2022-2023 Applied Research Report

Russ Edwards School
Agriculture & Environment
Assiniboine Community College

We have a new name!

Russ Edwards School Agriculture & Environment

Thank you to Mr. Russ Edwards and family.

The college has been growing its agriculture and environment programming to help address skills shortages in this key economic sector. Further, agriculture and food is the largest area of applied research at Assiniboine. The college has been fundraising for a new Prairie Innovation Centre for Sustainable Agriculture, which will enable further education, research and industry engagement. The formal naming of the School represents another step in this journey.

Russ Edwards, founder and owner of WGI Westman Group, has been a leader in the business community for nearly 50 years, and a champion at the forefront of the agricultural sector across the Prairies. Edwards' business roots stem back to his first business in Winnipeg in 1976, constructing culverts, steel roofing, and siding. In the 45 years following, WGI Westman Group has carved out a remarkable and uncharted path under Edwards' leadership. It has grown into one of Canada's largest manufacturers of steel products.

On October 17, 2022, Edwards announced a gift of $4 million dollars towards the school.

"This is an incredible gift, and we are eternally grateful to Mr. Edwards and his family for their commitment to help us build unparalleled educational opportunities in Manitoba," said Tim Hore, Dean of Russ Edwards School of Agriculture & Environment. "It will have a long-lasting impact as our college continues to advance its vision for leadership in agricultural education."

This is the first time the college has named one of its academic schools after an individual. Assiniboine has a long and dedicated history of delivering agricultural and environmental education throughout the province, with some of its longest-standing programs focused on agriculture and related training.

"Growing up on a farm in La Broquerie, Manitoba, I learned about caring for the land, planting seeds, and watching them grow. With Westman Steel and Behlen Industries both headquartered here in Brandon, Manitoba, some of the early seeds of WGI Westman Group's success were planted right here in this community," said Edwards, Chairman of WGI Westman Group Inc. "My family and I are incredibly grateful to now be in the position to make this donation to the School and establish the Russ Edwards School of Agriculture and Environment," Edwards added. "I hope generations of students will be able to use the knowledge gained here to plant their own seeds of success as well."

Incredibly hardworking, yet modest in his success as an entrepreneur and generosity as a lifelong philanthropist, Edwards embodies the essence of staying true to Prairie roots and principles.

"We are honoured that Mr. Edwards would allow us to include his name so prominently in a school so core to our vision for the college," said Mark Frison, President of Assiniboine. "We feel deeply moved that Russ recognizes our college's efforts to date and shares our vision for the future. As Manitoba's ag college, this commitment and naming designation will elevate Assiniboine's prominence in training and applied research efforts for years to come," Frison added.

An Introduction to this Report

VP Academic-Dr. Deanna Rexe

Excellence and Commitment

In the spirit of progress, this annual report highlights important stories from our researchers and applied research program. These stories are shared with a deep sense of pride in the contributions and impact that Assiniboine educators and researchers have made to our communities, to our business and industry partners, and to the educational experiences of our students.

Each success story is a testament to our faculty dedication to fostering a culture of excellence and commitment to our educational philosophy of "Learn by Doing". These diverse projects and initiatives have pushed the college forward in addressing important real-world challenges and developing innovative opportunities for student development.

We invite you to explore this report and join us in celebrating the remarkable journey of Assiniboine. Together, we look forward to a future with even greater collaboration and impact in applied research.

Dean-Mr. Tim Hore

Collaboration, creation and understanding=IMPACT!

Assiniboine Community College (ACC) has made significant strides in the execution of our applied research strategy. I want to congratulate the faculty researchers and students involved in research and capstone projects across the Edwards School this past year. From receiving over $2.6M in external research funding to continued planning for the Prairie Innovation Centre and greenhouse complex expansion at the North Hill campus, ACC is building on existing strengths and previous successes.

ACC's Faculty Researchers are responding to sector challenges and industry needs to solve problems and support innovation. Partner driven collaboration is key to supporting sustainability on the farm.

In 2022-23 we've seen increases in opportunities for students to gain real-world professional experience through applied research; increases in the number of faculty engaged in research activities and creating applied research opportunities within our college programs.

I encourage you to review our report and read highlights of the valuable work and results of the ACC Applied Research team.

What Guides Our Research

Learn by Doing | assiniboine.net

ASSINIBOINE COMMUNITY COLLEGE

Applied Research at ACC

Responding to Sector Challenges

We are ACC

Applied research at ACC aims to discover, interpret, apply, and disseminate knowledge in response to problems relevant to sector challenges and its industry partners. ACC's ability to be nimble in responding to research problems, and openness in adapting current scholarship to real-world issues gives the College an edge over traditional research institutions. Outcomes can include the development of new knowledge and technologies, new or enhanced product designs, and/or improved processes or services which improve business productivity and competitiveness.

The College is a community hub for hands-on learning and education in agriculture and horticulture industries, and knowledge transfer to industry. Student training is conducted in the College's greenhouse, soil and plant growth laboratories, field-based grow plots, teaching orchard, and weed centre, providing practical and theoretical educational and training experience to 100% of Assiniboine students enrolled in the School of Agriculture and Environment's programs. Direct and indirect research training is supported through curriculum programming in facilities including ACC's 3,300 ft^2 greenhouse, which serves as the "classroom" for a combined total of 28 students in the Sustainable Food Systems and the Horticultural Production programs. The College's 2.5 acre field-based grow plot and the teaching orchard both serve as research and training "facilities", and are integral to elevating student training in the Culinary Arts program offered through ACC's award-winning MICA unit. Crop sensory research is augmented by the expertise of the resident chefs and culinary students.

ACC is consistently increasing their applied research capacity and activities, providing greater research opportunities for students and faculty. In the last 5 years, ACC has conducted 35 applied research projects, many still in progress, partnered with 19 different industry collaborators, and trained 1,110 students within six training programs. Students have benefitted from a combined total of 55,600 hours of industry based and applied research training embedded in the curriculum, and practicum / co-op placements

Areas of expertise:

1. ***Soilless Substrate Cultures Research*** addressing the needs of greenhouse and/or nursery horticultural growers, particularly in Northern communities.

2. ***Advancing Hybrid High Tunnel Technology Research*** to address needs of greenhouse horticultural producers, fruit and vegetable growers, growers' associations, nursery propagators, and plant material producers for affordable, flexible crop production and management options outside typical growing seasons.

3. ***Greenhouse and Controlled Environments Research (including vertical and container farms)*** will explore affordable clean technology heating options for year-round food production, mitigate climate change with high- and low-tech solutions to optimize plant-growing conditions, quality, and yield, and examine the influence of closed greenhouse environments on crop productivity, energy savings, CO_2 emissions, pest pressures and water requirements.

4. ***Crop Production Sector Research*** will ensure stability and market growth through the development of improved crop pest management strategies; and advances in soil and soil fertility, forages, and crop agronomy on field crops to design more cost- and yield-effective field practices to build soil health and protect land, water, and air from contamination

5. ***Wireless Technologies Research*** is integrated into all research areas and is also a standalone focus of foundational digital agriculture solutions concepts of data collection and analytics; Machine Learning (ML) and Artificial Intelligence (AI) implementation of data-based control; and autonomy. This research will support the food security and environmental sustainability needs of agricultural producers, agribusinesses, system integrators, and technology solution providers.

6. ***Environment and Conservation Research*** is an emerging area of applied research for ACC. Student-led Capstone research projects have long concentrated on addressing environmental and conservation issues raised by industry partners. Recently, the College has expanded this work to include applications to external funders to support broader and multi-year projects with critical industry partners.

