that are known to cause severe damage when they are present in mixed infections. These viruses include: Rubus Yellow Net Virus (RYNV), Raspberry Latent Virus (RpLV), Raspberry Leaf Mottle Virus (RLMV) and Black Raspberry Necrosis Virus (BRNV). This study aims to eliminate four aphid-transmitted viruses from 200 infected raspberry plants that are part of AAFC Agassiz' (British Columbia) and Kentville's (Nova Scotia) raspberry breeding programme. This goal will be achieved following four distinct objectives: 1) Optimization of a fast multiplex RT-PCR on crude extracts to identify the presence of the viruses, 2) Development of a sensitive and precise multiplex ddPCR to confirm that the plants are virus free (post-treatment), 3) Thermotherapy in combination with cryotherapy as well as meristem/ shoot tip excision to eliminate the viruses and finally 4) Application of exogenous dsRNA to trigger the plant's RNAi machinery for viral eradication.

Transcriptome analysis of fruit retention-related differentially expressed genes due to pre-harvest spray hexanal in 'Honeycrisp' (*Malus domestica Borkh*)

Karthika Sriskantharajah and Jayasankar Subramanian

Department of Plant Agriculture, University of Guelph, Vineland, Ontario, L0R 1E0.

*Correspondence: sriskank@uoguelph.ca

'Honeycrisp' is a premium apple fruit variety due to its crunchy texture and unique flavour. However, 'Honeycrisp' possesses numerous challenges such as preharvest fruit drop (PFD), quality decline during storage and bitter pit. PFD is typical at the beginning of the harvest and increases with the extended harvesting period, resulting in up to 50 % loss of matured fruits. Ethylene from the ripening fruit stimulates the formation of the abscission layer in the stem resulting in abscission. Hexanal, an inhibitor of the phospholipase-D enzyme (PLD), has shown promising results in controlling fruit drop in many fruits. However, underlying molecular mechanisms of controlling fruit drop by hexanal is not fully understood. Here we studied the molecular changes that occur in the fruit stalk, specifically at the abscission zone (AZ), due to the application of hexanal using a transcriptomic approach in 'Honeycrisp.' To do this, 'Honeycrisp' trees were treated with hexanal formulation twice before the commercial harvest. AZ samples were collected from treated and non-treated fruits. RNA was isolated from AZ and were sequenced using Illumina Next-Seq 500. Raw reads were aligned to the apple reference genome, GDDDH13, ver. 1.1. EdgeR, an r package used for the differentially expressed genes (DEGs) analysis. Altogether, 373 DEGs were identified at the time of harvesting due to hexanal application. In addition to transcript profiling, hexanal treated fruits showed lower ethylene production, reduced PLD activity and an increased total soluble solid throughout the storage. Timely application of hexanal will help to extend the fruit retention and improve post-harvest storage of Honeycrisp.

In-vitro propagation techniques in lingonberry (*Vaccinium vitis-idaea* L.)

Umanath Sharma[1, 2], Abir U. Igamberdiev[1], and Samir C. Debnath[2]

1. Memorial University of Newfoundland, 232 Elizabeth Avenue, St. John's, NL A1B 3X9, Canada
2. St. John's Research and Development Center, Agriculture and Agri-Food Canada, Bldg. 25, 204 Brookfield Road, St. John's, NL A1E 0B2, Canada

Correspondence: usharma@mun.ca

Lingonberry (*Vaccinium vitis-idaea* L. family *Ericaceae*), also called partridgeberry, is a dwarf, evergreen shrub, native to the Northern hemisphere, bears red edible fruits. Lingonberry leaves and fruits are highly nutritious and possess various bioactive compounds. Nutrients such as sugar, organic acids, omega 3 and omega 6 fatty acids, B, C, A, and E vitamins, dietary fiber and minerals are found abundantly in lingonberry. On the top of that, presence of a variety of bioactive compounds such as flavanols, anthocyanins, hydroxycinnamic acid, arbutin derivatives, and proanthocyanidin make lingonberry a nutraceutical crop. Lingonberry is a genetically heterozygous plant species, and therefore, progeny derived from seed are not true-to-type. Conventionally, vegetative propagation is practiced either using rhizome divisions or stem cutting to multiply lingonberry. This method retains the genetic characteristics of the donor plant but is not economically viable in lingonberry due to a short life span, inadequate rhizome production, and time and labor intensive. *In vitro* propagation using tissue culture of lingonberry can multiply much faster than traditional methods and maintains the genetic fidelity. Tissue culture is a rapid plant propagation method in which an isolated plant cell or organ called explant is multiplied in a nutrient media with appropriate growth hormones. Mass propagation using tissue culture, also known as micropropagation is done by three methods: axillary shoot proliferation, adventitious shoot regeneration and somatic embryogenesis. Micropropagation can be done in semi-solid as well as liquid media. This study, based on review of literature, discusses different *in-vitro* propagation methods and media types employed in mass propagation of lingonberry.

