Program for the 59th Annual

Alberta Soil Science Workshop

Professional Development for Alberta Soil Scientists

Workshop Theme:

Challenges for Soil Science in Response to Changing Needs

February 21 to 23, 2023

Royal Hotel Calgary
Calgary, Alberta

www.soilsworkshop.ab.ca

MEMORIAM

DR. PETER HERBERT CROWN
Professor of Soil Science
University of Alberta
July 10, 2022

It is with much love and celebration of a life well lived that we say goodbye to Peter Crown, father, husband, exceptional teacher, and wonderful friend to so many. Peter passed away on July 10, 2022, with his family at his side.

Peter was predeceased by his parents, Walter and Gwen Crown, his older brother Robert and sister-in-law Judy Crown, his mother-in-law and father-in-law Edna and Reginald Ramer, his brother-in-law Harvey Ramer, and many aunts, uncles and cousins in the Crown, Powell, Ramer, and Stevenson families.

Born in Toronto and raised in the Birch Cliff area of Scarborough, Ontario, Peter attended Birch Cliff Public School and R.H. King Collegiate Institute where he enjoyed a good academic life and a wonderful time playing football and competing in wrestling before graduating in 1961.

He moved to Guelph, Ontario where he completed his Bachelor of Science in Agriculture and Master of Science degrees majoring in Soil Science. As a summer student Peter worked on soil inventory projects across southern and northern Ontario. Before completing his MSc program, he was hired as a soil scientist by Agriculture Canada and completed both his MSc and inventory projects before a transfer to Edmonton, Alberta in 1969.

During his graduate program he and Elizabeth (Betty) Ramer, also a graduate student at Guelph, dated and after completing their degrees married in 1968. The birth of their son, Warren, was a wonderful gift, and after enjoying numerous mountain camping trips as a family, they together enjoyed the development of a vacation home at Muriel Lake near Bonnyville.

In Alberta, Peter worked on a number of soil inventory projects ranging in location from the Fort McMurray area in the north to the Suffield Military reserve in the south, with work in the Oyen, Cold Lake, Lac La Biche and Rocky Mountain House areas, as well as Elk Island National Park.

At the same time, he began a doctorate program in the U of A's Department of Soil Science and completed his PhD in 1978. He then joined that Department, teaching and conducting research in the areas of soil science, land classification and remote sensing. He officially retired in 2002 but continued teaching soil science both in campus classrooms and at the Department's field school each spring. After retirement, Peter also spent time as a volunteer with the Red Cross emergency and disaster services program. Peter and Betty enjoyed many relaxing days at their Cabin on Muriel Lake. Their retirement years saw the small sailboat at Muriel Lake, replaced by a larger one kept at the marina and sailed on Cold Lake.

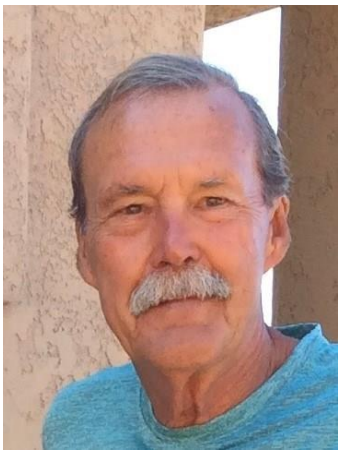
He and Betty spent joyful times travelling around the world, taking trips before and after Betty's International Standards Organization meetings, at which she was a Canadian representative in the area of protective clothing. Other trips were either research or teaching activities, taken on sabbatical leaves or visiting current and former graduate students in other countries. In all, they travelled together to 32 countries.

Cremation has taken place internment and a family service will take place at a later date in Ontario.

Memorial Donations in Peter's name may be made to the ALS Society of Alberta. 7874-10 Street NE, Calgary Alberta, T2E 8W1 or to a charity of one's choice.

MEMORIAM

DR. MARVIN JOSEPH DUDAS
Professor of Soil Science
University of Alberta
November 15, 2022



Dr. Marvin Joseph Dudas passed away peacefully in his sleep at Kelowna General Hospital on November 15th, 2022 at the age of 79. Survived by his loving wife, Sharon, 3 step children and 8 grandchildren, Kelly (Tim) Gaumont (Cassie, Zack, Cady, & Blake), Kristy Kolodychuk (Sammy and Abby) and Keith Kolodychuk (Connor and Zoey). His sister Georgina Pushor, brother Dennis (Colleen) Dudas, sister Nancy Dudas and 3 nephews.

Marvin was born in Coaldale, Alberta on March 17th, 1943. After growing up on the farm, he went to the University of Alberta where he received his Bachelor and Master degree in Soil Sciences. Being an excellent student, he then went to Oregon State University for his PhD. After graduating he did a post-doctoral for two years at the U of A. There Marvin became an award winning professor for 36 years. Marvin had a passion for helping his young students achieve their hopes and dreams, as evidenced by the many awards and accolades Marvin received in his career. Marvin's calm and encouraging nature was always treasured by his students. He always went above and beyond to mentor all of them and ensure they were successful in their endeavours, whether it be in school or more generally in their life.

Marv loved the outdoors. Some of his favorite activities were fishing, hunting, golfing and hiking. He especially enjoyed spending time at the cabin on Island Lake with family and friends. Marv was an excellent gardener as well, anything he planted flourished under his care.

Marv then retired to Kelowna for his summers and Mesa, Arizona for his winters.

Marv was an unbelievably kind, caring, loving man to all that knew him, especially to his wife, Sharon, of 32 years. They were each other's whole worlds.

Memorial to follow in the summer of 2023.

ALBERTA SOIL SCIENCE WORKSHOP BACKGROUND

The **Alberta Soil Science Workshop** (ASSW) has been in existence since 1962. The Workshop grew out of the Alberta Soils Advisory Committee which had 4 sub-committees: Soil Inventory, Soil Conservation, Soil Reclamation and Soil Fertility. The Alberta Soil Advisory Committee provided advice to the Government of Alberta. The Alberta Soils Advisory Committee was dissolved in the 1980's, but the various sub-committees felt it was beneficial for them to continue to meet and share scientific knowledge and experiences, so the current annual workshop developed through the volunteer commitment by soil professionals and scientists from government agencies, universities, and industry.

The purpose of the ASSW is to foster the network, extension and knowledge sharing for the scientific study of soil science for agronomic, environmental, reclamation and ecosystem applications through a range of forums. These forums include:

A) **Annual Workshop Meeting** which provides the opportunity to present and share current research or update on various projects related to soil science. The Workshop is a 2-day event comprised of a plenary (theme) session, plus technical sessions that relate to land use and rangelands, land reclamation, soil fertility, soil health, forest, riparian and wetland soils and pedogenesis and soil inventory. In addition, there is a volunteer session for presentations that may not fit the standard technical sessions. The Workshop includes both oral and poster presentations. The Workshop also fosters the development of students by providing travel assistance and presentation awards.
For more information see Website: https://soilsworkshop.ab.ca/

A compilation of historical public presentations given during the Alberta Soil Science Workshop (ASSW) meetings is available at https://sites.google.com/a/ualberta.ca/archivesassw/welcome

B) **Alberta Soils Tour** (AST) is held biannually to facilitate regional interaction among professionals, students, and enthusiasts in soil science and related fields. The AST provides hands-on field opportunities for professional development, learning, and collaboration. Typically, 40 to 100 attendees gather for a 2- or 3-day bus tour consisting of investigating sites that represent a range of soils, and abundant networking opportunities.

For more information see Website: https://soilsworkshop.ab.ca/tour.html

C) **Alberta Soils Network** (ASN) provides opportunities for environmental scientists interested in the field of soil science to network and develop professionally. The need for a soils network has gradually arisen because many new graduates no longer work at government agencies where specific in-house training in soils is provided. Training is left more and more up to a consortium of government, industry, academic, professional organizations, and consultants to work together on coordinating efforts for continuous education and linking resources. The network has identified a need to gain a current picture of soil science-related training, education, and information and so we are working to address this need.
For more information see Website: https://soilsworkshop.ab.ca/ASN.html

The ASSW operates as a totally independent and autonomous entity. Funding to support the ASSW activities (workshop, soils tour and soils network) is through registration and sponsorship. All organizing members are volunteers. The ASSW has collaborated with international, national and western Canada inter-provincial forum opportunities.

CURRENT EXECUTIVE AND ORGANIZING COMMITTEE

Chair

- Dr. Deo A. Heeraman (WSP E&I Canada Ltd.)

Past Chair

- Dr. Symon Mezbahuddin (Alberta Environment and Protected Areas)

Treasurer

- Len Kryzanowski (Retired Formerly with Alberta Agriculture and Forestry)

Secretary

- Erin Daly (University of Alberta)

Sponsorship

- Kris Guenette (University of Alberta)

Web Administration

- Erin Daly (University of Alberta)
- Kris Guenette (University of Alberta)

Eventbrite Registration

- Andrew Underwood (Innotech Alberta)

Alberta Soils Tour Chair

- Dr. Konstantin Dlusskiy (Paragon Soil and Environmental Consulting Inc.)

Committee Members

- Len Kryzanowski (Retired Formerly with Alberta Agriculture and Forestry)
- Erin Daly (University of Alberta)
- Dr. Konstantin Dlusskiy (Paragon Soil and Environmental Consulting Inc.)
- Kris Guenette (University of Alberta)
- Dr Eric Bremer (Western Ag Innovations)
- Andrew Underwood (Innotech Alberta)
- Dr Tom Jensen (Jensen AgGro Inc. and University of Lethbridge)
- Dr. Tariq Munir (University of Calgary)
- Ross Adams (Forestry Parks and Tourism)
- Mark Bateman (Canadian Natural Resources Limited)
- Gregory Hook (Canadian Natural Resources Limited)

Student Presentations/Evaluation

- Dr. Tariq Munir (University of Calgary)
- Ross Adams (Forestry Parks and Tourism)
- Konstantin Dlusskiy (Paragon Soil and Environmental Consulting Inc.)

TECHNICAL SESSION CHAIRS

Soil Fertility	Len Kryzanowski Retired Formerly with Alberta Agriculture and Forestry
Pedogenesis and Soil Inventory	Dr. Konstantin Dlusskiy Paragon Soil and Environmental Consulting Inc.
Land Use and Rangelands	Ross Adams Forestry Parks and Tourism
Land Reclamation	Mark Bateman Canadian Natural Resources Limited
Forest, Riparian, and Wetland Soils	Dr. Tariq Munir University of Calgary
Soil Health	Dr. Tom Jensen Jensen AgGro Inc. and University of Lethbridge
Poster Session	Dr. Eric Bremer Western Ag. Innovations
Volunteer Session	Dr. Konstantin Dlusskiy Paragon Soil and Environmental Consulting Inc.

SPONSORS

We are grateful to the sponsors who have contributed to the 2023 Alberta Soil Science Workshop. Please consider sponsorship of future Workshops to support professional soil science in Alberta, and to enhance the visibility of your organization. For the 2023 Workshop we acknowledge the generosity of the following sponsors:

1) **Paragon Soil and Environmental Consulting Inc.- Patron Level**
2) **Hoskin Scientific Ltd.- Platinum Level (Student Presentation Awards)**
3) **Nutrient Ag Solutions - Gold Level**
4) **UPL Agro Solutions Canada Inc. - Gold Level**
5) **ALS Environmental - Silver Level**
6) **Corteva Agriscience - Silver Level**
7) **University of Alberta, Department of Renewable Resources - Silver Level**
8) **Alberta Institute of Agrologists- Silver Level (Banquet Entertainment)**
9) **Matrix Solutions - Silver Level (Coffee)**
10) **Alberta Wheat Commission - Bronze Level (Coffee)**
11) **Western Ag Innovations Inc. - Bronze Level**
12) **WSP E&I Canada Ltd. - Bronze Level**

Better Together

PROGRAM – 2023 ALBERTA SOIL SCIENCE WORKSHOP

OVERVIEW

Tuesday, February 21, 2023

2:00 PM – 9:00 PM	Registration (Lobby)
2:00 PM - 5:30 PM	Pre-Conference Workshops (Sapphire Ballroom)
2:00 PM - 3:30 PM	Dr Eric Bremer (Western Ag Innovations): *Hands-on Experience with Plant Root Simulator (PRS) Probes*
4:00 PM - 5:30 PM	David Lloyd (AIA Registrar): *Professionalism, Competence and Regulatory Change*
6:00 PM - 9:00 PM	Cash Bar, Welcome Reception (Lobby)
6:30 PM - 7:30 PM	Alberta Soils Tour Volunteer Meeting **(**Sapphire Ballroom**)**