The Numbers…..


APPLIED
RESEARCH
RUSS EDWARDS SCHOOL
Agriculture & Environment
ASSINIBOINE COMMUNITY COLLEGE
$2.6 MILLION
in research funding
39 STUDENTS
in four programs participated in applied research inquiry
16 externally funded research projects led by
6 FACULTY RESEARCHERS
72
local, regional, provincial, national and international partners
16 EXTENSION EVENTS
featuring presentations from Assiniboine researchers
11 STUDENT-LED
industry partnered Capstone applied research projects
We have amazing opportunities in
APPLIED RESEARCH
find out about them today!
6 PEER REVIEWED
industry communications published

Funding Received $2,569,546

NSERC $774,719

Mobilize

Expanding applied research capacity for climate neutral sustainable innovations and solutions for agriculture

Given the urgent issues associated with the impact of climate change on sustainable food production systems and increasing global food insecurity, ACC's ultimate goal is to partner with industry, not-for-profits and community to research and develop innovations. These innovations will support industry sustainability across the food production value chain system while preparing students to meet workforce needs. From environmentally safe, high-quality inputs to sustainable harvesting practices and production systems using clean technology, ACC's expertise in the agricultural sector will be invaluable in creating viable future national and global systems.

Agriculture and Agri-Food Canada (AAFC)-Govt of Canada $25,000

AgriRisk Initiatives (ARI): Microgrants

The 4Rs: Growing horticultural crops in sustainable growing media

The horticulture sector in Canada is under pressure due to the increased demand for environmentally friendly cultivation of plants by adopting sustainable practices such as peat replacement in soilless media. For environmental conservation, peat-based growing media should be phased out, and peat-free alternatives must be developed, preferably from local biomass ingredients, in particular biochar. The proposed project will offer an answer to this increasing demand. By proactively responding to increasingly higher standards for sustainability, this project will result in high-quality horticultural products produced through environmentally friendly methods. The optimized plant growth, efficient fertilization methods, and reduced costs due to losses by diseases will reach growers and generate an economic benefit.

Weston Family Foundation $1,680,827

Soil Health Initiative

Developing a Net-Positive Network (NPN) for Education and Outreach to Build Healthier Soil Ecosystems in Western Canada

ACC will build a network of innovative farmers to create regional communities of practice in improving soil health and mitigating climate change. The Net-Positive Network will be a hub for agricultural innovation based on the work of a core group of innovative practitioners and producers to improve soil carbon levels in agricultural soils being used to produce grain crops. This net-positive carbon will lead to the rebuilding of agricultural soils in Manitoba, Saskatchewan and Alberta by sequestering the excess Greenhouse Gas (GHG) from the atmosphere into soil organic carbon, encouraging producers to implement soil health improvements through best management practices to create net-positive carbon grain farms. Producers will be empowered for change through a framework of relationships with industry and producer organizations and on-field learnings. The farmer-led network will support knowledge mobilization, transfer and exchange associated with the implementation of large-scale soil improvement practices supporting nutrient management and soil biodiversity.

National Research Council $55,000

Industrial Research Assistance Program (IRAP)

Contribution to Organization (CtO)- Assiniboine College Technology Advisory & Support Services for Manitoba SMEs

NRC IRAP plays an important role in Canadian economy in bringing together the key players in the innovation system for the benefit of small and medium-sized enterprises (SMEs). In order to achieve its objectives NRC IRAP provides contributions to eligible organizations that are providing innovation assistance services to SMEs in Canada. ACC will provide technology advisory and support services (TASS) and business advisory and support services (BASS) for SMEs; including technical, marketing or business advice and information to support the implementation of new technologies or processes for IRAP clients.

Agriculture and Agri-Food Canada (AAFC)-Govt of Canada $14,000

Youth Employment and Skills Program

The 4Rs: Growing horticultural crops in sustainable growing media

Prof. Dr. Poonam Singh is an instructor and key researcher in the Horticultural Production and Sustainable Food Systems programs at ACC. With international and Canadian experience in bioresources technology, Dr. Singh's main research focuses include developing sustainable technologies for sustainable greenhouse production of horticultural crops, evaluating new soilless media / substrates, hydroponic crop cultures, vertical farming, and horticultural crop physiology. An intern will work in the greenhouse complex, under the supervision of the researcher, testing soil-less growing media blends with hemp fibers, ash fiber and cat tail fibers as possible replacement for peat, to determine air-filled porosity, bulk density, total porosity, shrinkage, and various other parameters. The intern will conduct propagation trials, collect data and prepare reports; participate in extension and team meetings.

Mitacs $20,000

Accelerate Internships

Determining optimum fungicide control of Mycosphaerella blight and white mould in peas

With the increase of pea protein processing industries in Manitoba, acres under pea production are steadily increasing. In response, it is important to maximize the yield potential by managing Ascochyta (mycosphaerella) blight inoculum buildup over time by applying commercially available fungicide products that not only effectively control the disease but also show little impact to the environment. In Manitoba, many registered fungicide products are available for the management of Mycosphaerella blight and white mould infections, however, studies show the maximum effectiveness of fungicides occurs if applied at early flowering stage combined with understanding the weather conditions conducive to infection. Field trials will assess the relative performance of different registered fungicide products to guide pea producers to make crop application decisions. ACC, in partnership with MPSG are conducing multi-year field trials comparing the relative performance of fungicide efficacy and impact on the yield of five commercially registered fungicide products in FRAC Groups 3, 7, and 11 in controlling Mycosphaerella blight and white mould diseases in peas in Manitoba. In the summer of 2023, two students, supported by the Mitacs Accelerate program and matched funding from Manitoba Pulse and Soybean Growers (MPSG), worked with Dr. Baljeet Singh.

Current Work

Want to talk with ACC applied research experts? Email ACC-AppliedResearch@assiniboine.net to connect with the Applied Research team.

Developing a Net-Positive (NPN) for Education and Outreach to Build Healthier Soil Ecosystems in Western Canada

Funded by the Weston Family Foundation 2022-2027

Crop producers will be engaged as leaders in expanding the adoption of Best Management Practises (BMPs) across Western Canadian grain farms to improve soil health, increase soil organic matter, while improving biodiversity and resiliency in agricultural lands. This adoption is driven by the development of a grassroots, farmer-centric, stakeholder-supported Net-Positive Network (NPN) for education and implementation of best practice BMPs across Western Canada. Just as soils types and profiles differ, the successful implementation of economically viable BMPs will differ across the cropping regions of the western provinces. ACC's Net-Positive Network will be a hub for agricultural innovation based in the work of a core group of innovative practitioners and producers to create more carbon in agricultural soils than is being used to produce grain crops. This net-positive carbon will lead to the rebuilding of agricultural soils in Manitoba, Saskatchewan and Alberta by sequestering the excess GHG from the atmosphere into soil organic carbon, encouraging producers to implement soil health improvements through best management practices to create net-positive carbon grain farms.

Contribution to Organization (CtO)- Assiniboine College Technology Advisory & Support Services for Manitoba SMEs

Funded by the National Research Council-Industrial Research Assistance 2023-2024

ACC will provide Subject Matter Experts (SMEs) with access to expertise to address applied research gaps in primary agriculture, horticulture, greenhouse technologies, communications engineering technologies, land and water management, riparian area restoration, and alternative growing systems. Assistance from trained professionals; and, experienced human resources collaborate with to plan and identify new opportunities. ACC supports relationships and networking with SMEs and end users of their products and/or services. The focus of this project will be on SMEs based in Manitoba, but may include in some cases SMEs throughout Canada if approved by IRAP, who are currently and potentially involved in the research, development, commercialization of products and processes; particularly in the areas of: Agriculture and Agribusiness-primary ag; Horticulture crop production ;Information & Communication Technologies; Alternative greenhouse growing technologies-high tunnel, passive solar; Land and water management; Conservation and biodiversity; Climate change mitigation.