Posters

Abstracts
*Please find posters in separate the Poster PDF Document

Abstracts

Controlled Environment Cultivation for Better Plant-Based Medicines: An Investigation of *Withania Somnifera*

Lauren Plotnik

Environmental Sciences, University of Guelph.

*Correspondence: lplotnik@uoguelph.ca

Plant-based medicine is the primary method of medical treatment for the majority of the world's population. Although ancient in origin, the use of medicinal plants is experiencing a modern resurgence. The spike in global demand has created a twofold problem: increased pressure on wild populations and inconsistent medicinal products. Medicinal plants are continuously overharvested from the wild, and available consumer products are often contaminated or ineffective due to variation in the plant's bioactive compounds. Controlled environment agriculture (CEA) offers a solution to these issues as it allows growers to produce medicinal crops under a consistent environment that can be managed in order to produce a high quality and uniform medicinal product. Manipulating environmental factors, specifically light quantity (photosynthetic photon flux density in µmol m-2 s -1) and quality (wavelength in nm), can significantly influence a plant's medicinal traits. The presented research will focus on using CEA techniques for standardized production of Withania somnifera (Ashwagandha), a plant with medicinal properties, including purportedly as an anti-cancer agent. Growth environment parameters will be manipulated (e.g., light spectrum) and the response, in terms of active metabolite production, will be examined. Shifting medicinal plant production to CEA can increase consistency, uniformity and availability of unadulterated products, while helping to conserve wild populations. This can ultimately enable consumer access to safe, reliable and efficacious medicinal products, which is of great significance to both the canadian and world market.

Do Arbuscular Mycorrhizal Fungi form symbiosis with *Cannabis sativa* L.?

Christina Horst

University of British Columbia

*Correspondence: chorst@mail.ubc.ca

Cannabis sativa L. is an annual flowering plant that has been illicitly cultivated throughout the 20th century due to its recreational psychoactive usage (Small 2015). This prevented research on standard plant biology for recreational cannabis. This study investigated if recreational cannabis can form symbiosis with arbuscular mycorrhizal fungi (AMF) under greenhouse conditions, which is important because many AMF inoculants are developed and marketed towards cannabis producers. Approximately 80% of plants form symbiosis with AMF, and experience benefits such as increased growth, yield, and increased secondary metabolite production (Smith and Read 2008). However, mycorrhizal symbiosis and colonization intensity can vary between cultivars, especially in species that have been intensively cultivated. There is evidence of hemp-type, field-grown cannabis being mycorrhizal (Citterio et al. 2005), however there are no published reports of recreational chemovars forming symbiosis with AMF. Other environmental factors such as nutrient levels (Breuillin et al. 2010), and growing medium (Kowalska et al. 2014) can also affect AMF colonization. A 3 X 2 X 2 factorial greenhouse experiment was conducted to test if *Rhizoglomus irregulare* forms symbiosis with cannabis. Three cannabis chemovars, two growing media (rockwool and cocounut coir), and two concentrations of fertilizer (standard fertilizer mix and 50% diluted mix) were used. It was found that fertilizer level had the greatest effect on AMF colonization, with high levels of fertilizer strongly correlated with little colonization. This means that under standard greenhouse conditions, AMF inoculants may have little use because without consistent colonization they cannot confer physiological and biochemical benefits.