Wednesday, February 22, 2023

6:30 AM- 5:30 PM	Registration (Lobby)
6:30 AM - 7:30 AM	Breakfast (Emerald Ballroom)
7:45 AM - 12:00 PM	Plenary Session (Emerald Ballroom) *Challenges for Soil Science in Response to Changing Needs*
9:30 AM – 9:45 AM	Coffee and Refreshments (Lobby)
12:00 PM - 1:00 PM	Lunch (Emerald Ballroom)
1:00 PM – 4:05 PM	Soil Health Technical Session (Emerald Ballroom)
2:25 PM - 2:45 PM	Coffee and Refreshments (Lobby)
1:00 PM - 2:05 PM	Volunteer Technical Session (Sapphire 1 Room)
4:15 PM – 5:45 PM	Poster Session (Emerald Ballroom B)
5:45 PM – 9:00 PM	Cash Bar and Banquet (Lobby/Emerald Ballroom) Guest Speaker: Brian Keating "*Going Wild in Strange Times*"

Thursday, February 23, 2023

7:00 AM - 8:00 AM	Breakfast (Emerald Ballroom)
8:00 AM - 10:50 AM	Land Reclamation Technical Session (Emerald Ballroom)
8:00 AM - 10:50 AM	Soil Fertility Technical Session (Sapphire 1 Room)
10:05 AM - 10:30 AM	Coffee and Refreshments (Lobby)
10:50 AM – 12:00 PM	ASSW Business Meeting and Closing Remarks (Emerald Ballroom)
12:00 PM - 1:00 PM	Lunch (Emerald Ballroom)
1:30 PM	Bus shuttle departing to Edmonton via Red Deer

DETAILED PROGRAM

Tuesday, February 21, 2023 – Afternoon

PRE-WORKSHOP – SAPPHIRE BALLROOM

2:00 PM - 3:30 PM

Dr. Eric Bremer (Western Ag Innovations)

Hands-on Experience with Plant Root Simulator (PRS) Probes

Corresponding author: ericbremer@westernag.ca

Abstract

Have you ever wondered what plant roots see when they meet a fertilizer band? Or had to measure soil nutrients in Mongolia? Plant Root Simulator (PRS) probes are a useful tool to monitor soil nutrients *in situ* and in remote locations. They have been used in deserts, grassland, forests, tundra, wetlands and agroecosystems all over the globe. They consist of ion-exchange membranes on a plastic support. Eric Bremer, head of R&D for Western Ag Innovation, will provide a hands-on workshop on how to use PRS probes in a wide range of ecosystems, including general installation and handling, standardized burial methods at field capacity and saturation (including tips on controlling soil moisture and aeration), and lab methods to monitor nutrient dynamics adjacent to fertilizer prills.

Biography

Dr. Eric Bremer has been active in research on soil N and organic matter dynamics since grad student days at the University of Saskatchewan in the 1980s. He has managed the research use of PRS probes since 2011

4:00 PM – 5:30 PM

David Lloyd (Alberta Institute of Agrologists)

Professionalism, Competence and Regulatory Change

Corresponding author: dlloyd@aia.ab.ca

Abstract

The Alberta Institute of Agrologists (AIA) has shifted governance and operations emphasis and has emerged as a leading, competent profession in Alberta. The Institute used to be both an association and a regulatory body. Two existing pieces of legislation have refocused the profession. The current *Agrology Profession Act* (APA) eliminated all former "association" type activities (branches, networks, presidents, vice presidents, specific member support). The APA put in place very rigorous competence requirements related to practice standards and continuing competence. The "*Fair Registration Practices Act*", recently passed, requires professions to have fair and transparent registration requirements and to report annually on all registration activities. The new proposed Bill 23, the *Professional Governance Act*, takes professions to a new level of accountability, governance, and professional competence. The institute's key focus is to 'protect and serve the public interest' through the effective regulation of all professional members. Section 3 of the APA requires specific action to enable this effective service. The rest of the APA directs how this requirement is to occur.

Biography

David joined the Alberta Institute of Agrologists (AIA) in January 2009 as the CEO/Registrar. David has a B.Sc. in biology and chemistry from the University of Alberta, a BSF in Forest Management and Hydrology and a master's degree in soils; the last two from the University of British Columbia.

David spent 28 years with the Alberta government focusing on industrial land use and land reclamation throughout Alberta and finished as a regional director with Alberta Environment. Following his time with the Alberta government, David spent five years in environmental consulting. David is a past president of the Alberta and Canadian Land Reclamation Association. He is the past chair of Alberta's Joint Environmental Professional Practice Board. David served six years on the AIA Council (three as Council Chair). David has a passion to drive the Institute toward a stronger and more influential body of competent professionals, well recognized in Alberta and Canada, for all matters relating to Agrology.

ALBERTA SOILS TOUR VOLUNTEER MEETING

SAPPHIRE BALLROOM

6:30 PM - 7:30 PM

Dr. Konstantin Dlusskiy, P.Ag., Alberta Soils Tour Chair (Paragon Soil and Environmental Consulting Inc.)

Corresponding author: kdlusskiy@paragonsoil.com

Abstract

Alberta Soils Tour (AST) is held biannually to facilitate regional interaction among professionals, students, and enthusiasts in soil science and related fields. The AST provides hands-on field opportunities for professional development, learning, and collaboration. Typically, 40 to 100 attendees gather for a 2- or 3-day bus tour consisting of investigating sites that represent a range of soils, and abundant networking opportunities. Last year the *Alberta Soils Tour Committee* organized two successful tours associated with the 2022 joint conference of the *Canadian Society of Soil Science* and the *Alberta Soil Science Workshop*. The next *Alberta Soils Tour* is scheduled for May 2024.

In order to organize the upcoming 2024 Alberta Soils Tour, ASSW is calling for volunteers to participate in the preparation activities. This kick-off meeting initiates the process of preparation for the upcoming tour.

Meeting Agenda

- Announcement of the upcoming 2024 Alberta Soils Tour
- Choosing the tour region
- Upcoming preparation activities
- Sign up for volunteers

Cash bar, cheese and crackers will be available for those attending in person.

Virtual meeting option will be available via the ZOOM platform at:

https://us05web.zoom.us/j/81872711105?pwd=RE5WaXVsZTIrUFdEOGxNbVM1VXk1dz09

The *Alberta Soils Tour* (AST) and the *Alberta Soil Science Workshop* (ASSW) were born the same year (1962) under the umbrella of the *Alberta Advisory Fertilizer Committee*. The two events went hand by hand for the last 61 years, but the role of ASSW in AST evolved with time. From 1962 to 1988, both were organized by the *Alberta Soil Advisory Committee* (ASAC). In 1989, the ASAC was abolished and the initiative was held by volunteers. Between 1990 and 2013, ASSW sponsored the AST, which was organized by a group of enthusiasts. In 2017, ASSW adopted the AST, taking the responsibility to organize a volunteer-led tour every two years. For more information see the ASSW website: https://soilsworkshop.ab.ca/tour.html

Wednesday, February 22, 2023 – Morning

PLENARY SESSION – EMERALD BALLROOM

6:30 AM- 7:30 AM	**Breakfast – Emerald Ballroom**
7:45 AM - 8:00 AM	**Welcome and Introduction**
	Dr. Deo A Heeraman
	WSP Environment & Infrastructure (E&I) Canada Limited
8:00 AM – 8:45 AM	**Climate Impact on Cereal Crop Development and Soil Health Research in Subarctic Region of Alaska**
	Dr. Mingchu Zhang
	University of Alaska-Fairbanks
8:45 AM - 9:30 AM	**Nitrogen Fertilizer Management to Mitigate Greenhouse Gas Emissions**
	Dr. David Burton
	Dalhousie University
9:30 AM - 9:45 AM	**Coffee and Refreshments – Lobby**
9:45 AM - 10:30 AM	**Canadian System of Soil Classification 4th edition- Reviving the Soil Classification Working Group**
	Daniel Saurette
	Ontario Ministry of Agriculture, Food and Rural Affairs Ontario
10:30 AM - 11:15 AM	**Land Capability Classification of Reclaimed Lands in Alberta- History and Future**
	Leonard Leskiw, Dr. Brittany Flemming, Dr. Michael Carson, Dr. Konstantin Dlusskiy, and Lee Waterman
	Paragon Soil and Environmental Consulting Inc.
11:15 AM – 12:00 PM	**Update on the Senate Committee on Agriculture and Forestry's study of soil health in Canada**
	Senator Paula Simons
	Standing Senate Committee on Agriculture and Forestry
12:00 PM– 1:00 PM	**Lunch – Emerald Ballroom**

Wednesday, February 22, 2023 – Afternoon

SOIL HEALTH TECHNICAL SESSION

EMERALD BALLROOM

*****Graduate Student Presentations

PM	**Soil Health** Emerald Ballroom
1:00 - 1:05	**Chair: Dr. Tom Jensen**
1:05 - 1:25	**Microbial Diversity is Not Impacted by Manure Application** *Erin Hall, Tiffany Traverse, Greg Semach, Bharat Shrestha, Patrick Neuberger, Monika Gorzelak*
1:25 - 1:45	**On-farm comparison of microbial community diversity and associated organic matter in Chernozemic profiles** *Patrick Neuberger, Timothy Schwinghamer, Monika Gorzelak, Carlos Romero, Kris Nichols, Kimberly Cornish*
1:45 - 2:05	***How can microbial diversity be used as an indicator of soil health in different land management conditions?** *Roya Faramarzi, M Derek MacKenzie, Monika Gorzelak*
2:05 - 2:25	***Effect of non-native cicer milkvetch on soil carbon, nitrogen, and soil microbiome in Canadian dry mixedgrass prairie** *Michele Tran, Cameron Carlyle, and Malinda Thilakarathna*
2:25 - 2:45	***Coffee and Refreshments – Lobby***
2:45 - 3:05	**Size fractionation of trace elements in soil solutions recovered from soils under contrasting long-term agricultural management** *Lina Du, Chad W. Cuss, Miles Dyck, Tommy Noernberg, William Shotyk*
3:05 - 3:25	***Different lime application incorporation methods and the effects on soil acidity reduction** *Mark Wagner and Tom Jensen*
3:25 - 3:45	**Liming Acidic pH Soils and the Net Effects on CO2 Balance** Tom Jensen, Laura Haenni, and Navneet Kaur
3:45 - 5:45	***Poster Session (Emerald Ballroom B)***
5:45 - 9:00	***Cash Bar, Banquet and Entertainment (Lobby/Emerald Ballroom)*** Guest Speaker: Brian Keating "*Going Wild in Strange Times*"

Wednesday, February 22, 2023 – Afternoon

VOLUNTEER TECHNICAL SESSION

SAPPHIRE 1 ROOM

PM	**Volunteer** Sapphire 1 Room
1:00 - 1:05	**Chair: Dr. Konstantin Dlusskiy**
1:05 - 1:25	**The Untapped Irrigation Potential of Soils in the Peace River Region** *Scott Boorman*
1:25 - 1:45	**Gray Luvisols are Polygenetic** *Miles Dyck, Sylvie Quideau, Justine Lejoly, Preston Soenson*
1:45 - 2:05	**Impact of cement kiln dust application on soil fertility, greenhouse gas emissions and crop productivity** *Ali El-Naggar, Morgan Duggan, Scott X. Chang*
2:05 - 2:25	**Alberta Soils Tour 2022: a review** *Konstantin Dlusskiy and Ed Karpuk*
2:25 - 2:45	***Coffee and Refreshments – Lobby***

Wednesday, February 22, 2023 – Afternoon

POSTER SESSION 4:15 – 6:00 PM

SESSION CHAIR: ERIC BREMER

EMERALD BALLROOM B

*****Graduate Student Presentations

1.	***Using archived soil samples to examine carbon sequestration after 20 years of no tillage in Alberta, Canada** *Camila Camara De Almeida Cardoso and M Derek MacKenzie*
2.	***Response of microbial communities to long- and short-term coordinated nitrogen and sulfur fertilization** *Laura Bony, Miles Dyck, and Sylvie Quideau*
3.	***Investigating pyrogenic carbon content and character of montane soils of the Southern Rockies post wildfire** *Nathan Storey, Miles Dyck, Sylvie Quideau*
4.	***Exploring the Agronomic and Soil Health Benefits of Liming in the Canadian Prairies** *Priscillar Wenyika, Miles Dyck, Linda Gorim*
5.	**Differential responses of bacterial communities across geographic locations and ecozones in Alberta agricultural fields amended with urea and humic-based amendments** *Rhea Amor Lumactud, Linda Gorim, and Malinda Thilakarathna*
6.	***Humalite as soil amendment for improving soil health** *Sumedha Vaishnavi Nallanthighal, Karanjot Gill, Malinda Thilakarathna, and Linda Gorim*
7.	***Investigating the substrate adsorption kinetics of naphthenic acid fraction compounds from oil sands process-affected water** *Camryn Charriere, Douglas Muench and John Headley*
8.	***Bioaugmentation of the Plant Rhizosphere to Support Constructed Wetland Treatment Systems for Oil Sands Process-Affected Water** *Annie Zymela, Lisa Gieg and Douglas Muench*
9.	**Determining specific compost blends for regenerative agriculture in central Alberta** *M.D. Mackenzie, B. Lanoil, M. Khodaei, C. Cardoso, Z. Fries, S. Cui, J. Kowalski*
10.	**Lead-saturated biochar-soil interactions: contamination risks and release dynamics of Pb** *Ali El-Naggar, Christopher Nzediegwu, M. Anne Naeth, Scott X. Chang*