CtO-Myera Nu-Agri-Nomics Group Canada Inc & ACC

Food as Medicine: Field evaluation of five purple carrot varieties-led by Dr. Sajjad Rao

Carrots in general are tasty and healthy, and a powerhouse of vitamins K and other minerals. Carrots are rich in beta-carotene, which improves vision. Apart from these common nutrients, purple carrots are considered more nutritious due to the purple hue due to the enhanced levels of bioactive anthocyanins (ACNs). The identification of purple carrot variety or varieties that can be grown commercially can provide new markets for producers and processers. Purple carrots offer a significant bioactive content and resulting health benefits, which can be used as an ingredient in various food products. The analytics of the five purple cultivars grown will help to inform Myera health researchers as they prepare for health trials for products in which purple carrots and purple carrot powder use. This project will produce purple carrots for the purpose of identifying the cultivar(s) with the best potential from the perspective of anthocyanin and B-carotene content followed by priorities of taste and yield.

CtO-Typha Company Ltd. & ACC

Baseline Chemical and Physical Assessments of Typha as a Potential Soilless Growing Media Amendment-led by Dr. Poonam Singh

The development of horticulture products derived from Typha plants presents a circular system, wherein captured nitrogen and phosphorus from agricultural runoff is given a second life. Harvesting Typha plants at key influent locations is critical to overcome non-point source pollution in fresh water lakes and for wetland restoration. In a joint effort with Strategic System Engineering, Typha Company will harvest Typha at three primary locations (Grants Lakes, Pelly Lake, and the Netley-Libau Marsh). Once, the plant fibres are extracted through hammer milling or shredding, they are pasteurized by steam or dried at high temperatures to eliminate any potential pathogens, pests, and wild seeds. Typha Company is targeting a rapidly growing market gap by offering consumers sustainably sourced products for seamless incorporation into existing growing systems. Optimizing natural ecosystem functioning will enable Typha Company to effectively up-cycle surplus nutrients into valuable products, while providing a viable substitute to un-environmentally sound products currently available to growers (e.g. peat moss). This project will determine the chemical and physical properties of Typha fibres in order to provide a baseline composition profile for the creation and testing of Typha-based soilless growing blends as possible sustainable alternatives for peat, to support climate change mitigation.

Soil Biochar Testing Program

Funded by NSERC Mobilize 2023-2025

Application of Biochar as Soil Amendment to Improve Health and Quality of Manitoba Soils while limiting the carbon release to the environment-led by Dr. Baljeet Singh with Jonique Farms St. Laurent, MB.

Incorporating biochar in farmland has many benefits, including converting the waste material to soil amendments and improving air, water quality, and soil health while protecting the environment from hazardous and toxic chemicals. Many soil health parameters are known to be improved by applying biochar such as soil organic carbon content, water, and nutrient holding capacity, soil pH, drainage, and soil structure which positively impacts crop yield. Research indicates the maximum benefits of biochar soil application are achieved based on the biochar source, application rate, and placement in soil, supported by minimizing wind and water erosion risk through broadcasting biochar in moistened soils followed by uniform incorporation into the topsoil. Biochar sources are generally low in plant nutrients and cannot serve as a fertilizer source for plants. Therefore, maintaining a good fertility crop plan is important to realize the maximum benefits of biochar amendments. Research data is available for biochar soil applications elsewhere, in Canada and globally however, field trials in Manitoba are needed to investigate the effects of biochar application rate and techniques of incorporation on soil health and crop yield. This project will explore biochar application rates and methods of application in field-based trials to improve soil health and fertility of Manitoba soils, while reducing greenhouse gas emissions and returning waste carbon back into the soil.

Stony Creek Brook Trout Habitat Restoration

Funded by NSERC Mobilize 2023-2025

Brook trout habitat restoration-Stony Creek Manitoba-led by Mr. James Hood with Manitoba Fisheries and the Whitemud Watershed

Stony Creek is a significant waterway in Manitoba, situated northeast of Park Lake and Franklin Creek, and located in the Whitemud Watershed District. Historically the creek was a popular spot for anglers due in part to being the farthest southern extent of naturally occurring brook trout spawning habitat. The fish population decline has been attributed to massive flooding in July 2020. The erosive force of water damaged trout habitats and spawning grounds and significantly altered the stream channel. This project aims to address the population decline of brook trout, in a segment of Stony Creek, through the formulation of a habitat restoration plan. The creek's brook trout populations have declined and angling tourism has been reduced. A recent graduate of the Land & Water Management program has drafted a habitat restoration plan for implementation. The project will strive for a 3% increase in the population of brook trout in Stony Creek by the end of the project; evaluate restoration options along other parts of the creek; and develop evidence-based recommendations for restoration plans for spawning habitats for other fish and other locations.

In June 2023, James Hood led a team of students, faculty and industry to initiate river bank restoration work. The team of Whitemud Watershed staff, ACC staff and ACC students planted about 675 trees along the banks of Stony Creek. Golden Willow (about 600) were planted immediately adjacent to the stream at the area referred to as Site B. There has been some natural regeneration of willow where there is some soil, so the planting focussed on the non-vegetated stony areas, especially in places where water appears to run. Oakanese Poplar (about 75) were planted in rather more upslope areas at Site B.

Environmental DNA (eDNA) Collection for Wild Pig Surveillance in Manitoba

Funded by Squeal on Pigs, Manitoba Pork and NSERC Mobilize

Testing of environmental DNA surveillance methodology for wild pigs in Manitoba-led by Mr. James Hood in partnership with Squeal on Pigs Manitoba, Bioscision Diagnostics and Manitoba Pork

Manitoba is Canada's largest producer of pigs. With the risk of African Swine Fever moving into Canada, one diseased wild pig could shut down Canada's entire pork export market, worth $4.96B. Wild pigs damage natural habitats and displace wildlife as well as uproot/trample crops, causing economic farm losses. The only current surveillance of wild pigs in Manitoba is provided through reported sightings. The collection of environmental DNA (eDNA) has been used to detect elusive, endangered wildlife and many countries are using eDNA water assays to identify wild pigs. This project will test a USDA eDNA water assay protocol to map and track wild pig locations in Manitoba. If eDNA is present, wild pigs are most likely nearby and using the tested water source.