Analyzing the Role of N and K Fertilizer in After-Dormancy Yield of Day-Neutral Strawberry

***Paul, A.,** Gravel, V.

McGill University

*Correspondence: angela.paul@mail.mcgill.ca

Day-neutral strawberry (DN) has been developed aside from short-day and everbearing varieties to produce fruit irrespective of photoperiod, allowing for an extended harvest season and higher yields. DN variety strawberries, however, tend to suffer in yield potential following winter dormancy through transplant loss and delayed flower bud formation in Spring. A viable solution is the optimization of N and K fertilizer. An ideal source and concentration of N and balancing N and K ratios was hypothesized to increase nutrient storage in DN transplants and facilitate optimal growth after breaking dormancy. This study aimed to understand N and K fertilizer's role in DN transplants before, during, and after dormancy to establish a fertilizer guide for pre-dormancy transplant production. Two trials were conducted: Trial 1 considered N source and concentration, testing nitrate, ammonium, and urea supplied at 50mg/L, 100mg/L, and 150mg/L. Trial 2 compared N:K ratios at 1:1, 1:2, and 1:4 intervals. Both trials monitored weekly phenology data and took weekly plant samples for dissection, biomass assays, and sugar content analysis in the crown. Transplants for both trials were kept in cold storage in October to initiate dormancy, and samples were taken monthly for the same data parameters. Transplants were again sampled after dormancy. Results found no significance in data obtained in Trial 1 before or during dormancy. Trial 2 observed that a 1:2 ratio of N:K resulted in greater observed flower buds before dormancy and more significant flower buds counted within the crown from dissections taken during dormancy. Results suggest that a 1:2 N:K ratio is optimal for increasing flower bud production and yield in DN transplants after dormancy.

Do different Brassica cover crops differ in their effects on the soil fungal and nematode communities in a vineyard?

Corynne O'Farrell[1], Melanie Jones[1], Tom Forge[2], Miranda Hart[1]

[1]University of British Columbia Okanagan; [2]Summerland Research and Development Centre Agriculture and Agri-Food Canada

*Correspondence: cmofarre@gmail.com

Brassica cover crops with biofumigant activities have been used to mitigate soil born pathogens in vineyards for years. Although this practice is common, the effect of these crops on soil microbes in the field, including both pathogens and beneficials, is not well understood. This study will compare the response of the soil microbial community to four different cover crops with biofumigant properties, two which are commonly used in Okanagan vineyards (*Sinapis alba* L. and *Raphanus sativus* (L.) Domin) as well as two Brassicas which are native to the Okanagan (*Capsella bursa-pastoris* (L.) Medik. and *Boechera holboelli* (Hornem.) Á.Löve & D.Löve). These cover crops will be grown in a vineyard for the full growing season and soil samples taken at the end of the season for DNA and nematode extraction. The fungal community will be analyzed by sequencing of the ITS2 sub-region with Illumina. The nematode community will be analyzed by counting based on trophic groups. Additionally, a greenhouse experiment will be conducted to determine if any of the cover crops used are able to act as hosts for fungal and nematode pathogens of interest (*Ilyonectria liriodendra* (PARC60 and PARC393) and *Misocriconema xenoplax)*. The cover crops will be grown in soil inoculated with the pathogen and grown for 4 months, at the end of which pathogen abundances will be measured.

Righting a Wrong: Can Enhanced Efficiency Products help Reduce N2O Emissions from Fertilizer?

Trang Phan[1], Rich Farrell[2] and Kate Congreves[1]*

[1]Dept of Plant Sciences, [2]Dept of Soil Science, University of Saskatchewan,

*Correspondence: kate.congreves@usask.ca

Nitrous oxide (N2O) is a potent greenhouse gas, and agricultural soils are by in large the dominant source of Canada's total N2O emissions. Soil-derived N2O is produced via the microbial pathways of nitrification and denitrification, processes that are primarily influenced by soil moisture and fertility levels. In horticultural production systems, vegetable and fruit crops often require high levels of N input for optimal yields. Horticultural farmers may choose to apply fertilizer in the fall to help lessen the workload during the busy spring season. However, under moderate to high soil moisture conditions, the high soil N availability favours denitrification process and increases risk of N2O emissions, especially during the spring thaw. For this reason, determining a more effective fertilizer management is the key to sustainable horticulture. Enhanced Efficiency N fertilizer (EENF) products have a strong potential to reduce N2O emissions. As such, we conducted a 7-week soil incubation study to evaluate the effects of ureaN fertilizer with and without enzyme inhibitors (Nitrapyrin) on i) the production mechanisms and ii) reduction potentials of N2O before and after soil freezing. Soil microcosms (25 grams) were sealed in 1L jars, and incubated under a sequential change in temperature, simulating fall, winter, and spring temperatures: 4°C for two weeks, -10°C for one week, 4°C for five days, and 23°C for two weeks. Different soil moisture treatments were tested (i.e., 55, 70, 80% soil waterfilled pore space) for each fertilizer treatment, and a non-fertilized control. Headspace gas samples were frequently collected during each temperature phase and analyzed for N2O production and 15N2O isotopomers. Preliminary results will be presented. The study will provide fundamental knowledge about the how nitrification inhibitors may influence N2O fluxes before, during, and after the soil freezes.