Thursday, February 23, 2023 – Morning

LAND RECLAMATION TECHNICAL SESSION

EMERALD BALLROOM

*****Graduate Student Presentations

AM	**Land Reclamation** Emerald Ballroom
8:00 - 8:05	**Chair: Mark Bateman**
8:05 - 8:25	**Creation and Afforestation of a Phosphogypsum Anthrosol** *Connie Nichol*
8:25 - 8:45	***Assessing Soil Physical Factors on Root Systems Development and Growth of Different Plant Functional Types on Phosphogypsum Stacks** *Emmily MacDonald, Pak Chow, Miles Dyck, Simon Lamdhausser, Connie Nichol*
8:45 - 9:05	**Residual effects of pipeline construction on agricultural soils of the Canadian prairie** *Ivan R. Whitson*
9:05 - 9:25	**Combining reforestation approaches: targeted utilization of native plants and herbicides to battle undesirable vegetation** *Mark Baah-Acheamfour, Amanda Schoonmaker, Stefan G Schreiber, Eckehart Marenholtz*
9:25 - 9:45	**Application of Genomics to Enhance Constructed Wetland Treatment Systems for Remediation of Oil Sands Process-Affected Water** *Mitchell Alberts, Douglas Muench and Christine Martineau*
9:45 - 10:05	**Bioengineering as a Progressive Solution to Bank Erosion in Public Green Spaces** *Stephanie Reddecliff*
10:05 - 10:30	***Coffee and Refreshments – Lobby***
10:50 - 12:00	***ASSW Business Meeting and Closing Remarks***
12:00 - 1:00	***Lunch – Emerald Ballroom***

Thursday, February 23, 2023 – Morning

SOIL FERTILITY TECHNICAL SESSION

SAPPHIRE 1 ROOM

*****Graduate Student Presentations

AM	**Soil Fertility** Sapphire 1 Room
8:00 - 8:05	**Chair: Len Kryzanowski**
8:05 - 8:25	**Winter wheat responses to enhanced efficiency granular nitrogen fertilizer in the Canadian Prairies** *Zhijie Wang, Jennifer L. Owens, Xiying Hao, Elham Rahmani, Rezvan Karimi and Brian L. Beres, Ben W Thomas, Chris Holzapel, Kabal Gill*
8:25 - 8:45	**Implications of Soil Nitrogen Cycling for Improving Fertilizer N Use Efficiency** *Eric Bremer and Ben Ellert*
8:45 - 9:05	***Soil organic nitrogen priming to nitrous oxide: a synthesis** *Erin J. Daly, Guillermo Hernandez-Ramirez, Kate A. Congreves, Tim Clough, Carolina Voigt, Eliza Harris, Reiner Ruser*
9:05 - 9:25	**Nitrogen Rate of Return Calculators for Brown, Dark Brown and Black soils** *Rigas Karamanos, Jeremy Boychyn and Sheri Strydhorst*
9:25 - 9:45	**Effect of Humic Acid-Based Soil Amendments on Soil Nitrogen Availability and Wheat Growth** *Pramod Rathor, Linda Gorim and Malinda Thilakarathna*
9:45 - 10:05	***How do different compost blends with or without biochar additions affect C and N mineralization in agricultural soils from central Alberta** *Mohammad Khodaei and M Derek MacKenzie*
10:05 - 10:30	***Coffee and Refreshments – Lobby***
10:30 - 10:50	***Effect of feedstock type and pyrolysis temperature on seeding characteristics of biochar for struvite crystallization** *Nageshwari Krishnamoorthy, Christopher Nzediegwu, Scott X. Chang, Xiaohui Mao, Hongbo Zeng and Balasubramanian Paramasivan*
10:50 - 12:00	***ASSW Business Meeting and Closing Remarks***
12:00 - 1:00	***Lunch – Emerald Ballroom***

Plenary Session Abstracts

Wednesday, February 22, 2023

CLIMATE IMPACT ON CEREAL CROP DEVELOPMENT AND SOIL HEALTH RESEARCH IN SUBARCTIC REGION OF ALASKA

Dr. Mingchu Zhang

Institute of Agriculture

School of Natural Resources and Extension

University of Alaska Fairbanks, Fairbanks Alaska.

Corresponding author: mzhang3@alaska.edu

Abstract

Climate warming in the subarctic region of Alaska provides challenges to current small grain production systems in Alaska and to soil health that supports such a system. Facing these challenges, two fundamental questions are asked 1) can current cultivars still be used in the future warmer climate? 2) What soil health indicators should be aligned to support future agriculture production? For the first question, two modeling approaches (simulation and AI) are used to determine future crop yield when current cultivars are used. Results showed that performance of AI algorithms varied with crop growth stages and locations of the trial, and DSSAT simulation is constrained by locality of additional field physiological measurements. Nevertheless, results from both approaches indicate yield decline as climate warms in the subarctic regions. For the second question, soil health research was conducted by comparison of soil test parameters from a studied soil with a reference soil. The results indicated that the commonly used approach, i.e., comparison of a soil of interest with a reference soil did not work in the subarctic condition. In this presentation, the limitation of current approach of soil health research in the subarctic areas is presented, and alternative approaches are discussed. By addressing the two questions, food for thought is provided for the uniqueness of agriculture production and soil science research in the northern climatic conditions.

Biography

Dr. Zhang obtained his Ph.D. in soil science in 1993 from the University of Alberta. Currently, he works as a tenured track full professor in the Institute of Agriculture, Natural Resources and Extension at the University of Alaska Fairbanks (UAF). In addition, he serves as the vice chair

in the Circumpolar Agriculture Conference, an organization for agriculture related research in the circumpolar region. He served as department chair from 2009 to 2012 in the Department of High Latitude Agriculture at UAF. Dr. Zhang has expertise in agronomy, soil science, waste management, and permafrost soil. Right now he is the PI for two key USDA funded projects. He is expanding his soil science expertise in the area of archaeology, and currently supervises two Ph.D. archaeology students along with other traditional soil science graduate students

NITROGEN FERTILIZER MANAGEMENT TO MITIGATE GREENHOUSE GAS EMISSIONS

Dr. David L. Burton, PAg, FCSSS

Centre for Sustainable Soil Management

Dalhousie University, Truro, NS

Corresponding author: dburton@dal.ca

Abstract

Reduction in N_2O emissions from agriculture has been identified as a priority by government and industry. Nitrogen fertilizer use in Canada has doubled since 2006 and in 2020 resulted in 11 Mt CO_2e of direct N_2O emissions, representing 69% of direct N_2O emissions from agricultural. Improved nitrogen management provides the opportunity to reduce N_2O emissions without adversely effecting profitability.

The opportunity for robust implementation of the 4R nutrient management framework along with a fifth “R”, right rotation, will be discussed in the context of reducing N_2O emissions from Canadian agriculture. Examples will be drawn from the major crops grown in Canada including canola, corn, and potato production systems. The critical importance of determining the rate of N application will be discussed and tools and strategies for ensuring “right rate” will be considered. The need to capture and report on improved nitrogen management at national and international levels will also be discussed.

Biography

Dr. David Burton, a Soil Scientist, is a Dalhousie Distinguished Research Professor, Director of Dalhousie’s Centre for Sustainable Soil Management, and a Fellow of the Canadian Society of Soil Science.

Dr. Burton’s research examines the role of the soil environment in influencing the nature and extent of microbial metabolism in soil. His focus has been on processes in the cycling of nitrogen in soils and their implications for soil fertility and environmental impact. His current research programs involve an examination of the production and consumption of greenhouse gases in natural and agricultural landscapes, the development of tools for the measurement of soil nitrogen supply to plants, the influence of climate on soil biological processes, and the assessment of the quality of the soil biological environment and its influence on soil health. It is the aim of this work to better understand the factors that control soil microbial processes and to use this information to developing sustainable land management systems in a changing climate.

CANADIAN SYSTEM OF SOIL CLASSIFICATION 4TH EDITION: REVIVING THE SOIL CLASSIFICATION WORKING GROUP

Daniel D. Saurette, M.Sc., PhD Candidate

Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA)

School of Environmental Sciences, University of Guelph, Guelph, ON

Land Resource Specialist

Corresponding author: daniel.saurette@ontario.ca

Abstract

The Canadian System of Soil Classification (CSSC) was last updated in 1998. Since its release, federal expertise in soil survey and classification has declined significantly, and the technical capacity for oversight of the CSSC is no longer present within the organization. The Pedology Committee of the Canadian Society of Soil Science (CSSS) was established in 2005 as a coordinating body for the advancement of soil classification and genesis in Canada with the primary objective of centralizing pedology expertise within the CSSS to mitigate the effects of diminishing federal government involvement in soil survey.

In 2008, the Pedology Committee identified a need to capture current pedological knowledge for each soil Order in the CSSC; and a need to develop a framework to accept and publish revisions to the CSSC. As a result, in 2011, a Special Issue of the Canadian Journal of Soil Science (CJSS) dedicated to soil taxonomy for the ten Orders of the CSSC was published. However, with a lack of a developed framework for proposing and making changes to CSSC, an effort to develop the 4th edition of the CSSC never materialized.

In 2018 the Pedology Committee mandate was re-examined, and update of the CSSC was adopted as one of its top priorities. As such, the Soil Classification Working Group (SCWG) was re-established with representation from across Canada and all sectors to guide the development of a framework that would lead to implementing the 4th edition of the CSSC. At the 2019 CSSS meeting it was agreed that major revisions to the CSSC would require publication in a peer-reviewed journal. A Collection of articles, Advances in Soil Survey and Classification in Canada, has now been published in the CJSS (https://cdnsciencepub.com/topic/cjss-soil-survey), and includes 10 research articles dedicated to proposed revisions to the CSSC.

Starting in January 2023, the SCWG will resume meetings to discuss, evaluate, and make decisions to accept or reject the proposed changes to the CSSC. In addition to these major

proposals, an online form is available for soil scientists across Canada to submit minor revisions to the CSSC, such as consistency issues, spelling or editing errors, and re-organization of the manual. The working group will then be tasked with updating the “orange book” and working through publication of the 4th edition of the CSSC.

Biography

Mr. Daniel Saurette is a Land Resource Specialist with the Ontario Ministry of Agriculture, Food and Rural Affairs, based in Guelph, ON. He has an Honors Bachelor of Environmental Studies in Forest Conservation from Lakehead University, an MSc in Soil Science from University of Alberta, and is currently a PhD candidate at the University of Guelph. Daniel has worked both in the private sector and an environmental consultant and in the public sector with AAFC and OMAFRA. Daniel specializes in soil classification, soil mapping, and landscape interpretation. His current focus is on developing predictive digital soil mapping techniques to expedite delivery of updated soil maps for agricultural areas of Ontario using big data and machine learning. As part of this work, Dan is completing a PhD program which seeks to develop techniques to optimize sample design for predictive digital soil mapping.

LAND CAPABILITY CLASSIFICATION OF RECLAIMED LANDS IN ALBERTA – HISTORY AND FUTURE

Leonard Leskiw, P.Ag.

Dr. Brittany H. Flemming, P.Bio

Dr. Michael Carson, P.Bio

Dr. Konstantin Dlusskiy, P.Ag.

Lee Waterman

Paragon Soil and Environmental Consulting Inc., Edmonton, AB

Corresponding author: len@leskiw.ca

Abstract

Land capability classification in Alberta commenced in the 1960's as part of the Canada Land Inventory: Soil Capability Classifications for Agriculture (1965) and Land Capability Classification for Forestry (1967, 1970). Modifications to these rating systems were made for Alberta natural lands during the 1970's and 80's, with further revisions made in the 90's by cooperative government-industry-consultant committees to make the rating systems applicable to reclaimed lands.

Agricultural or forest capability reclamation assessments, dictated by the land use, have been applied as part of Environmental Impact Assessments and to a lesser extent, Reclamation Certificate Applications since the 1990's. Several industry and government-funded soil and vegetation monitoring projects were also established during this time, as well as numerous graduate and industry-lead research projects, all geared to better understand and improve reclamation practices. What has since emerged from this work is the importance of soil-vegetation relationships based on ecological site types as a driver of land capability, a key consideration that is missing from the current system.