The ACC Team

Researcher Summary

James Hood, MNRM	Grant Nicol, CET, INTET (CANADA)	Dr. Sajjad Rao	David Rourke, MScAg-Adjunct	Dr. Baljeet Singh	Dr. Poonam Singh
•Watershed planning •Riparian assessments •Conservation restoration	•Communications Engineering •Wireless systems •Data collection & communication •National accreditation	•P.Ag •Plant Breeder •Crop Diversification •Greenhouse technology	•Agrologist •Farmer •Farm based research •Climate change mitigation	•P.Ag •Soils and soil fertility •Agronomist •Pesticide specialist •Spectroscopy	•P. Ag •Sustainable horticulture •Biological IPM •Greenhouse cultivation •Soilless greenhouse crop production systems
5 Year Plan	5 Year Plan	5 Year Plan	5 Year Plan	5 Year Plan	5 Year Plan
•Methodology for surveillence of wild pigs •Habitat restoration Stony Creek MB •Living Laboratory Stony Creek MB	•Using wireless sensors for livestock monitoring •Sensors, IoT, cellular data systems •Wireless control of ag systems	•Greenhouse technology studies- heating, lighting, fertigation and impact on crop production •Protective cultivation •Greenhouse in a Box •Strawberry variety optimization for Manitoba producers •Ethnic crop production development	•Greenhouse gas emission reduction in primary agriculture •Reduction of synthetic fertilier use •Year round cropping to improve soil health	•Evaluating biochar as soil amendment •Fungicide decision tools for pulse diseases •Soil characterization using NIRS	•Replacement for peat in soilless growing media •Development and characterization of soilless media blends for greenhouse and horticulture •Studying local waste products as source of biochar and option for component of soilless growing media •Protective crop production through the root zone.

Other Collaborations

University of Manitoba: Near-Infrared Spectrometry for Manitoba Soil Physiochemical Properties Determination

Funding: S-CAP Research & Innovation

Led by Dr. Annemieke Farenhorst (UofM); ***Co-Applicant Dr. Baljeet Singh (ACC);*** *Dr. Timi Ojo (MB Agriculture) and Dr. Afua Adobea Mante (UofM)*

The study proposes to use a novel approach, Near-Infrared Spectrometry (NIRS) from Fourier Transform analyzer to determine the physical & chemical properties of soils at the 120 MB Agriculture weather stations. The results from the non-destructive, rapid analysis are expected to provide observed hydraulic values for improved soil moisture modeling, determine the accuracy of using NIRS for various soil physiochemical properties, and increase the uptake and efficiency of soil analysis in Manitoba.

The overall purpose of this research is to utilize a large number of soil samples from the MB Agriculture weather station locations to determine a wide range of soil physical properties (SPPs) and chemical properties (SCPs) using Near Infrared Spectrometry and expand on the accuracy and versatility of pedotransfer functions.

University of Winnipeg-TerraByte team: Agriculture re-envisioned-breaking through the proximal data bottleneck

Funding: Research Manitoba Innovation Proof-of-Concept

Led by Dr. Christopher Bidinosti (UofW); ***Participant Mr. Grant Nicol (ACC)***

Global food security is one of the most pressing issues of our time. However, advances in sensors, robotics, and machine learning (ML) promise a new era through automated methods of weeding, disease evaluation, plant care, and phenotyping. Such capabilities will increase crop yields and expedite breeding programs, while reducing inputs (e.g. water, fertilizer, herbicide, pesticide) and environmental impact. The fundamental crux to developing such technology is the need for very large quantities of labeled plant images with which to train ML models for detection and classification tasks. The main objective of this project is the continued development and eventual commercialization of a data rover to increase the collection of high-quality data in the field, thereby accelerating the work of plant breeders, plant scientists and farmers.

Partners, Funders and Supporters

ACC thanks our many partners, funders and supporters. These are only a few.

Natural Sciences and Engineering Research Council of Canada
Conseil de recherches en sciences naturelles et en génie du Canada
Canada

We acknowledge the support of the Natural Sciences and Engineering Research Council of Canada (NSERC).
Nous remercions le Conseil de recherches en sciences naturelles et en génie du Canada (CRSNG) de son soutien.

Manitoba Pulse Soybean Growers

Manitoba forage & grassland Association

Manitoba Pork

Farm Management Canada / Gestion agricole du Canada
1992 - 2022 30 Years - Ans

Weston Family Foundation

Rourke Farms

Manitoba Nursery Landscape Association

Canadian Agricultural Partnership

Manitoba

Mitacs

Squeal on Pigs!

Agriculture and Agri-Food Canada

myera Group

typha co.

Carbon Lock Tech

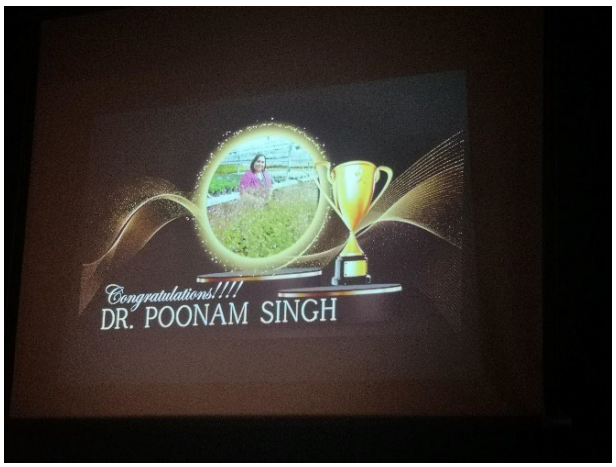
National Research Council Canada

Jonique Farms

Accolades

Dr. Poonam Singh-2022 YWCA Women of Distinction Award Winner-Science, Technology and Trade

As a Professor of Horticultural Science, Dr. Singh is passionate about teaching and research in horticulture to help create the next generation of professionals who will shape the future. She has been involved in a wide range of research projects, with support from organizations such as NSERC, the Canadian Agricultural Partnership, Ag Action Manitoba, and more. Dr. Singh has also published several research articles on her work. “I would tell young women who are entering the science world - you are entering a field that is full of opportunities for growth and impact, and your perspective and contributions are valuable. Surround yourself with supportive mentors and peers who will encourage and challenge you. And most importantly, never lose your passion and curiosity for discovery, as it is what drives progress.”



Publications-Media

Sustainability of Growing Media-Using waste-stream products for horticultural crop production-Dr. Poonam Singh

Reprinted from the Manitoba Nursery Landscape Association Online Newsletter Winter 2023 pg. 15

Canadian greenhouses extensively use peat as a growing medium for cultivating ornamental and nursery crops. Peat gets extracted from peatlands, sensitive ecosystems with the unique ability to sequester considerable amounts of carbon and store excess precipitation. Peat extraction results in high carbon dioxide emissions into the atmosphere, thus contributing to the greenhouse gas effect and climate change. There is an increasing demand worldwide to reduce and replace peat in the growing media with sustainable alternatives (preferably from local biomass ingredients) having a lower environmental impact. For developing successful peat reduced or peat-free substrates, it is pertinent to thoroughly understand the behavior of the constituents in new growing media. Therefore, physical (air-filled porosity, easily available water, bulk density, total porosity, shrinkage, water retention and movement, hydrophobicity), chemical (pH, organic matter content, chemical composition, carbon: nitrogen ratio, $CaCO_3$ content), and biological (phytotoxicity, nitrogen immobilization, rate of decomposition) characteristics of all separate components must be known to optimize a media formulation. In addition, the positive and negative characteristics of each ingredient and their effect on the growth and health of plants must be researched.

Although the peat-perlite mix is the most commonly available and preferred growing media by growers. However, presently several other new media blends are available for horticultural crop production. At Assiniboine Community College's sustainable greenhouse complex, we are exploring alternatives such as wood fibers, hemp fibers, (by-products of timber and agricultural industry, respectively), cattail fibers (wetland plant), biochar and ash (from thermal conversion of plant materials) as viable constituents of sustainable growing media for potted plant cultivation. The project, currently in progress, is determining the biophysio-chemical properties of these new up-cycled and locally available soilless substrates, exploring the ability to replace conventional peat based media, and investigating its suitability for crop cultivation in greenhouses/nurseries. Using such local and sustainable materials as a growing substrate would benefit the environment and support long-term sustainability goals. Horticultural growers will benefit from access to a valuable by-product/waste product from the timber/agricultural industry. Environmental benefits will result from combating global climate change by sequestering carbon and advancing local horticulture production into a sustainable growing system.