Determining the Role That Abiotic and Biotic Stress Factors Play on the Grapevine Trunk Disease Latent Pathogen *Phaeomoniella Chlamydospora* Development in Young Vines

Jared Hrycan, Julie Boulé, Jane Thielmann, Pat Bowen, Tom Forge, Miranda Hart, and José
Ramón Úrbez-Torres

University of British Columbia Okanagan / Agriculture and Agri-Food Canada

*Correspondence: jared.hrycan@gmail.com

Phaeomoniella chlamydospora is a fungal pathogen that infects and colonizes the xylem of grapevines causing Petri disease. This grapevine trunk disease affects young grapevines (< 5 year-old), leading to premature death, often before vineyards are established and in full production, causing significant economic losses. Growing evidence has led to the hypothesis that *P. chlamydospora* may act as a latent pathogen in grapevines, with grapevine stress acting as the main trigger for disease development. Two greenhouse experiments are currently underway to determine how drought (abiotic stress) and ring nematode infestation (biotic stress) affect symptom expression and disease development in young 'Merlot' vines. The role that the arbuscular mycorrhizal fungus *Rhizophagus intraradices* may play to ameliorate stress and thus, reduce/avoid disease development is also being investigated. *Phaeomoniella chlamydospora* was vacuum inoculated into dormant 'Merlot' cuttings at three different concentrations (25,000 spores, 5,000 spores, 1,000 spores). Grapevines were planted in pots and placed under greenhouse-controlled conditions for the duration of the study. Pathogen viability and quantity will be determined using fungal re-isolations and droplet digital PCR at time of inoculation, time of planting, and at the end of the experiment. Throughout the experiment, plant water stress and matric water potential will be monitored via leaf-gas exchange and soil tensiometers. Shoot and leaf dry weight will be collected throughout the experiment to determine the effect on growth and internal necrosis caused by *P. chlamydospora* will be measured at the end of the experiment. It is hypothesized that vine stress will increase disease progression, which will be more pronounced in vines with higher concentrations of the pathogen, while *R. intraradices* will reduce/avoid disease development via plant stress reduction.

Value-addition to haskap berry: development of anthocyanin-rich nanoparticles

M. Amararathna[1], and H. P. Vasantha Rupasinghe[1]

[1]Department of Plant, Food, and Environmental Sciences, Faculty of Agriculture, Dalhousie University, Truro, NS, Canada.

*Correspondence: madu.ama@dal.ca

Haskap berry or blue honeysuckle (Lonicera caerulea L.) is a recently introduced fruit crop, which is rapidly expanding within Canada. Ripe haskap berries are rich in anthocyanins, which contribute to the sensory and health beneficial properties. However, anthocyanins degrade during food processing and even after ingestion. The entrapment of anthocyanins in polymeric nanoparticles is a promising solution to reduce their oxidative degradation. The objectives of the present study were to identify the phytochemical properties of haskap berry extracts and develop an efficient method to encapsulate extracted anthocyanins in nanoparticles. The anthocyanin-rich extracts were isolated from well ripped haskap berries of cultivar Tundra, analyzed for its phytochemical composition, and encapsulated in three different polymeric nanocarrier systems; poly (lactide-co-glycolide)-polyethylene glycol, maltodextrin and carboxymethyl chitosan (CMC). HPLC analysis confirmed that the nanoparticles are consisted of cyanidin-3-O-glucosides (C3G), other anthocyanins and phenolic acids. Transmitted electronic microscopy images confirmed that the nanoparticles were spherical shape. All the particles shared monodispersed particle size. However, the anthocyanin encapsulation efficiency was significantly higher (58%) in CMC than in the other two systems (< 2%). Therefore, the CMC could be a promising noncytotoxic candidate to encapsulate C3G and other anthocyanins, isolated from haskap berries.