So, are we heading in the right direction and what might we implement to better our knowledge, processes, and outcomes? A few options, such as combining edaphic features, ecological sites, forest productivity, and carbon status are proposed for consideration by industry, consultants, government, universities, and land managers. Renewed collaboration and sharing positive and negative reclamation results provides a preferred pathway to best practices, and more cost-effective and successful reclamation. Alberta is a world leader in land reclamation. It is now time to make refinements based on reviewing past work, selecting the best methods to evaluate the reclaimed lands to meet foreseeable needs, and defining a succinct approach that will work well here and be a model for other provinces and beyond.

Biography

Leonard Leskiw, P Ag, has as a farming background, a B.Sc. and M.Sc. from the U of A, and about 50 years' experience in soils work across Canada and internationally. He conducted many projects including: soil survey, agricultural capability, irrigation suitability, forest capability, soil reclamation and remediation, environmental impact assessment, conservation and reclamation planning, construction monitoring, long term soil and vegetation plot monitoring, and teaching soils and reclamation courses at the University of Alberta as well as for industrial clients.

Leonard worked on government and industry committees in establishing pipeline reclamation criteria, the well site reclamation criteria, and land capability classification systems for reclaimed soils for agriculture and forestry, which all became regulatory guidelines for the Alberta Government. As lead or co-author he published several papers in the Canadian Journal of Soil Science.

UPDATE ON THE SENATE COMMITTEE ON AGRICULTURE AND FORESTRY'S STUDY OF SOIL HEALTH IN CANADA

Senator Paula Simons, MSc

Standing Senate Committee on Agriculture and Forestry

Corresponding author: katelin.cummings@sen.parl.gc.ca

Abstract

On April 26, 2022 the Standing Senate Committee on Agriculture and Forestry was authorized to examine and report on the status of soil health in Canada with the purpose of identifying ways to improve soil health, enable Canadian forest product and agricultural producers to become sustainability leaders, and improve their economic prosperity; That in particular, the committee should examine: (a)current soil conditions in Canada; (b)possible federal measures that would support and enhance agricultural and forest soil health, including in relation to conservation, carbon sequestration and efforts to address the effects of climate change; (c)the implications of soil health for human health, food security, forest and agricultural productivity and prosperity, water quality and air quality; and (d)the role of new technologies in managing and improving soil health.

As part of its study on soil health, the committee has so far;

- Held ten meetings
- Heard from more than 35 expert witnesses
- Received 15 witness briefs
- Visited the Canada Agriculture and Food Museum in Ottawa

Deputy Chair, Senator Paula Simons will provide an update on the committee's findings to date.

Biography

Paula Simons was appointed to the Senate of Canada in 2018, after a long and distinguished career as one of western Canada's most acclaimed journalists.

She has been a radio documentary-maker, a playwright, and an author of popular history, but she is best known for her work as a political columnist and reporter with the Edmonton Journal.

Over the course of her 23 years at the paper, Senator Simons earned two National Newspaper Awards, one for investigative journalism and one for column writing. She earned a further six National Newspaper Award citations of merit for her columns and editorials on Alberta politics.

Her work has also been recognized with awards from the UNESCO Canadian Committee for World Press Freedom, Journalists for Human Rights, the Society for Features Journalism, the Alberta Centre for Civil Liberties Research, the Canadian Bar Association, the Canadian Mental Health Association, and the Edmonton Historical Board.

In 2021, she was nominated for her first National Magazine Award, for her regular column, On Second Thought, which appears in Alberta Views Magazine. She is also the host of her own political podcast, Alberta Unbound.

Senator Simons is the deputy chair of the Standing Senate Committee on Agriculture and Forestry, and a member of the Standing Senate Committee on Transportation and Communications. She has also served as a member of the Standing Senate Committee on Energy, the Environment and Natural Resources.

Born and raised in Edmonton, Senator Simons holds a B.A. Honors degree from the University of Alberta, and a Master's degree from Stanford University.

Soil Health Technical Session Abstracts

Wednesday, February 22, 2023 – Afternoon

MICROBIAL DIVERSITY IS NOT IMPACTED BY MANURE APPLICATION

Erin Hall, Tiffany Traverse, Greg Semach, Bharat Shrestha, Patrick Neuberger, Monika Gorzelak

Erin Hall, Patrick Neuberger, and Dr. Monika Gorzelak

Agriculture and Agri-Food Canada, Lethbridge Research Centre, Lethbridge, AB

Tiffany Traverse

Fourth Sister Farm, BC

Greg Semach

Agriculture and Agri-food Canada, Beaverlodge Research Farm, Beaverlodge, AB

Dr. Bharat Shrestha

Agriculture and Agri-Food Canada, Beaverlodge Research Farm, Beaverlodge, AB

Corresponding author: erin.hall@agr.gc.ca

Abstract

Enhancing soil fertility in small scale farm operations in the Peace Country is an important aspect to maintaining strong food security in the region. Manure has previously been shown to increase organic carbon and total nitrogen pools with effects on crop yield for years after its application. Manure can impact soil health and fertility by increasing the microbial biomass in the soil. Microbial diversity is important for promoting plant productivity, improving drought tolerance, and supporting nutrient cycling. However, it is unknown how livestock manure types can impact microbial diversity in agricultural soils from the Peace Country. A closed-loop farming system was developed at Fourth Sister Farms using four manure amendments (equine, bovine, swine, poultry) as well as a vermiculite treatment. After soil amendment, fava beans were planted in spring 2021 and cultivated. Soil and manure samples were collected both before and during the growing season before characterization of bacterial and fungal communities using high-throughput sequencing. Preliminary findings show enriched fungal richness in vermicompost, with no changes to fungal beta-diversity or taxonomic profiles. The knowledge gathered from this research will be transferrable to a greater community of Indigenous and non-Indigenous growers.

ON-FARM COMPARISON OF MICROBIAL COMMUNITY DIVERSITY AND ASSOCIATED ORGANIC MATTER IN CHERNOZEMIC PROFILES

Patrick Neuberger, Timothy Schwinghamer, Monika Gorzelak, Carlos Romero

Agriculture and Agri-Food Canada, Lethbridge Research Centre, Lethbridge, AB

Carlos Romero

Department of Chemistry and Biochemistry, University of Lethbridge, Lethbridge, AB, Canada.

Kris Nichols, Kimberly Cornish

Food Water Wellness Foundation, Olds, Canada

Corresponding author: patrick.neuberger@agr.gc.ca

Abstract

Grassland soils are critically important to maintaining above and belowground biodiversity, which in turn reflects higher ecosystem functioning. Agriculture represents the largest potential disturbance to prairie ecosystems in Canada and has the potential to affect microbial diversity. We characterized microbial diversity across a gradient of land use intensity in southern Alberta. We predicted that total organic carbon would be an important driver in microbial community diversity and total organic carbon would also vary with land management. Soil profiles were collected from irrigated croplands, rotationally grazed, and adaptive multi-paddock systems. DNA was extracted from these profiles and the microbial communities were sequenced using an Illumina MiSeq Next Generation Sequencer. Preliminary results indicate fungal and bacterial diversity decreased with depth along soil profiles and increased with total organic carbon. These findings indicate that management practices that promote microbial diversity have the potential to increase total organic carbon in grassland soils.

HOW CAN MICROBIAL DIVERSITY BE USED AS AN INDICATOR OF SOIL HEALTH IN DIFFERENT LAND MANAGEMENT CONDITIONS?

Roya Faramarzi and M Derek MacKenzie

Department of Renewable Resources University of Alberta, Edmonton, Canada

Monika Gorzelak

Lethbridge Research and Development Centre Agriculture and Agri-Food Canada / Government of Canada

Corresponding author: rfaramar@ualberta.ca

Abstract

The demand for agricultural products with the increasing global population drives the use of intensive cultivation practices and consequently may affect soil health. However, maintaining soil health can preserve sustainable agriculture, increasing social resilience and food security. Understanding the linkages between indicators of soil health, such as soil aggregate stability, soil organic carbon, and soil microbial community structure, can help to build valuable tools for sustainable agriculture systems. This study examines 1m soil cores split into two depths and taken from three contrasting management practices (adaptive multi-paddock grazing, rotational grazing, and annual cropping) from different ecoregions (Foothills Parkland, Dry Mixed Grass, Northern Fescue, and Foothills Fescue) in Alberta, Canada. Microbial community structure is determined by fungal and bacterial amplicon sequencing, and standard techniques are used for wet aggregate stability. Soil organic carbon was determined by combustion. This study will assess how soil microbial diversity might be influenced under various environmental and land management conditions. We will evaluate whether soil microbial biodiversity and aggregate stability are good indicators for defining soil health. Changes to bacterial and fungal communities will be discussed. The results will inform land users and agricultural stakeholders for more sustainable management of their lands in the future. This study will assess the changes in aggregate stability and soil microbial community under different land management practices.

EFFECT OF NON-NATIVE CICER MILKVETCH ON SOIL CARBON, NITROGEN, AND SOIL MICROBIOME IN CANADIAN DRY MIXEDGRASS PRAIRIE

Michele Tran, Cameron Carlyle, and Malinda Thilakarathna

Department of Agricultural, Food, and Nutritional Science, University of Alberta, Edmonton, AB

Corresponding author: metran@ualberta.ca

Abstract

Cicer milkvetch (*Astragalus cicer* L.) is an introduced perennial forage legume to the Canadian prairies. While cicer milkvetch can increase forage production, it has previously been found to decrease soil carbon. Reductions in soil carbon may be associated with changes in the soil microbiome, which can affect soil carbon and nutrient cycling. Therefore, this research aims to understand how cicer milkvetch may impact the soil microbiome and the ecosystem goods and services provided by grasslands.

Field trials were conducted in the dry mixedgrass prairie region at Mattheis Research Ranch 150 km east from Calgary. Ten plots of cicer milkvetch were randomly selected, each with an adjacent plot of untreated grassland and grassland with nitrogen applied to simulate the legume nitrogen fixation effect. Preliminary results show that total shoot biomass and available soil nitrogen were higher under the cicer milkvetch compared to grass plots without nitrogen fertilizer. However, available soil nitrogen was not significantly different between cicer milkvetch and grass supplied with nitrogen fertilizer, suggesting cicer milkvetch plays an important role in altering soil nitrogen. Soil microbiome, enzyme activity, and CN elemental analysis of vegetation and soils will be performed to understand the mechanisms of which cicer milkvetch reduces the carbon.

SIZE FRACTIONATION OF TRACE ELEMENTS IN SOIL SOLUTIONS RECOVERED FROM SOILS UNDER CONTRASTING LONG-TERM AGRICULTURAL MANAGEMENT

Lina Du, Miles Dyck, Tommy Noernberg, William Shotyk

Department of Renewable Resources, University of Alberta, Edmonton, AB, Canada

Chad W. Cuss

Department of Renewable Resources, University of Alberta, Edmonton, AB, Canada

School of Science and the Environment, Memorial University of Newfoundland, Corner Brook, NL, Canada

Corresponding author: lina2@ualberta.ca

Abstract

Long-term agricultural management practices may impact inherent soil properties which, in turn, play a key role in the speciation and transformation of trace elements (TE) in soil solutions. In this study, we characterized the distribution of TE species in soil solutions into particulate (> 0.45 µm), dissolved (< 0.45 µm), colloidal (1 kDa to 0.45 µm) and mainly ionic (< 1 kDa) fractions. Asymmetrical flow field-flow fractionation (AF4) coupled to UV-Visible absorption (UV) and ICP-MS was used to measure the distribution of dissolved TEs among primarily ionic and small species < 1 nm, organic-dominated colloids and primarily inorganic colloids. Eight soil treatments were chosen from the University of Alberta Breton Plots and associated Bentley Forest Preserve, including the control, NPKS inorganic fertilizer, and manure treatments, applied under different crop rotations (2-year of wheat-fallow rotation and 5-year of cereal-forage rotation), and a forested site (never cultivated). Soil solutions were collected under vacuum using surgical (316) stainless steel lysimeters (5 micron pore size). The acid-cleaned lysimeters yielded excellent blank values for most of the TEs of environmental interest. In the soil solutions, Ag, Al, As, Ba, Li, Pb, Th, Tl, U and V were mainly present in particulate forms. In contrast, dissolved fractions were more important for Cd, Co, Cu, Mn and Mo under some agricultural managements. Among the dissolved fractions of TEs, As, Ba, Co, Li, Mn, Mo and V were mainly present as ionic species. Under wheat-fallow rotation and uncultivated site, V showed higher proportions associated with inorganic colloids from unfertilized soils compared to other cultivated and fertilized soils. Copper was primarily associated with organic matter in soil solutions from treatments with manure. Compared to other TEs, significantly higher proportions of dissolved Al, Pb, Th and U were associated with inorganic colloids. However, their ionic species were predominant from treatments with NKS and (or) NPKS fertilizers.