Someone's Trash is Someone's Treasure: Using industrial waste/by-products as sustainable growing media for horticultural crops-Dr. Poonam Singh

Reprinted from the Manitoba Master Gardener Association Newsletter, originally May 2022

Lettuce plants grown in peat mixed with cattail (Typha spp.) fibers (10-40% volume/volume) Photo courtesy: Poonam Singh

Currently, in Canada, greenhouse growing of potted ornamental plants is carried out using peat, a soilless media, that is extracted from peatlands, sensitive ecosystems with the unique ability to sequester considerable amounts of carbon, and store excess precipitation. Peat extraction results in the release of high carbon dioxide emissions into the atmosphere, thus contributing to the greenhouse gas effect and resulting in climate change. For environmental conservation, peat-based growing media should be phased out, and peat-free alternatives should be developed, preferably from local biomass ingredients. Alternatives for peat such as coir are available, but, there are issues on sustainability such as releasing salt into the environment in the country of origin when washing out the substrate. Therefore, there is a need for searching potential media substitutes for peat with a lower environmental impact.

Although the peat-perlite mix is most commonly available and preferred growing media by growers. However, nowadays several other new media blends are also available for horticultural crop production. Finding the right media formulation necessitates an understanding of the composition and function of each component of the media blend. A favorable growing medium generally consists of two or more ingredients. Growers must be familiar with the positive and negative characteristics of each ingredient and their effect on the growth and health of plants.
Growing media components are either organic or inorganic. Organic components include, but are not limited to: peat moss, wood chips, sawdust, coconut coir, rice hulls, wood fiber, etc. Inorganic components include, but are not limited to: rockwool, perlite, pumice, vermiculite, expanded clay, etc. While formulating new media blends, a sound knowledge of physical (air-filled porosity, easily available water, bulk density, total porosity, shrinkage, water

retention and movement, hydrophobicity), chemical (pH, organic matter content, chemical composition, carbon: nitrogen ratio,$CaCO_3$ content), and biological (phytotoxicity, nitrogen immobilization, rate of decomposition) properties are of utmost importance.

At Assiniboine Community College's sustainable greenhouse complex, we are exploring wood fibers, hemp fibers (by-products of timber and agricultural industry, respectively), cattail fibers (wetland plant), and ash (from thermal conversion of plant materials) as constituents of sustainable growing media that could serve as a viable option for potted plant cultivation. Wood (pine and other trees), hemp and cattails are locally available materials in Manitoba. Numerous greenhouses burn several tonnes of flax shives (agricultural waste) as boiler fuel to heat their greenhouse, producing ash as a by-product. The project, currently in progress, is determining the bio-physio-chemical properties of these new up-cycled and locally available soilless substrates, exploring the ability to replace conventional peat-based media, and investigating its suitability for the crop cultivation in greenhouses/nurseries. The use of such local and sustainable materials as a growing substrate would have a dual benefit for the environment and support long-term sustainability goals.

Most of the peat-based media used for horticultural crop production is discarded after a single use. However, there are many uses of spent growing media that are being explored by scientists and growers worldwide; some examples are its direct use as a soil improver (for gardening projects), as a bulking agent for composting, as a feedstock for biochar production, and its reuse as direct growing media for crop production. Care should be taken towards assessing salt build-up, and phytosanitary risks when up-cycling the media, and required strategies to combat these problems should be developed. Recycling and reusing peat media will result in a clear reduction in CO2 emissions and a lower impact on the climate. If some or all of the strategies of developing peat-reduced or peat-free media become successful, the economic benefits would accrue to Canadian companies processing agricultural waste into growing media products, thus allowing them to expand into new markets. Horticultural plant industries will benefit from access to a valuable by-product/waste product from the timber/agricultural industry. Environmental benefits will result from combating global climate change by sequestering carbon and advancing local horticulture production into a sustainable growing system.

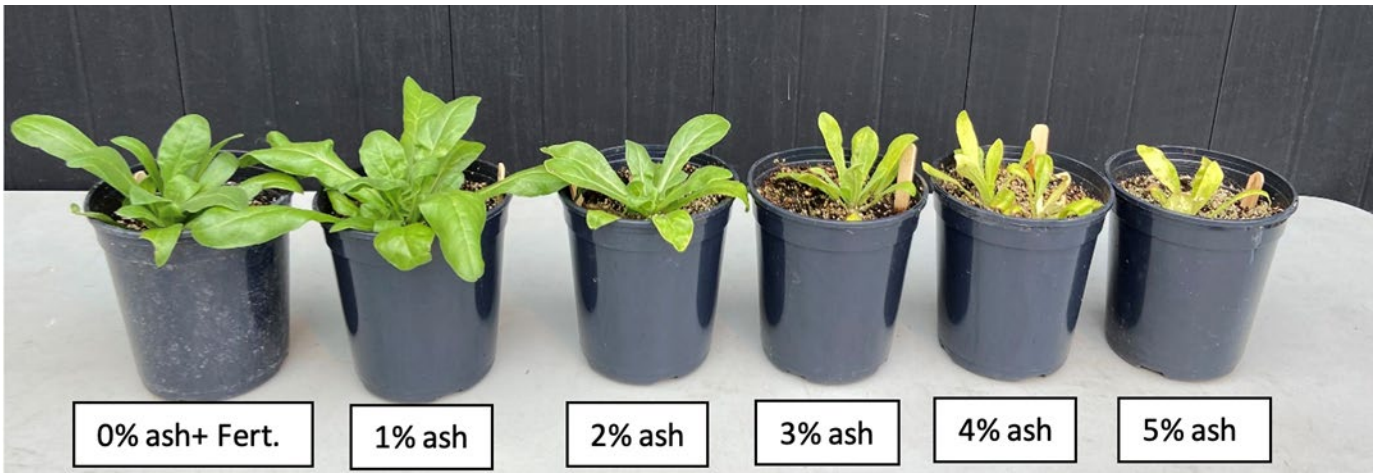
Sweet alyssum plants grown in peat mixed with hemp hurd (10-40% volume/volume) at the Assiniboine Community College's sustainable greenhouse complex. Photo courtesy: Poonam Singh

Cash in the Ash-Dr. Poonam Singh

Manitoba Master Gardener Association Newsletter, January 2023

Numerous greenhouses in Canada burn several tons of agricultural biomass like flax shives, wood chips and other waste of landscape and timber industry as boiler fuel to heat their greenhouse, producing biomass ash as a by-product. One such example is Vanderveen's Greenhouse Ltd. (the largest wholesale greenhouse of Manitoba) in Carman, Manitoba, where they use 6000 tons of flax shives annually as a boiler fuel resulting in 120 tons of ash as a waste product. Assiniboine Community College (ACC), collaborated with Vanderveen's to explore the use of biomass ash in soilless media for producing horticultural crops in nurseries/greenhouses. Biomass ash affects soil chemistry and biology in complex ways, due to primary effects, such as elevated pH and nutrient addition, and to derived effects such as changes in nutrient availability and interaction with biological processes (Bardgett, 2005). We expected biomass ash addition to increase pH and nutrient (mainly K and P) levels in the peat-based growing media.