LED Lighting in Controlled Environment Agriculture

Jennifer Hoogenboom

University of Guelph

Correspondence: hoogenbj@uoguelph.ca

Environmental growth chambers are valuable tools for research and development, allowing for precise control of all environmental parameters. These systems can control temperature, humidity, carbon dioxide, light quality and light intensity to provide a programmed recipe that is optimal for photosynthesis for a wide range of crops. Whole plant in situ measurement of photosynthesis can be accomplished when placed under a homogenous environment. Using PGC Flex and PS1000 Photosystem Chambers, response curves that quantify the relationship between photosynthesis and evapotranspiration can be measured. Light is one of the most important environmental cues that can affect plant growth and development. The manipulation of environmental variables, particularly light quality and intensity, on plants have predictable outcomes. These trends have been shown to be similar amongst various closely related species. Many other plants have been thoroughly researched throughout history, despite this, the focus of most empirical work on the plant, *Cannabis sativa* has been severely limited. Whether trends identified in other species remain consistent in cannabis remains a question. Due to the recent legalization it is of increasing importance to cannabis producers to identify the best methodology in producing quality flower for both recreational and medicinal consumers. By standardizing the production of cannabis in indoor facilities this allows for medical consumers to obtain product that is consistent and manageable. The pursuit of this research will yield valuable insight of how LED light quality and quantity can be utilized to produce consistent and high-quality cannabis plants using high end controlled environment technology.

Effect of Ratios of Far Red to Blue Lights on *Colletotrichum acutatum*

Charkhzarrin, Z*[1], V. Gravel[1]

[1]Department of Plant Science, McGill University, Ste-Anne-de-Bellevue (Quebec), Canada, H9X 3V9

Correspondence: zahra.charkhzarrin@mail.mcgill.ca

One of the most important fungal pathogens, seriously threatening strawberry production not only in Canada but also in the world, is *Colletotrichum acutatum* causing strawberry anthracnose fruit rot. To effectively reduce the losses caused by this pathogen, improve strawberry yield, and limit the abundant use of chemical fungicides, new more eco-friendly management methods have to be developed. Recently, visible spectrum of light, especially the blue light, have been extensively investigated for their potential microbiocidal effects. Therefore, based on the results from previous work which showed restrictive and fatal effects of three combinations of far-red (FR) and blue (B) lights (FR:B 1:1, 1:5, and 5:1) on spores and mycelia of this pathogen, their impacts on *C. acutatum* pathogenicity on detached fruits were assessed. Results of this experiment suggest that 1:1 and 1:5 ratios of FR:B lights are either fatal or they can eradicate the pathogenicity of *C. acutatum* on fruits. Also, ratio of 1:5 significantly restricted the expansion of the symptoms on the fruits. Interestingly, the mentioned effects of light treatments were permanent. Therefore, based on the results and also considering the positive effects of these ratios of lights on strawberry plants, there is a potential for building a new management method for controlling this disease on strawberries and at the same time improving plant production.

Genotyping-by-sequencing and its Application to Asparagus Breeding Program

Gurleen Sidhu

University of Guelph, Department of Plant Agriculture

Correspondence: gsidhu04@uoguelph.ca

The development of new hybrids with improved yield and other economically valuable traits such as quality, disease, replant resistance and longevity is the ultimate objective of the asparagus breeding programs across globe. Understanding the genetic basis of these as well as those that support the development of hybrids, such as tissue culture response and production of berries on male plants (andromonoecy) would benefit a breeding program. However, asparagus being perennial and dioecious, mapping and study of genetic architecture is difficult. Therefore, introduction of genotyping-by-sequencing (GBS) approach is important for overcoming challenges in asparagus mapping providing a method for genotyping thousands of new markers in this crop. GBS is a simple highly multi-plexed system for constructing libraries in a range of plant species including those with complex genomes such as asparagus. This technique is becoming an increasingly important technology as the sequencing cost per genotype is quite low and methods are also far less complex compared to other restriction-site associated DNA markers. The technological advancement available through GBS technology provides a new opportunity to expand mapping and studies of genetic architecture in asparagus for many traits. It also allows diversity analysis at a depth not possible with previous methods. Therefore, application of genotyping-by-sequencing (GBS) approach in asparagus breeding program will significantly speed up development of new hybrids and enhance asparagus breeding program in future.