DIFFERENT LIME APPLICATION INCORPORATION METHODS AND THE EFFECTS ON SOIL ACIDITY REDUCTION.

Mark Wagner, and Tom Jensen

University of Lethbridge, Geography & Environment Department, Lethbridge, AB

Corresponding author: mark.wagner@uleth.ca

Abstract

The use of ammonium-based nitrogen fertilizers ranging from 80 to 120 lb N/acre (90 to 134 kg N/ha) on Southern Prairie soils is resulting in gradual acidification of top soils in the previously neutral to alkaline pH soils. It is generally accepted that the most effective way to apply agricultural lime to an acidic pH topsoil is to spread it on the surface followed by intense tillage incorporation to a depth of about 12 cm. However, many farmers who have used no-till or direct seeding on fields for two to three decades are hesitant to intensively cultivate soils after applying agricultural lime to neutralize soil acidity. A three-site study, near Shaunavon, SK, Skiff, AB, and Strathmore, AB, was conducted, lime applied in early November 2020, comparing three different methods to incorporate lime, namely intense tillage, heavy harrowing, and no incorporation. The results of soil acidity amelioration will be presented as monitored in the Falls of 2021 and 2022.

LIMING ACIDIC PH SOILS AND THE NET EFFECTS ON CO_2 BALANCE

Tom Jensen, Laura Haenni, and Navneet Kaur

University of Lethbridge, Geography & Environment Department Lethbridge, AB

Corresponding author: jenstl@uleth.ca

Abstract

When agricultural lime is applied to a low pH or acidic soil, the general chemical reaction to raise the pH is "**$CaCO_3$ (solid) + $2H^+$ = Ca^{+2} + CO_2 + H_2O".** Initially this looks like a way to contribute CO_2 emissions into the atmosphere. However, the higher more neutral soil pH of the topsoil after liming is more conducive to bacterial activities, especially mineralization of nitrogen. Two related studies were conducted respectively in a greenhouse and in the lab to try and assess the net effect of liming on net CO_2 release to the atmosphere.

Volunteer Technical Session Abstracts

Wednesday, February 22, 2023 – Afternoon

THE UNTAPPED IRRIGATION POTENTIAL OF SOILS IN THE PEACE RIVER REGION

Scott Boorman

Paragon Soil and Environmental Consulting Inc., Edmonton, AB

Corresponding author: sboorman@paragonsoil.com

Abstract

The soils within the Peace River Region have high potential for agricultural development and irrigation. Water availability, uniform landscapes, precipitation, and water holding capacity of the soils all contribute to excellent opportunities for irrigation use in Northern Alberta. Brunisolic, Luvisolic, and Chernozemic soils within the Peace region can all have good to excellent capability for irrigation. Irrigation capability of these soil orders is highly influenced by acidic parent materials, proximity of calcareous materials to the surface, proximity of Bt horizon to the surface, and geological layering with multiple parent materials. Irrigation infrastructure and distance to water sources provides an additional challenge to irrigating soils in the Peace River Region. The irrigation potential and challenges involved with irrigating soils in the Peace River Region will be discussed with specific examples provided from irrigation feasibility assessments.

GRAY LUVISOLS ARE POLYGENETIC

Miles Dyck, Sylvie Quideau, Justine Lejoly

Department of Renewable Resources, University of Alberta, Edmonton, AB

Preston Sorenson

Department of Soil Science, University of Saskatchewan, Saskatoon, SK

Corresponding author: mdyck@ualberta.ca

Abstract

With respect to the pedosphere, human activities in the last 100 years have been the major driver of soil change. Despite human activities being one of the main soil-forming factors recognized by soil scientists (in addition to climate, organisms, parent material, relief, groundwater, and time), the Canadian System of Soil Classification emphasizes soil as a natural body. We argue human-agricultural activities are direct and indirect drivers of significant changes to the carbon balance and cycling in A horizons of Gray Luvisolic soils in western Canada, resulting in changes to A horizon carbon stocks, structure, and micromorphology. Evidence from scientific literature, in-field soil profile observations and the National Pedon Database are presented in support of our argument. We propose a polygenetic, two-stage model of Gray Luvisol soil formation. The first stage is dominated by the climate forcing of the Holocene, resulting in a relatively stable boreal forest ecosystem including relatively minor perturbations from natural and human-induced wildfire and other disturbances. The second stage is dominated by direct, human-driven disturbances such as cultivation, release of exotic fauna (earthworms), and indirect human-driven disturbances associated with anthropogenic climate change. Further, we propose modest amendments to the Canadian System of Soil Classification to reflect a polygenetic model of soil genesis in Gray Luvisolic soils that preserve the balance between observation and interpretation inherent in the system

IMPACT OF CEMENT KILN DUST APPLICATION ON SOIL FERTILITY, GREENHOUSE GAS EMISSIONS AND CROP PRODUCTIVITY

Ali El-Naggar[1], Morgan Duggan[2], Scott X. Chang[1]

[1] Department of Renewable Resources, University of Alberta, 442 Earth Sciences Building, Edmonton, AB T6G 2E3, Canada

[2] Norstar Industries Ltd.

Corresponding author: sxchang@ualberta.ca

Abstract

Cement kiln dust (CKD) is an industrial by-product from the cement industry that has a potential use (as an alternative to limestone) in acidic soils due to its alkalinity nature. This study evaluated the effects of CKD application alone or in combination with a digestate (DG) or a humic acid (HA) along with only 50% of needed chemical fertilizers (HF) on soil properties, greenhouse gas emissions, and crop yield through a field experiment conducted in Breton plots, University of Alberta. Treatments included the application of: 1) CKD-HF, 2) CKD-HF-DG, 3) CKD-HF-HA, 4) CKD with the full amount of needed chemical fertilizers (CKD), and 5) control (CK) with only chemical fertilizer. All plots were planted to wheat. After the addition of the CKD based treatments to the soil, the pH was increased due to the richness of the CKD with calcium, however, this effect was minimal by the end of the experiment, due to the consumption of calcium by the wheat. The application of CKD-HF-DG enhanced the soil available P by 16% compared to the CK by the end of the experiment. The application of CKD-HF-DG increased the soil NO_3^-, and N_2O and CO_2 effluxes rates within two weeks of application, the CKD-HF-HA decreased the N_2O efflux during the first two months, thereafter, the effect of all treatments on the CH_4, CO_2, and N_2O efflux rates was negligible. The CKD- HF-DG and CKD-HF-HA increased the wheat grain yield by 35 and 25%, and the wheat straw biomass by 34 and 18%, respectively, compared to the CK. We conclude that the addition of CKD together with either digestate or humic acid to soil has positive impacts on enhancing soil properties and crop productivity, and decreasing the reliance on chemical fertilizers.

ALBERTA SOILS TOUR 2022: A REVIEW

Konstantin Dlusskiy

Paragon Soil and Environmental Consulting Inc., Edmonton, AB

Ed Karpuk

Alberta Environment and Protected Areas, Red Deer, AB

Corresponding author: kdlusskiy@paragonsoil.com

Abstract

The 2022 biannual Alberta Soils Tour occurred in conjunction with the 2022 conference of the Canadian Society of Soils Science (CSSS). The group of volunteers organized two tours:

- One-day Mid-Conference tour in the Edmonton Region (May 26, 2022)
- Three-days Post-Conference tour from Edmonton to Jasper and Banff National Parks (May 28-30, 2022)

Over one hundred participants from the joint CSSS-ASSW conference attended the tours. Stops along the two tours covered a wide variety of sites. Local and regional pedology were presented using a multi-disciplinary approach that included hydrology, botany, geology, sedimentology, geomorphology *etc*.

The Mid-Conference tour highlighted the variability of landscapes in the Edmonton area with key locations at:

- Glacial Lake Edmonton (Eluviated Black Chernozems on glaciolacustrine and glaciofluvial sediments)
- Cooking Lake Moraine (Orthic and Dark Gray Luvisols on the Edmonton Glacial Till)
- Bruderheim Dune Field (Eutric Brunisols and Terric Mesisols in aeolian dune landscape)

The Post-Conference tour allowed participants to overview the wide range of Alberta landscapes traversing different Natural Subregions along the route with stops to observe:

- Black Chernozems and Humic Gleysols on glaciolacustrine sediments of the Glacial Lake Edmonton
- Dark and Orthic Gray Luvisols on the morainal landscape at the Breton Plots
- Brunisolic Gray Luvisols on shallow bedrock in the Foothills of the Rocky Mountains
- Regosols and Brunisols near the Athabasca Glacier
- Eutric Brunisols and bisequa Gray Luvisols near Jasper
- Reclaimed soils (Fusco Spolic Anthroposols) in a reclaimed coal mine area near Hinton
- Organic soils in treed and shrubby fens along the Foothills of the Rocky Mountains

Comprehensive tour guidebooks were prepared for each Tour and are now available at http://soilsworkshop.ab.ca/history.html

Poster Session Abstracts

Wednesday, February 22, 2023 – Afternoon

USING ARCHIVED SOIL SAMPLES TO EXAMINE CARBON SEQUESTRATION AFTER 20 YEARS OF NO TILLAGE IN ALBERTA, CANADA

Camila Camara De Almeida Cardoso and M Derek MacKenzie

Department of Renewable Resources, Faculty of ALES, University of Alberta, Edmonton, AB

Corresponding Author: camarade@ualberta.ca

Abstract

Sustainable agriculture, a climate change solution, improves soil and environmental health. Moreover, healthy soil supports life and has the fundamental ability to sequester carbon from the atmosphere and stores it below ground long-term. In extreme circumstances, degraded soil health results in desertification and the inability to support life. Maintaining soil's health is, therefore, essential for food security and climate change mitigation. The soil quality monitoring project collected and archived soil samples across Alberta's agroecosystems from 1998 to 2007. In 2019, we resampled these sites with the aim to analyze carbon stability and determine if no tillage has promoted long-term carbon sequestration. The methodological approach of the research is to use Fourier-transform infrared spectroscopy (FTIR) to analyze carbon bonds in soil organic matter (SOM). For this, I will perform FTIR measurement in both bulk soil and in soil oxidized with sodium hypochlorite in order to create a subtraction spectra. The idea is that the oxidation will remove the SOM, thus the subtraction spectra will allow me to analyze only SOM fraction. This study will evaluate whether 20 years of sustainable agriculture can enhance soil carbon sequestration and storage and provide Alberta farmers with a long-term assessment of transitioning to regenerative agriculture.

RESPONSE OF MICROBIAL COMMUNITIES TO LONG- AND SHORT-TERM COORDINATED NITROGEN AND SULFUR FERTILIZATION

Laura Bony, Miles Dyck, and Sylvie Quideau

Department of Renewable Resources, University of Alberta, Edmonton, Alberta

Corresponding Author: lbony@ualberta.ca

Abstract

Soil nutrient stocks and cycling have been greatly affected by crop rotation and fertilization. If nutrients removed in harvested crops are not replaced, soil health, crop productivity and quality may decline. This research aims to assess the response of crops and microbial communities to N and S fertilizer applications. More specifically, our target is to quantify the effects of long- and short-term N and S fertilizer applications on the efficiency of elemental S oxidation, soil N mineralization, and soil microbial communities and enzymes involved in N and S cycling in agricultural soils with different fertilization histories. The research project takes place at the Breton Classical Plots in Alberta and includes six long- and four short-term treatments. Long-term treatments include manure, NPKS, NS, Control, NPK, and PKS. Short-term treatments include granular micronized sulfur fertilizers blended with urea. Soil was sampled at the depths of 0 to 7.5 and 7.5 to 15 cm and analyzed for basic soil properties and microbial communities using PCR. The results of these findings will provide information on fertilizer use efficiency with coordinated management of N and S for supporting on-farm nutrient management decisions. Further, this research will contribute to quantifying the link between soil health and nutrient stewardship.

INVESTIGATING PYROGENIC CARBON CONTENT AND CHARACTER OF MONTANE SOILS OF THE SOUTHERN ROCKIES POST WILDFIRE

Nathan Storey, Miles Dyck and Sylvie Quideau

University of Alberta, Edmonton, AB

Corresponding Author: nstorey@ualberta.ca

Abstract

Pyrogenic carbon is a broad continuum of compounds of varying physicochemical character. The role of these compounds in fire adapted ecosystems, such as the boreal forest and montane environs of Canada, is currently understudied. We do know, however, that these compounds play a key role in natural carbon sequestration mechanisms at northern latitudes. Pyrogenic carbon has many interaction effects with soil organic matter, soil physical properties, and soil microorganisms. The objective of this research is to quantify and qualify the content and character of pyrogenic carbon in the soils of Waterton Lakes National Park at two timescales.