Bardgett, R. (2005) The Biology of Soil: A Community and Ecosystem Approach. Oxford University Press, Oxford. https://doi.org/10.1093/acprof:oso/9780198525035.001.0001



Plant growth response in ash amended peat media mix

Plants at lower ash concentrations (1-2%) had greener leaves with higher total chlorophyll contents as compared with plants grown in higher ash concentrations (3-5 %) (Fig 3). Growth at 1-2% ash treatments was very similar to plants treated with fertilizer mix. There was no difference observed in flowering of the plants 0, 1, and 2 %. Plants at 4% and 5% died after approximately 45 days after transplanting (DAT). 3% ash treated plants died after 68 days of 90 day lifecycle after transplanting.

Culinary Treatments Affect Sensory Attributes and Consumer Preference for Sweet Potato Cultivars-Dr. Sajjad Rao, Bryan Hendricks, Amanda Gray, Dr. Poonam Singh

Journal of Food Research Volume 12, No. 1 (2023)
DOI:10.5539/jfr.v12n1p1

Food quality and taste preference are important factors influencing the production and adoption of sweet potato (*Ipomea batatas L.)* cultivars in a specific growing region. There is very limited published information available on the sensory attributes and quality profile of sweet potato cultivars grown in Canada, even though there is a substantial increase in both production and consumption over the last few years. This study analyzed five different culinary treatments on sweet potato sensory attributes along with taste preferences. Oven-baked, boiled, fried, steamed and mashed culinary treatments were found significantly different ($P < 0.05$) for mealiness, sweetness and for taste profiles. Sweet potato cultivars were significant different ($P < 0.05$) for taste and sweetness attributes. A non-significant difference was recorded for interaction between culinary treatments and the tested cultivars for bitterness, mealiness, sweetness and taste profile. Expert panel preferences significantly differed ($P < 0.05$) for boiled, fried and steamed culinary treatments for tested cultivars, whereas, no difference was observed for oven-baked and mashed sweet potatoes. Boiled, fried, steamed and mashed culinary treatments for 'Covington' were most liked by the panelists, followed by 'Radiance'. These sensory analysis and preferences of tested sweet potato cultivars can provide a reference for the food processing industry in preparing sweet potatoes for Canadian consumer consumption and the study outcomes can be used to guide sweet potato variety development for specific quality traits.

Black plastic mulch affects soil temperature and yield of sweet potato under short season temperate climates-Dr. Sajjad Rao, Dr. Poonam Singh, Tom Gonsalves

International Journal of Vegetable Science Volume 29, 2023 Issue 1

Temperature is critical for the plant growth and yield of sweet potato (*Ipomoea batatas* L.) in northern cool season climates. Few studies have quantified the effect of temperature using different crop systems to improve the growth of sweet potato (*Ipomoea batatas* L.). Our study examined the impact of black mulch on raised beds for sweet potato (*Ipomoea batatas* L.) production in open field conditions in Manitoba. Black mulched plots were compared with non-mulched plots over 3 years for effects on soil temperature and commercial yields. Three year mean soil temperatures (19.9°C) were significantly higher under mulched plots compared to non-mulched soil (19°C). Higher total, marketable and US#1 yields were harvested from mulched plots than non-mulched plots; however, no differences were recorded for US#2, jumbo and cull yields over 3 years. Marketable yield increases of 47, 39 and 30%, were recorded for mulched plots over non-mulched plots in years 2018, 2019 and 2020, respectively, with a 3-year average yield increase of 39%. Use of black mulch contributed to increased sweet potato commercial yields in short season-temperate climates.

Impact of planting dates on yield and pod quality traits of snap bean under short-temperate season climates-Dr. Sajjad Rao

International Journal of Horticultural Science 2022, 28:57-62; https://doi.org/10.31421/ijhs/28/2022/11054

Snap bean, a warm-season crop, have low frost tolerance. The optimal temperature for seed emergence and plant growth is important. Therefore, appropriate planting dates for adapted varieties has paramount significance in improving pod yield and quality of snap bean under short cool season climates. Three snap bean cultivars planted at 3 different dates were examined to evaluate the effects of planting dates on snap bean pod yield and quality traits in a 2-year study in a short season climate in Manitoba, Canada. Results of this study showed that three, two weeks apart, planting dates had a non- significant effect on marketing yield of three different cultivars tested in this study. Planting dates showed significant effect on un-marketable yield, pod fresh weight, pod length and total soluble solids. Higher marketable and un-marketable yields along with longer pod length and soluble solids, in all three cultivars, were more profound when seeded at mid and late planting dates. Snap bean grew under higher temperature and accumulated more growing degree days (GDD) when planted in mid June and early July when compared to early June planting. These results conclude that marketable yields of snap bean were not significantly affected by planting dates when seeded-two weeks apart-in shorter growing environments which allow commercial and market gardeners, in northern areas with shorter growing seasons to optimise planting snap bean, without reducing pod yield and quality.

Extension

Parkland Crop Diversification Foundation Annual Field Day-July 27, 2022

Pulse Production- Dr. Baljeet Singh, Laura Schmidt, Amir Farooq

Ascochyta/Mycosphaerella blight complex is among the most widespread and economically damaging foliar diseases of peas (Pisum sativum) in Manitoba. Ascochyta infections are caused by the fungi Ascochyta pinodes (leaf infection), Ascochyta pinodella (foot rot infection), and Ascochyta pisi (pod infection) on peas. Mycosphaerella infection begins at the bottom third of the plant and progresses upward during the early flowering stage of crop growth. White mould (*Sclerotinia sclerotium*) affects the stems, leaves, pods, and seeds of peas and symptoms begin with brown, water-soaked lesions at the stem that quickly expand under cool and moist conditions. These lesions become water-soaked, rotted tissues eventually expanding in size. Under humid conditions, such lesions may become covered with white, cottony growth eventually developing into black sclerotia in the infected tissue. The lesions eventually become dry, bleached, and shredded, causing wilting and subsequent death of entire branches, and girdling of the main stem. The On-Farm Network disease surveillance program of the Manitoba Pulse and Soybean Grower (MPSG) Association conducts yearly surveys to monitor disease pressure on peas in Manitoba (Table 1). In 2018, Mycosphaerella blight was present in all fields surveyed with (100% prevalence), whereas white mould infections were not noted in any of the fields. In the summer of 2022, product evaluation and comparison trials were launched by the Assiniboine Community College at Roblin (MB) and Portage La Prairie (MB) sites with the objective to test the efficacy of registered fungicide products and to assess the impact on pea yield. Five commercially available, registered fungicide products were applied close to the flowering stage at each trial site., The trial sites reported Mycosphaerella blight was present (100% prevalence) in all test plots at both sites, with an average severity level of 2 and 3 (1-7 scale) seven days after the application at Roblin, MB and Portage, MB sites, respectively.