Potential flavin secreting endophytic bacteria of apple (*Malus domestica*) roots and their effect on plant growth promotion.

A. Nivethika[1,2], S. Yurgel[2].

[1]Department of Biosystems Technology, Faculty of Technology, University of Jaffna, Sri Lanka, and [2]Department of Plant, Food and Environmental Sciences, Faculty of Agriculture, Dalhousie University, Canada.

Correspondence: aj634155@dal.ca

Flavins (FLs) are essential molecules to carry out numerous flavoprotein-mediated redox reactions in a variety of metabolic pathways. This study is focused on isolation and characterization of FL secreting endophytic bacteria from apple (*Malus domestica*) roots and determine their **P**lant **G**rowth **P**romoting (PGP) effect. Minimal mannitol ammonium ($MMNH_4$) media will be used to isolate FL secreting endophytic bacteria. Determination of FL secretion in growth media will be done by measuring relative fluorescence at excitation wavelength of 470 nm and emission wavelength of 530 nm using Bio-Tek Synergy H1 Hybrid Multi-Mode Reader and the Gen5 software application. The readings will be normalized to OD_{600}. The isolates with highest 470/530 fluorescence will be selected. Those potential FL secreting isolates will be assessed for other PGP functions. Phosphate solubilization test will be done using Pikovskaya's (PKV) agar medium, containing insoluble tricalcium phosphate (TCP). Nitrogen fixation assessment will be done by using Jensen media (N free solid media) and I*n vitro* 1-aminocyclopropane-1-carboxylic acid (ACC) deaminase activity test will be done in M9 minimal media supplemented with 3 mM ACC, production of indole acetic acid (IAA) will be assessed by the colorimetric method using Salkowski reagent (0.5M FeCl3 + 70% perchloric acid). Alfalfa (*Medicago sativa*) plant will be used to test the ability of isolate to promote plant growth in laboratory condition. The harvesting will be done after 5 weeks and dry mass of the plants will be evaluated to assess the plant growth promotion. Our hypothesis is that FL secretion might be a novel PGP bacterial function, which can enhance the plant growth and development. If our hypothesis is correct, FL secreting PGP bacteria could be considered as eco-friendly and greener alternative to chemical fertilizers and pesticides and could act as the biofertilizer.

Keywords- Plant Growth Promotion, Flavin secretion, Phosphate solubilization, N fixation, ACC deaminase and Indole Acetic Acid production

Assessing the Postharvest Evolution of Fruit Quality Parameters In Commercial Blueberry Varieties And New Selections

Yifan Yan, Yixin Gu, Eric Gerbrandt, Michael Dossett, Anubhav Pratap Singh, Simone Castellarin

University of British Columbia

Correspondence: yyan8@mail.ubc.ca

There are several commercially important fruit quality traits that determine the marketability and shelf life in blueberry, and the development and evaluation of new breeding selections with premium fruit quality is a priority for the blueberry industry in British Columbia (BC).
In the current study, blueberry samples were collected from six commercial varieties ('Duke', 'Bluecrop', 'Draper', 'Calypso', 'Elliott', and 'Last Call') and 20 new selections in BC's berry breeding program. Blueberry samples were collected from experimental and commercial fields in summer of 2019. Samples were stored at 0.5 °C for up to 4 weeks. To assess the effect of storage time on blueberry quality, samples were analyzed for berry weight, total soluble solids, titratable acidity, pH, texture (Texture Analyzer), and color at 0, 2, and 4 weeks after harvest.
Loss of fruit weight (*i.e.*, water loss) during storage differed among varieties and selections, with most of the new selections showing reduced weight loss in comparison with the commercial varieties. Blueberry varieties and selections differed in the pattern of change in total soluble solids and titratable acidity during storage, but the ratio of total soluble solids to titratable acidity was within an acceptable range of 1.0-3.3 for most varieties and selections. Total soluble solids increased during storage, with the increase between 2 and 4 weeks of storage correlating with water loss. In most varieties and selections, fruit hardness increased between 0 and 2 weeks of storage and then decreased between 2 and 4 weeks of storage. This decrease in fruit hardness was also correlated to water loss.
These results provide new insights on the evolution of blueberry quality features during postharvest storage, which will be useful for selecting new varieties in BC.