This observational study collected soils at depths of 0-5cm and 5-15cm from 15 burned sites within 5 watersheds and 10 unburned reference sites within 2 watersheds 4 years after the Kenow wildfire. These and soil samples collected by Parks Canada immediately following the fire were evaluated using the Walkley-Black titration method to determine the pyrogenic carbon content and were compared spatially, temporally, by depth, and between burned and reference. Preliminary results suggest trends associated with depth are reversed between burned and unburned sites, and the relationship between pyrogenic and total carbon is very similar between 2018 and 2021 samples, with the soils collected immediately following the fire exhibiting higher quantities of pyrogenic carbon. Linkages between the hillslope and streams are being actively investigated.

EXPLORING THE AGRONOMIC AND SOIL HEALTH BENEFITS OF LIMING IN THE CANADIAN PRAIRIES

Priscillar Wanyama, Miles Dyck, Linda Gorim

University of Alberta, Department of Renewable Resources, Edmonton, Alberta

Corresponding Author: wenyika@ualberta.ca

Abstract

Crop production is limited by acidic soils in many parts of the world. Acidic soils constitute about 30% of the world's land and about 50–80% global land that could be arable. In Canada, occurrence of acidic soils has been reported since the 1960s in Alberta and northeastern British Columbia with about a third of the soils having a pH of 6 or lower. About 6.3 million acres of land in Western Canada is considered acidic (pH 6.0 or less) and another 8.5 million acres have a pH of 6.1–6.5. Farmers severely impacted by acidic soils have resorted to forage production instead of grain crops in some of their fields. With the long-term and increasing rates of application of N fertilizers, soils might become increasingly acidic across Western Canada. Lime is not commonly used in the Canadian prairies because of its high costs. Information on the best liming sources, optimizing its application rate (timing and frequency) and its impact on soil health and crop productivity still need further investigation. Cement kiln dust (CKD) is a potential ideal source of lime for use in rectifying acidic soils in the prairies. CKD is affordable and readily available for farmers in Alberta. However, there is need for evaluations to determine the ideal application rates. Soil tests for estimation of lime requirements and time of application for the Prairies are required. Field-based research on CKD still remains unclear. We currently thus do not have a baseline for the benefits of liming in major crops grown in the prairie provinces. Therefore, this project aims at investigating the benefits of liming on ameliorating acidic soils and improving soil health. Soil samples were collected from limed plots and control plots at depths of 0–15, 15–30 and 30–60 cm. Measured soil health indicators include pH, CEC, exchangeable cations, readily soluble Al and Mn, soil texture, available NPKS, organic C, total C, total N and soil microbial community structure (16S rRNA and ITS) in lime versus no lime plots. Analyses were performed at the University of Alberta Natural Resources Analytical Laboratory.

DIFFERENTIAL RESPONSES OF BACTERIAL COMMUNITIES ACROSS GEOGRAPHIC LOCATIONS AND ECOZONES IN ALBERTA AGRICULTURAL FIELDS AMENDED WITH UREA AND HUMIC-BASED AMENDMENTS

Rhea Amor Lumactud, Linda Gorim, and Malinda Thilakarathna

Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB, Canada

Corresponding Author: lumactud@ualberta.ca

Abstract

Soil is a diverse and complex habitat that supports ecological services. However, intensive chemical fertilizers and pesticide use have led to soil health issues. Thus, a sustainable strategy, such as using humic-based products (HPs) such as humalite as biostimulants, is needed to support agricultural productivity while maintaining the health of the agroecosystem and reducing reliance on agrochemicals. We explored the impacts of HPs application and its cumulative effects on the soil microbiome in wheat (first year) and canola (second year) across four Alberta ecozones.

Preliminary results showed four distinct microbial communities, as revealed by Principal coordinate analysis, which corresponds to geographic locations and soil parameters. Bacterial diversity significantly differs; all sites were predominated by Actinobacteria, followed by Proteobacteria and Acidobacteria, in the first-year wheat field trial. We did not observe significant impacts of HPs application on soil bacterial communities and parameters in the first year. However, we observed significant responses on the relative abundance of some bacterial groups and key soil parameters with urea application, which are influenced by geographic location. Though preliminary, these results suggest that soil health and sustainable management recommendations are context-specific and dependent on the site or ecological zone, among other factors.

HUMALITE AS SOIL AMENDMENT FOR IMPROVING SOIL HEALTH

Sumedha Vaishnavi Nallanthighal, Karanjot Gill, Malinda Thilakarathna, and Linda Gorim

Department of Agriculture, Food and Nutrition Science, University of Alberta, Edmonton, AB

Corresponding Author: nallanth@ualberta.ca

Abstract

Increasing demands for food production, often accompanied by the overuse of chemical fertilizers, have contributed to soil degradation. Biostimulants such as humic substances like 'Humalite' are known to maintain soil health by increasing soil physical, chemical, and biological properties. 'Humalite' is a naturally occurring coal-like material with a high humic acid concentration. A field study was conducted at four sites and three soil zones in Alberta to evaluate humalite application as a strategy to promote soil health and reduce the amount of nitrogen fertilizer applied in crop production. The objectives of this study were: (a) to assess humalite effects on different soil health indicators, and (b) to evaluate whether humalite application can lead to reduced urea application rates. At four sites, five humalite and three urea application rates were assessed in a split-plot design with wheat (2021) and canola (2022) Soil parameters such as active carbon, microbial respiration, ammonium, nitrate and pH were analyzed at flowering stage. No clear pattern of humalite effect on soil health was observed in Year1. Results from Year2 indicate an increase in microbial respiration, microbial biomass and soil pH and a reduction in nitrate concentration and active carbon.

INVESTIGATING THE SUBSTRATE ADSORPTION KINETICS OF NAPHTHENIC ACID FRACTION COMPOUNDS FROM OIL SANDS PROCESS-AFFECTED WATER

Camryn Charriere and Douglas Muench

University of Calgary, Calgary, AB

John Headley

Environment and Climate Change Canada, Saskatoon, SK

Corresponding Author: dmuench@ucalgary.ca

Abstract

Bitumen mining in the Athabasca oil sands region of northern Alberta results in the accumulation of large volumes of oil sands process-affected water (OSPW). Naphthenic acid fraction compounds (NAFCs) are a class of organic compounds that contribute to OSPW toxicity. The oil sands industry aims to identify large-scale, low input approaches to reduce OSPW toxicity and NAFC concentrations. Among the approaches that are being investigated is phytoremediation, a natural and low-cost approach that utilizes plants and their associated microbes to treat wastewater. Previous studies have demonstrated that phytoremediation approaches for OSPW are effective in reducing toxicity and organics levels. While there is evidence for bioremediation of NAFCs using this approach, adsorption to the soil sediment is likely a contributor to NAFC removal. The adsorption of NAFCs onto soil surfaces can be described by a linear isotherm, where the adsorption coefficient (K_d) can be measured by the mass of solute adsorbed per dry weight of solid (S) and the concentration of the solute in the soil solution (C) at equilibrium (K_d=S/C). We will describe NAFC adsorption experimental results using a native soil substrate supplemented with various levels of organic compounds. The use of sterile and non-sterile environments assists in accounting for soil partitioning in mass balance calculations. In addition, the selective adsorption of specific NAFC classes are analyzed to explore the features of individual classes that may demonstrate higher binding capabilities.

BIOAUGMENTATION OF THE PLANT RHIZOSPHERE TO SUPPORT CONSTRUCTED WETLAND TREATMENT SYSTEMS FOR OIL SANDS PROCESS-AFFECTED WATER

Annie Zymela, Lisa Gieg and Douglas Muench

The University of Calgary, Calgary, AB

Corresponding Author: dmuench@ucalgary.ca

Abstract

The extraction of bitumen from oil sands in the Athabasca region of northern Alberta results in the generation of large quantities of oil sands process-affected water (OSPW). Natural organic acids, called naphthenic acid fraction compounds (NAFCs), accumulate in OSPW and are primary contributors to its toxicity towards aquatic organisms. The oil sands industry is actively assessing low-energy water treatment approaches to remediate OSPW. Constructed wetland treatment systems (CWTS) harness the natural potential of wetland plants, microbes, and geochemical processes to remove pollutants from wastewater. Plants have an important role in supporting root-associated microbial growth in CWTS. However, the complex plant-microbe interactions that foster the removal of NAFCs are still largely unknown.

The aim of this research is to better understand the synergistic plant-microbe interactions that take place in CWTS. The research presented here involves the identification of NAFC-degrading microbes from root tissues to curate specialized microbial communities that can be tested in NAFC biodegradation scenario. Several NAFC degrading communities from CWTS are being characterized using genome sequencing approaches. These communities are being selectively enriched and will be tested at a mesocosm scale in bioaugmentation studies for increased efficiency of OSPW phytoremediation. The results of this research may assist in guiding large-scale CWTS approaches for OSPW treatment.

DETERMINING SPECIFIC COMPOST BLENDS FOR REGENERATIVE AGRICULTURE IN CENTRAL ALBERTA

M.D. Mackenzie[1], B. Lanoil[2], M. Khodaei[1], C. Cardoso[1], Z. Fries[1], S. Cui[1], J. Kowalski[1]

[1]Department of Renewable Resources, University of Alberta, Edmonton AB

[2]Department of Biological Sciences, University of Alberta, Edmonton AB

Corresponding Author: mdm7@ualberta.ca

Abstract

With cities like Edmonton producing source separated organics (SSO) from their municipal solid waste streams, more compost will be available for use in agriculture fertility. Currently there is no recommend rate of application of compost for grain production in AB and it is not clear if inorganic fertilizers will need to be used to off-set nutritional requirements not met by the slow release fertility of compost. A carbon (C) credit protocol for producers using compost also needs to be created to offset the extra expenses and incentivize producers. We propose to test several compost blends on different soil types, under canola production to begin generating data to show if this system will work in AB. Specific blends will be factorial combinations of compost, biochar, gypsum, and wood ash, replicated three times at each site. PRS probe data for pre-growing season samples showed differences between compost blends and soil type. Canola yields varied by soil type and treatment with similar results for compost and synthetic fertilizers. Respiration indicated that microbial activity was affected by treatment and differed between soil types. Further data are being analyzed, including microbial diversity and function, seasonal GHG emissions, and C sequestration.

LEAD-SATURATED BIOCHAR-SOIL INTERACTIONS: CONTAMINATION RISKS AND RELEASE DYNAMICS OF PB

Ali El-Naggar, Christopher Nzediegwu, M. Anne Naeth, Scott X. Chang

Department of Renewable Resources, University of Alberta, 442 Earth Sciences Building, Edmonton, AB T6G 2E3, Canada

Corresponding author: sxchang@ualberta.ca

Abstract

Biochar has received growing interest for its environmental applications including the sustainable management of agricultural and animal wastes and the remediation of contaminated soils and waters. Biochar is an efficient tool for the removal of several toxic elements from contaminated water, mainly via the adsorption of contaminants onto the biochar surfaces. The soil application of biochar saturated with toxic elements (spent biochar), after its separation from the water, and its interaction with soil are still under research. In the current study, wheat straw and cattle manure biochars and their spent Pb-saturated biochars were applied into loamy soil to investigate the spent biochar-soil interactions via incubation experiment. The overall aims were to evaluate: 1) the risk of Pb contamination in soil treated with spent Pb-saturated biochar, and 2) the release dynamics and distribution of Pb among different geochemical fractions in soil treated with spent Pb-saturated biochar. The pH values of the spent Pb-saturated biochars were 37 and 29% lower than the wheat straw and cattle manure biochars, respectively. The decrease in biochar pH after saturation with Pb would affect soil fertility, and Pb stability onto biochar surfaces when applied to soil. The Pb stability on surfaces of spent Pb-saturated biochar in soil, Pb phytoavailability, potential mobility risks and re-distribution among different geochemical fractions in the soil will be presented.

Banquet Presentation

Wednesday, February 22, 2023 – Evening

"Going Wild in Strange Times"

A spirit lifting journey
into some of the best Canadian wilderness locations.

A keynote presentation by Brian Keating

Feeling tired of Covid?

Get out.

That's right, get up & get outside!

The restorative powers of Nature simply cannot be overstated. If we invest the necessary focused awareness, time and energy, the outdoors can tell us so much about ourselves and the world around us.

For this presentation, after some brief forays into some international locations, Brian will return us to his own western Canadian landscapes, reconfirming the value of our collective understanding of the importance of wild spaces and the creatures that have adapted to live there.