Manitoba Agronomists' Conference- December 14 & 15, 2022

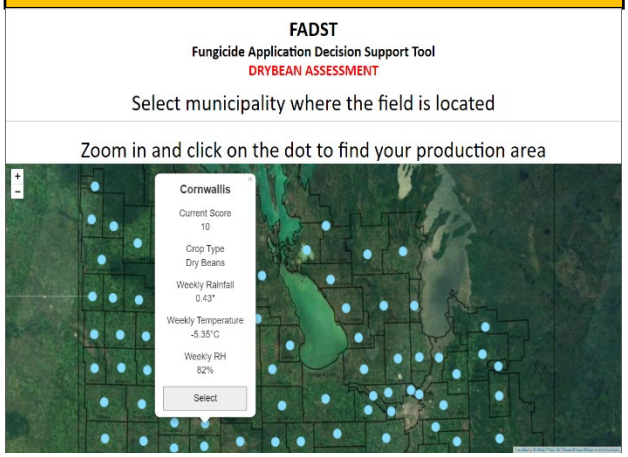
The Fungicide Application Decision Support Tool (FADST) for White Mould Management in Dry Beans in Manitoba

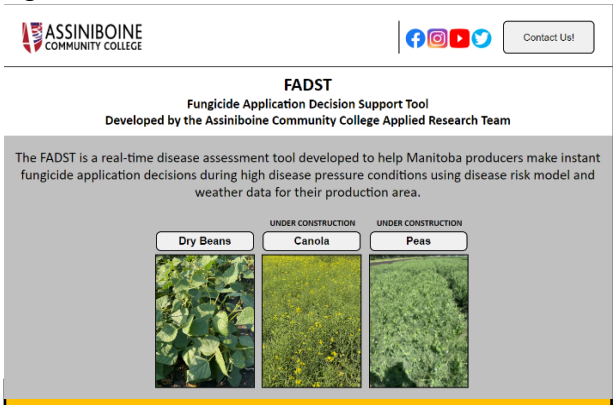
http://fadst.assiniboine.net/desktop_site/index.php

Baljeet Singh, Eric Purvis, Steven Hills, Billie Bootsman, and Lisa Crede
Assiniboine Community College, Brandon, Manitoba

Introduction:

White Mould is a serious fungal disease of legumes and pulse crops in Manitoba, caused by a highly destructive soil-borne pathogen (*Sclerotinia sclerotiorum*), which is difficult to manage, causing thousands of dollars in revenue loss annually. Currently, only fungicide applications are able to manage the disease, largely controlled by weather conditions, agronomic practices, and choice of dry bean varieties.



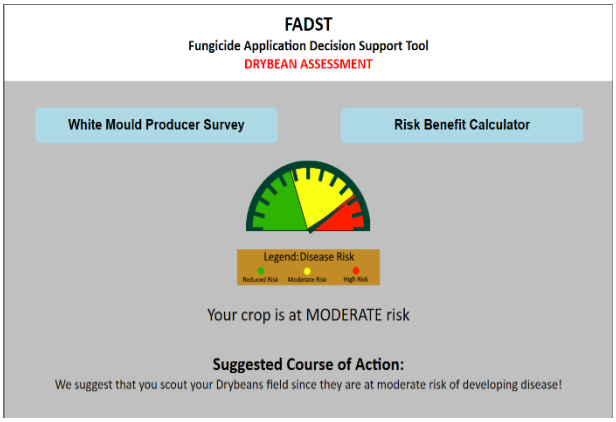


Developing FADST:

A real-time weather-based FADST was developed using the leaflet platform, based on the integration of weather data collected from 108 MB Ag. weather stations across the province and a disease severity model adopted from the University of Nebraska-Lincoln. The FADST will predict a municipality-scale disease risk using weather data in real-time processed for a 7-day weekly rolling average and disease severity values (DSV) of related weather parameters such as rainfall and temperature.

Testing and Validation of FADST:

The FADST was tested during the 2021-2022 growing seasons by comparing computed risk assessment with field disease severity evaluations. The risk maps generated are freely available to dry bean producers via a dedicated web page. The FADST can be modified for other crops/diseases and reduce the reliance on pesticide applications but still achieving desirable disease management while protecting the environment and farm economics.



Acknowledgments and Funding Partners:

The ACC Applied Research Team is thankful for the funding support from **Manitoba Pulses and Soybean Growers (MPSG)** and the **Canadian Agricultural Partnership (CAP) program**. The authors are also thankful Dr. Timi Ojo, from the Manitoba Agriculture and Resource Department (MARD) for providing weather data support for the project.

CULTIVATE Sustainability Conference and Trade Show. September 7, 2022 Winnipeg, Manitoba

Dr. Poonam Singh (panellist) and Dr. Sajjad Rao attended "WATER & WASTEWATER USAGE"

Brandon University Seminar Series, November 22 and 29, 2022

Dr. Sajjad Rao, Invited Speaker

Sustainable Passive Solar Greenhouses: *"A viable option for propagating planting material for colder climate regions"*

The outdoor climate energy plays an important role in determining greenhouse microclimate and crop performance in passive solar designed greenhouses, which can be used to gauge and to define the cost of production. This study, at Assiniboine Community College, aimed to outline active and passive solar energy gains in sustainably designed greenhouses by evaluating the climate energy effect – heating light effect and heating outside temperature effect- to maintain required greenhouse microclimate for optimum crop production. Climatic and supplemented energy data along with yield and other agronomic information were recorded for crops in two different greenhouses; namely passive solar greenhouse with minimal technology (PS1) and passive solar greenhouse with medium technology (PS2) i.e. active solar panels providing in-floor heating. Daily and monthly information gathered in this research project on climatic effect on energy consumption, energy costs with crop yields provides valuable production and economic information using sustainably designed greenhouses for colder climate growers.

Dr. Poonam Singh, Invited Speaker

Sustainable Greenhouse Horticulture: Solution for a healthy future

Greenhouse horticulture is one of the most intensive types of agricultural systems with the advantages of environmental control, efficient resource utilization, and use of advanced crop production technologies resulting in higher productivity and better quality of the produce. However, without proper management, greenhouse crop production could be non-sustainable; the use of resources in a concentrated space and time has the potential to negatively impact the environment. Therefore, the application of suitable cultivation techniques is essential to prevent problems developing from this type of production. This seminar will discuss Dr. Singh's research focussing on developing sustainable technologies for the greenhouse production of horticultural crops such as developing/evaluating new soilless growing media, hydroponic crop cultures, vertical farming, etc. Dr. Singh's research aims at adopting sustainable practices and improving the production efficiency of horticultural farms, thus helping growers reduce production costs, increasing resource efficiency, and contributing to long-term economic and environmental sustainability.

Manitoba Ag Days, January 18-20, 2023 Brandon, Manitoba

Dr. Sajjad Rao, Invited Speaker: "Next Generation Greenhouse Farming"

Assiniboine Community College's research team is working to achieve a sustainable tomorrow. The next generation of greenhouse farming requires net-zero to net-positive environmental impact while producing food, meeting future food security challenges and achieving production targets. Evidence-based applied research provides a plant-conscious growing system by utilizing local climate energy to maintain a growing environment for producing food year round. Join Dr. Rao as he outlines the potential of commercially viable, economically affordable and environmentally manageable greenhouse technology.

Dr. Baljeet Singh, Invited Speaker: "Applied Research and Farm Partnerships, "Fixing That Broken Wheel"

In order to address growing season challenges, applied research efforts are critical to rapidly changing and challenging crop production systems. Collaboration plays an important roles in linking upstream innovation to downstream adoptions and true partnerships are all about connecting the right people with the right information to manage the challenges. Join Dr. Singh as he shares how applied research and farmer partnership can better align strategic thinking and adoption of new agricultural production technologies and practises on farms.

Grow23-A Manitoba Nursery Landscape Association Event, February 8, 2023

Invited Speaker, Dr. Poonam Singh

Sessions: Reduce, Reuse, Recycle, Recover: 360-degree approach of growing horticultural crops in sustainable growing media

Currently, in Canada, greenhouse growing of horticultural plants is carried out using peat, a soilless media extracted from peatlands, sensitive ecosystems with the unique ability to sequester considerable amounts of carbon and store excess precipitation. Peat extraction releases high carbon dioxide emissions into the atmosphere, thus contributing to the greenhouse gas effect and resulting in climate change. This has led to an extensive search for sustainable alternatives for peat by the horticultural industry across the world. Learn about local and waste-stream products as constituents of sustainable growing media that could serve as a viable option for potted plant cultivation.