What remarkable Western Canadian locations did Brian explore over the last three years? What energizing face-to-face encounters did he have?
How has he managed to attract so much wildlife to his inner city garden?

Brian is an international tour guide and professional speaker. He also was mostly unemployed during Covid 19. But the opportunities that opened up will be told as only Brian can, with humour and anecdotes that are guaranteed to give you a better understanding of all things locally wild.

The presentation is designed to inspire and enthuse, offering hope for a better tomorrow.

Brian Keating

Head Naturalist of goingwild.org & co-director of greatBIGnature.com

Honorary Conservation Advisor, Calgary Zoological Society
Former Adjunct Assistant Professor of Anthropology, University of Calgary

For half of his 30 year career at the Calgary Zoo Brian was the Director of Education. For the other half, he was the founding Director of Conservation, where he raised money and spent it on environmental projects around the world. Presently, he's the Zoo's Honorary Conservation Advisor to their outreach conservation efforts. For just over 20 years, he was a part-time Adjunct Assistant Professor of Anthropology at the U of C. He's presently the owner of www.goingwild.org and co-producer of www.greatBIGnature.com

Brian has been leading groups on nature-based travel for just under four decades, exploring some of the best wildlife areas on the Planet. He's a weekly guest on Calgary's CBC Radio, and for many years, was a regular on the Discovery and Canadian National Geographic channels, using much of his own wilderness adventure and wildlife filming to tell stories about the value and importance of nature. He's in high demand as an international speaker, presenting at some 40 events a year.

His wife, Dee, is a retired physician and keen naturalist who always joins him on his adventures.

Land Reclamation Technical Session Abstracts

Thursday, February 23, 2023 – Morning

CREATION AND AFFORESTATION OF A PHOSPHOGYPSUM ANTHROSOL

Connie Nichol

Nutrien, Fort Saskatchewan, Alberta

Corresponding author: connie.nichol@nutrien.com

Abstract

Phosphogypsum (PG) is a by-product of phosphorus fertilizer production that is stored in large piles (stacks). Typically, PG stack reclamation focuses on engineered soil caps vegetated with grass. Research has shown that rather than this traditional approach, gypsum stack reclamation can be improved by creating an Anthrosol and planting trees in the gypsum/soil mix. Concentrated woody plantations of willow and hybrid poplar have been established on 25 hectares of PG stacks at the Nutrien facility in Fort Saskatchewan, Alberta, Canada. These trees are sequestering carbon at a rate of 30 t CO2 eq/ha/year to combat climate change while producing woody biomass that can potentially be used for green energy. The woody plantations have been shown to be sustainable and environmentally protective while preventing water infiltration into the stacks.

ASSESSING SOIL PHYSICAL FACTORS ON ROOT SYSTEMS DEVELOPMENT AND GROWTH OF DIFFERENT PLANT FUNCTIONAL TYPES ON PHOSPHOGYPSUM STACKS

Emmily MacDonald

Department of Renewable Resources, University of Alberta, Edmonton, Alberta

Pak Chow, Miles Dyck, Simon Landhäusser

Department of Renewable Resources, University of Alberta, Edmonton, Alberta

Connie Nichol

Environmental Coordinator, Nutrien Ltd., Fort Saskatchewan, Alberta

Corresponding author: emmily@ualberta.ca

Abstract

Reclamation of waste piles using phyto-caps is an environmentally advantageous option as it can be a cost-effective method for disposal while mitigating contaminant release. In the case of phosphogypsum (PG) - a by-product of the phosphate fertilizer industry, a phyto-cap needs to be effective in containing a highly erodible material that has the propensity to leach radioactive and trace elements. Therefore, the vegetation used on reclaimed PG stacks must be viable long-term, decrease water infiltration, and with that erosion potential.

To assess the use of three different plant functional types (tree, shrub, grass) on PG stacks, a two-part study was conducted to explore the rooting behaviour of these vegetation types established on a reclaimed stack at Nutrien Ltd. Fort Saskatchewan, AB. To explore some of the mechanisms in depth, I also executed a controlled study on the rooting behavior of seedlings in relation to PG physical parameters. Soil cores taken on the reclaimed stack within the areas consisting primarily of the three different types showed that grasses and hybrid poplar trees had established their root systems up to 85cm into the stack material. In contrast, willow limited its rooting to a depth of 50cm; however, soil physical factors such as bulk density, volumetric water content, and air-filled porosity measured in the field did not show a relationship to overall root density or root penetration for all three types. To explore these relationships further, I tested the interaction between PG bulk density (BD) and plant available water (WC) on the growth and rooting behaviour of *Populus balsamifera* in a controlled greenhouse study. Results indicate that when BD was low (1.0 g cm^{-3}), WC did not play a role in seedling growth and roots egressed normally into the PG; however, when BD was higher (1.15 and 1.3 g cm^{-3}), growth only increased when WC was high, which is likely due to new roots growing only below the surface of the PG material. The findings of this research will give further insights into the use of different vegetation types and their resiliency as phyto-caps for PG stacks.

RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION ON AGRICULTURAL SOILS OF THE CANADIAN PRAIRIE

Ivan R. Whitson

I Whitson Innovations Inc., Edmonton, AB

Corresponding author: iwhitson@telus.net

Abstract

The objective of this study was to determine if reclamation on a major pipeline corridor had achieved equivalent agricultural capability. The pipelines dated from the 1960's (Line 3), 2000's (L67, the Alberta Clipper) and 2010's (L3R, Line 3 Replacement). Soil units on the Enbridge corridor were ranked in terms of physical and chemical properties expected to influence reclamation outcomes, and the most sensitive were sampled. Six quarter sections were chosen randomly from a set of 56 that possessed the target soils. Capability ratings were determined with the 1995 federal system.

Land capability on the pipelines was mostly class 4 with some class 3, whereas the reverse was true for references. The downward shift in the mode on the pipelines reflected soil physical and chemical differences between pipelines and references. These included greater frequency of inorganic carbonate detection in topsoil and subsoil, and greater calcium carbonate equivalent and higher topsoil pH on pipelines. Average total organic carbon increased from L3R to L67 to L3 but was highest in the references. For the target soils, representing 17% of the length of the Enbridge corridor, equivalent capability has not been achieved.

COMBINING REFORESTATION APPROACHES: TARGETED UTILIZATION OF NATIVE PLANTS AND HERBICIDES TO BATTLE UNDESIRABLE VEGETATION

Mark Baah-Acheamfour, Amanda Schoonmaker

Centre for Boreal Research, Northern Alberta Institute of Technology (NAIT), Peace River, AB

Stefan G. Schreiber

EnviroStats Solutions Inc, Edmonton, Alberta, Canada

Eckehart Marenholtz

Chickadee Reclamation Services, Edmonton, Alberta, Canada

Corresponding author: aschoonmaker@nait.ca

Abstract

This 5-year study tested the principle of accelerating cover dominance of native plant communities to the exclusion of undesirable pioneer species on reclamation sites from two perspectives: weed suppression and native species establishment. A split-plot design with weed suppression as the main plot and native species establishment as the split-plot factor was used. Weed suppression treatments included: wood mulch, plastic film mulch, rototilling, pre-emergent herbicide (torpedo applied at 580 g ha^{-1}), and untreated control. Native species establishment treatments included: roots-in-a-bag, hitchhiker, native grass seeding and normal planting (control). Key findings by year 4 were: (1) aspen benefitted the most when the presence of forbs and grasses reduced markedly by year 4; aspen density also increased the most ($P < 0.001$) in film mulch, rototill, and torpedo than wood mulch or control, (2) stem density of all trees and shrubs combined were more than twice in the film mulch, rototill and torpedo compared to the wood mulch or control, (3) white spruce establishment with hitchhiker or root-in-a-bag was more than twice the density in native grass seeding or normal planting, and (4) native grass seeding, hitchhiker and normal planting treatments were associated with the highest aspen survivorship consistently from years 1 to 3 ($P < 0.05$) and by year 4, it was significantly greater only in native grass seeding and hitchhiker treatment. Given the above, we re-measured the trial in year 5 (data to be presented to the workshop) to better represent an operational best practice for excluding undesirable competitor species, while giving seedlings a head-start in growth in land reclamation.

APPLICATION OF GENOMICS TO ENHANCE CONSTRUCTED WETLAND TREATMENT SYSTEMS FOR REMEDIATION OF OIL SANDS PROCESS-AFFECTED WATER

Mitchell Alberts and Douglas Muench
University of Calgary, Calgary, AB

Christine Martineau
Laurentian Forestry Centre, NRCan, Québec, QC

Corresponding author: dmuench@ucalgary.ca

Abstract

Surface mining of oil sands in the Athabasca region of northern Alberta generates large volumes of oil sands process-affected water (OSPW) that accumulates in on-site storage facilities. The toxicity of OSPW is largely due to the accumulation of naphthenic acid fraction compounds (NAFCs) that are a natural component of the oil sands ore. Efficient, low cost and large-scale OSPW remediation technologies must be available to address the challenge of reducing the organics levels and toxicity of OSPW. Constructed wetland treatment systems (CWTS) are one of very few scalable and cost-effective technologies for remediating large volumes of wastewaters. The attenuation of NAFCs in CWTS, in part, involves cooperative processes between naturally occurring microbial communities and wetland plants. However, the conditions required to establish optimal wetland biological communities to degrade NAFCs and detoxify OSPW are not well understood. The goal of this research project is to apply genomics-based methods to better understand the mechanisms of NAFC removal from OSPW and to provide insight on approaches that will enhance the efficacy of CWTS for OSPW treatment. In this presentation, we will provide an overview of the project and discuss early results from our research.

BIOENGINEERING AS A PROGRESSIVE SOLUTION TO BANK EROSION IN PUBLIC GREEN SPACES

Stephanie Reddecliff

Paragon Soil and Environmental Consulting Inc., Edmonton, AB

Corresponding author: sreddecliff@paragonsoil.com

Abstract

Green spaces are regarded as leading elements in the promotion of environmental sustainability and quality of life in urban areas, increasing the need for preservation of existing infrastructure and access. Dynamic waterways such as rivers and streams are common focal points within green spaces in the Edmonton region, however, these areas are subject to constant change due to erosion, drought, and flooding. While some changes to banks may be considered beneficial, consistent and compounding changes can be detrimental to urban green spaces.

The Watershed Resiliency and Restoration Program (WRRP) facilitated a progressive and collaborative bioengineering plan implemented by Paragon Soil and Environmental Consulting Inc., Associated Environmental Consultants Inc., and the Town of Devon, with the goal of building long term resiliency and improving natural watershed functions in several parks within Devon, Alberta. Using natural techniques progressively over time, such as bioengineering, instead of structural restoration or conventional construction was preferred in these parks to minimize loss of public access and maintain the natural aesthetic of the parks.

Bioengineering treatments were determined with primary goals of establishing systems for water management and systems for steep slopes to slow erosion and establish native vegetation for bank stabilization. Water management treatments included dense live toe staking with willow and red-osier dogwood (*Cornus stolonifera*), live pole drains with willow, and poplar staking with balsam poplar (*Populus balsamifera*), while systems implemented for management of steep slopes included wattle fence construction with balsam poplar. Additional bioengineering techniques such as live silt fences, live gully breaks, live bank protection, modified brush layers, live reinforced earth walls, and brush layers in a cut or fill are other techniques commonly used and could be considered for future treatments should site conditions allow.

Implementation of these treatment plans over time on the banks of Battery Creek and the North Saskatchewan River has identified challenges that impacted overall success of the bioengineering treatment areas, including wildlife, extreme weather events, spring freshets, ice floes and ice shoves.

REMEDIATION OF HEAVY METALS FROM OIL SANDS PROCESS WATER USING BIOCHAR

Abhijeet Pathy, Christopher Nzediegwu, M. Anne Naeth, Scott X. Chang

Department of Renewable Resources, University of Alberta, Edmonton, AB

Land Reclamation International Graduate School, University of Alberta, Edmonton, AB

Corresponding author: sxchang@ualberta.ca

Abstract

Due to its large volume and presence of hazardous contaminants, oil sands process water (OSPW) remediation must be both efficient and cost-effective. Biochar, a carbon-rich substance created by thermochemical decomposition of biomass in the absence or presence of oxygen, could be a viable solution. Biochar is a well-known adsorbent that has been used to remove a variety of pollutants over the past decade. Nevertheless, there are two significant limitations: (i) the majority of adsorption studies are conducted with synthetic solutions (contaminants), and (ii) the majority of adsorption studies are conducted at the laboratory scale. These constraints prohibit biochar's widespread usage as an adsorbent. This work remediates OSPW heavy metal pollution using biochar produced at large scales. We used two distinct biochars (canola straw and wheat straw) produced in a laboratory and on an industrial scale. X-ray diffraction, Brunauer-Emmett-Teller, Fourier Transform Infrared Spectroscopy, and scanning electron microscopy, among other characterizations, were used to study and compare these biochars' physical and chemical properties. The study will further evaluate the adsorption performance of produced biochars through a bench-scale experiment with the aim of scaling up the process. This study's result will encourage industries to scale up biochar production for wastewater remediation.

Soil Fertility Technical Session Abstracts

Thursday, February 23, 2023 – Morning

WINTER WHEAT RESPONSES TO ENHANCED EFFICIENCY GRANULAR NITROGEN FERTILIZER IN THE CANADIAN PRAIRIES

Zhijie Wang, Jennifer L. Owens, Xiying Hao, Elham Rahmani, Rezvan Karimi and Brian L. Beres

Agriculture and Agri-Food Canada, Lethbridge Research and Development Centre, Lethbridge, AB

Ben.W. Thomas

Agriculture and Agri-Food Canada, Agassiz Research and Development Centre, Agassiz, BC

Ken. Coles

Farming Smarter, Lethbridge County, AB

Chris. Holzapfel

Indian Head Agricultural Research Foundation, Indian Head, SK

Kabal S. Gill

SARDA Ag Research, Falher, AB

Corresponding author: brian.beres@agr.gc.ca

Abstract

Optimizing the timing of nitrogen (N) enhanced efficiency fertilizers (EEFs) may maximize winter wheat (Triticum aestivum L.) grain yield, protein content, and N-use efficiency (NUE). From 2013 to 2018, experiments were conducted at two irrigated and six rain-fed sites across the Canadian Prairies (24 site-years) to evaluate winter wheat responses to N source and timing/placement effects of EEFs. Nitrogen sources included untreated urea, nitrification inhibitor nitrapyrin treated urea (Nitrapyrin), urease inhibitor N-(n-butyl) thiophosphoric triamide (NBPT) plus nitrification inhibitor dicyandiamide (DCD) treated urea (NBPT+DCD), and polymer-coated urea (PCU). The N sources were all side-banded at planting, 30% side-banded at planting plus 70% broadcast in-crop late-fall (averaged 38 days after planting; split-applied late-fall) or 30% side-banded at planting plus 70% broadcast in-crop early-spring (averaged 224 days after planting; split-applied early-spring). Nitrous oxide and methane emissions were measured at one rain-fed site to test whether N source and timing/placement influenced CO2-equivalents (CO2-eq; nitrous oxide+methane). Under irrigation, NBPT+DCD consistently produced the highest yields regardless of timing/placement; however when all side-banded at planting, grain protein content was at times sub-optimal (≤11%). This concern was effectively remedied by a split-applied early-spring strategy. Untreated urea produced the highest net CO2-eq and yield-scaled CO2-eq emissions, with the highest emissions when urea was split-applied early-spring. To optimize winter wheat production and NUE when using granular EEFs, our results suggest that producers may side-band all NBPT+DCD at planting or split-apply early-spring under irrigated environments and side-band all NBPT+DCD at planting under rain-fed environments in the Canadian Prairies.

IMPLICATIONS OF SOIL NITROGEN CYCLING FOR IMPROVING FERTILIZER N USE EFFICIENCY

Eric Bremer

Western Ag Innovations, Lethbridge, AB

Ben Ellert

Agriculture and Agri-Food Canada, Lethbridge Research Centre, Lethbridge, AB

Corresponding author: ericbremer@westernag.ca

Abstract

Crop recovery of at most 50% of the nitrogen applied in fertilizers is often attributed to large N losses that can be substantially reduced. However, despite considerable efforts, improvement in N fertilizer efficiency has been limited. A partial explanation is that a substantial proportion of the fertilizer N not recovered in crops is recycled through soil organic matter and recovered in subsequent crops. Under cereal cropping systems on the Canadian prairies, about half (24 to 78%) of fertilizer N not recovered by crops in the year of application was recovered in soil. Based on long-term ^{15}N studies, this N is slowly released to crops over a time period of decades to centuries. Total recoveries may be as high as 90% if environmental N losses after application and during subsequent non-growing periods are minimized. Strategies to monitor and maximize crop recovery of fertilizer N will be discussed

SOIL ORGANIC NITROGEN PRIMING TO NITROUS OXIDE: A SYNTHESIS

Erin J. Daly, Guillermo Hernandez-Ramirez

University of Alberta, Edmonton, Alberta

Kate A. Congreves

University of Saskatchewan, Saskatoon, Saskatchewan

Tim Clough

Lincoln University, Lincoln, New Zealand

Carolina Voigt

University of Eastern Finland, Kuopio, Finland

Eliza Harris

ETH Zurich, Zurich, Switzerland

Reiner Ruser

University of Hohenheim, Stuttgart, Germany

Corresponding author: edaly@ualberta.ca

Abstract

The priming effect (PE) is the short-term change in soil organic matter (SOM) mineralization in response to external stimuli, such as additions of carbon (C) and nitrogen (N) to soil. The PE is a critical consideration for the stability of SOM, and literature has largely framed the PE in terms of C, measured as CO_2 evolved from SOM. Fewer publications to date have focused on how the PE affects the soil N cycle, and the subsequent alteration of biogenic N_2O production as a result, despite the potency of N_2O as a greenhouse gas and ability to destroy stratospheric ozone. This review summarizes our current understanding of how the PE can amplify or diminish N_2O production from soils, henceforth referred to as N_2O priming. Diverse results across individual studies suggest that the underlying mechanisms of N_2O priming cannot be fully explained by a single hypothesis and disentangling the complexity of N_2O priming requires the integration of multiple co-occurring mechanisms. Therefore, we identified key research needs as follows: investigation into the potential control that C:N ratios of added substrates and soils exert on N_2O priming, incorporation of N_2 and N_2O isotopomer measurements in N_2O priming studies to better quantify the relative contribution of different N_2O producing processes, conducting studies with and without the presence of living plants to capture the influence of contrasting rhizodeposition (quantity and quality), and conducting long-term research on soils with different management histories, to better understand how soil memory might dictate the magnitude and direction of N_2O priming. Finally, we propose that the development and validation of models that can accurately simulate the complexity of soil N dynamics and account for the feedback effects of climate change on N_2O priming is a key research gap that must be addressed, namely in under-studied areas including permafrost-affected areas of the arctic, subarctic, and alpine regions, where the effects of climate change on N_2O priming may be amplified but are currently largely unaccounted for.

NITROGEN RATE OF RETURN CALCULATORS FOR BROWN, DARK BROWN AND BLACK SOILS

Rigas Karamanos, Jeremy Boychyn and Sheri Strydhorst

Alberta Wheat and Barley Commissions, Calgary, AB

Corresponding author: R. Karamanos rkgeoponica@gmail.com

Abstract

A historical database of 168 wheat and 182 barley field trials, conducted in Alberta, were utilized to develop a nitrogen (N) economic response decision making tool. The tool helps growers understand possible economic returns under varying N fertilizer rates and crop prices. Substantial changes in crop and fertilizer prices in the past years demonstrate the value and need for this tool.

This tool is based on yield responses under various soil zones and nitrate levels. A similar tool was developed in the early 2000's for western Canadian and Manitoba soils. The tool, originally developed in excel format, allows users to evaluate various N specific net returns per acre scenarios depending on: N source, N cost, expected crop price, and soil nitrate-N to the 60 cm depth. First, users select their soil type: black, dark brown and brown. Next, users select the appropriate soil zone and crop (wheat or barley), which in turn determines N response. Then, users select fertilizer source and cost, crop price, N fertilizer rate (based on yield target) and soil test N. Finally, the tool determines the N fertilizer rate likely to provide maximum net returns. The calculators can be accessed at: https://www.albertawheatbarley.com/the-growing-point/articles-library/nitrogen-calculators-for-black-dark-brown-and-brown-soil?setcommission=alberta-wheat

EFFECT OF HUMIC ACID-BASED SOIL AMENDMENTS ON SOIL NITROGEN AVAILABILITY AND WHEAT GROWTH

Pramod Rathor, Vianne Rouleau, Linda Gorim and Malinda Thilakarathna

Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB T6G 2P5, Canada

Corresponding author: prathor@ualberta.ca

Abstract

The application of synthetic chemical inputs in current agricultural practices has significantly improved crop production, but their utilization has severe irreversible negative consequences on the environment. Application of biostimulants, including humic substances such as humalite found in deposits in southern Alberta and rich in humic acid (HA), has recently gained significant attention as a potential biostimulant to improve soil health and crop production. Therefore, a series of controlled environmental studies were conducted in greenhouse to understand the beneficial effects of humalite on wheat root architecture and agronomic parameters by applying different rates of humalite together with recommended NPK fertilizer. Humalite increased the total available soil nitrogen (NO_3^- and NH_4^+) during the growing period compared to the plants supplied with recommended fertilizer application alone. Furthermore, root morphological parameters (root length, volume, surface area), plant biomass, number of tillers, number of heads, and grain yields were significantly higher in humalite-treated plants compared to the fertilizer application alone treatment. These findings suggest that humalite can be used to improve plant growth and yield while reducing the inputs of synthetic fertilizers.

HOW DO DIFFERENT COMPOST BLENDS WITH OR WITHOUT BIOCHAR ADDITIONS AFFECT C AND N MINERALIZATION IN AGRICULTURAL SOILS FROM CENTRAL ALBERTA

Mohammad Khodaei and M Derek MacKenzie

Department of Renewable Resources, Faculty of ALES, University of Alberta, Edmonton, AB, T6G 2R3

Corresponding author: mkhodaei@ualberta.ca

Abstract

Food security and increasing demand is leading to severe pressure on the soil's capacity to retain its function and sustainability. Conventional agriculture aims to maximize food production, but it has the potential to generate soil erosion and threaten soil health. Regenerative agriculture practices such as no tillage and compost blend application, may lead to increased or preserved soil health. Soil health is a metaphor for soil function which encompasses soil fertility, crop productivity, water retention during droughts, microbial biodiversity and function, and soil organic carbon in agroecosystems. This study was designed to determine if compost blends changed soil health in soils under conventional and regenerative practices. A 65-day lab incubation of two replicated soil types were amended with five treatments of blended composts and biochar, along with an unamended control. CO_2-C fluxes were quantified using soil gas analyzers and NO_3 and NH_4 were measured via colorimetry using an Autoanalyzer every week. Microbial biomass carbon and nitrogen were measured using chloroform fumigation extraction. To date, there has been a positive correlation between biochar/compost treatments and rate of C mineralization. Biochar treatments may decrease N mineralization in the short term due to the high ratio of C/N in biochar. Soil which had been in regenerative agriculture produced more mineralized C and N than conventional agriculture soil.

EFFECT OF FEEDSTOCK TYPE AND PYROLYSIS TEMPERATURE ON SEEDING CHARACTERISTICS OF BIOCHAR FOR STRUVITE CRYSTALLIZATION

Nageshwari Krishnamoorthy, Christopher Nzediegwu,, Scott X. Chang

Department of Renewable Resources, University of Alberta, Edmonton, AB

Xiaohui Mao, Hongbo Zeng

Department of Chemical and Materials Engineering, University of Alberta, Edmonton, AB

Balasubramanian Paramasivan

Department of Biotechnology & Medical Engineering, National Institute of Technology Rourkela, Odisha, India – 769008

Corresponding author: sxchang@ualberta.ca

Abstract

Struvite crystallization is a viable approach for recovering phosphorus from phosphorus-rich solutions such as urine; however, the seeding characteristics of biochars on struvite crystallization and the impacts of feedstock type and production temperature are poorly understood. This study investigated the application of microwave-pyrolyzed biochars produced from different feedstocks and under different temperatures as seeding materials for struvite crystallization from urine and the influence of biochar properties on the overall nutrient recovery and struvite crystal size. Biochar pH had no effect on struvite crystallization due to the buffering effect of urine. Sawdust biochar produced at 500°C had the highest struvite yield (7.91 g L^{-1}), phosphorus (97.9%), and ammonium recovery (87.1%) and relative crystal size (85.2%) compared to the non-seeded treatment due to the higher surface area, pore volume, and hydrophobicity. Increasing pyrolysis temperature increased biochar's hydrophobicity and bulk density, improving the seeding process. Regardless of the feedstock type, higher biochar zeta potential and electrophoretic mobility enhanced phosphate recovery. The ash content of biochar was negatively correlated with its surface area, pore volume, and particle size, but positively correlated with the bulk density and suspension stability of biochar. In conclusion, feedstock type and pyrolysis temperature significantly affected biochar properties for struvite crystallization.