Canadian Hydroponic Association Webinar June 22, 2023

Dr. Sajjad Rao, Invited Speaker: "Passive Solar Greenhouse Systems for Hydroponic Crop Production"

A Passive Solar Greenhouse can be designed and oriented to utilize maximum solar energy for hydroponic crop production. A medium technology greenhouse, with a half-dome structure with a passive solar system in addition to in-floor heating, consisting of basic features but warmer due to better heat sinks, can provide optimum climatic conditions for hydroponic crop production.

The medium technology passive solar greenhouses were designed to collect, store, and distribute solar energy in the form of heat in the winter and dissipate heat in the summer. The main components of greenhouses included steel framing, side covering polycarbonate wall, glazed with Solawrap, which is a three-layer transparent polyethylene film, with air bubbles in the middle acting as energy-saving insulation, which has a solar radiation transmissivity of 0.83., a north wall for conserving solar energy, which is insulated and covered with 24ga black painted steel material, and one hydronic unit heater connected through glycol loops with propane fueled boiler. The medium technology can give high output and can be built with locally available customized materials and inputs. A combination of Passive and Active Solar systems work better and can be utilized for year around hydroponic crop production.

ACC Students-Learn By Doing

Focus-Ally McCutcheon-Bat Handbook Land and Water Management Capstone

Adapted in part from the Empire-Advance March 6, 2023

As part of her Year Two Applied Research Capstone study, Ally McCutcheon (ACC Graduate 2023) compiled and produced a handbook for bat lovers in order to increase bat awareness and monitoring in Manitoba and Ontario. The handbook contains a wealth of information about the only mammal truly capable of sustained flight. Along with a complete listing of the bat species native to these provinces, Ally's reference manual has facts about the life cycle of bats as well as some areas of concern.

Around 70% of the bats in the world are insectivores and all the bat species in Canada are insectivores. The insects that they feed on are crop pests in agriculture and forestry. A single bat can eat its body weight in insects in just one night. Another important benefit these animals provide is their ability to act as bioindicators which are species are organisms that can reflect wider-scale impacts on the environment. Insectivores like the bats in Canada are sensitive to pesticide accumulations that could be present in their habitat, and they can provide early warning of toxins that might be there. But the life of a bat is filled with perils. White-nose Syndrome (WNS) is a deadly fungal disease that affects bats in hibernation. The fungus that causes WNS was first introduced from Europe to North America. It was discovered in a cave in Albany, New York in 2006. The fungus thrives in cold humid environments and grows on bats while they are hibernating. It infects the muzzle and wing tissue of bats and spreads easily through contact from bat to bat or from the walls of the cave. Bats with WNS warm up more often during their hibernation than healthy bats, which causes them to lose the energy they need to survive the winter. In some locations where WNS is found, cave-dwelling bats have suffered mortality rates of 90-100%. Currently there is no cure for White-nose syndrome.

As well as this deadly disease, habitat loss is having an increasing affect on bat populations. In Canada, bats live in forests where they can hunt near bodies of water. Habitat loss reduces the available territory that bats need like mature trees for roosts, and it also reduces their area for hunting. Bats have a bad reputation and humans have many inaccurate ideas about them. People say all bats carry rabies, drink human blood and fly blindly into our hair where they get tangled up. Not true.

What can be done to help? One way is to build a bat house on your property. As well as providing a safe roost for the bats, it gives a chance to observe them, and learn about these fascinating animals.

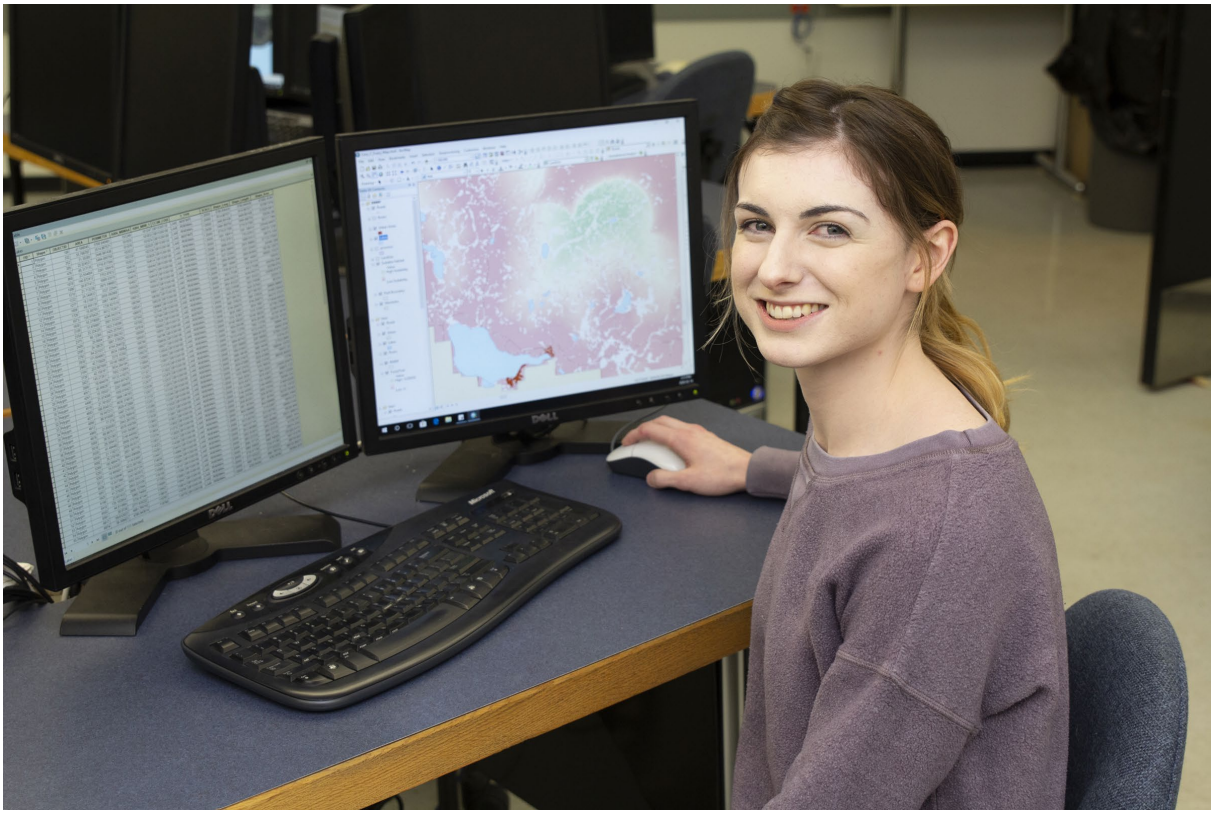
ACC Student Led, Industry Partnered Applied Research Capstones

Communications Engineering Technology
Led by Grant Nicol

Project: IOT Cloud Platform
Description: Research and design work on configuring a cloud based platform for managing IoT devices and data. The goal is to develop a platform that could be used for ACC course work as well as support applied research projects.

Project: LoRa Indoor Propagation Analysis
Description: The study of indoor signal propagation at 915 Mhz. The test results and information gathered will be used to create a model to predict the coverage of a LoRa gateway for indoor use in a commercial environment.

Project: Eye Movement Monitoring System
Description: Designed to reduce accidents by detecting and alerting sleepy drivers. This device monitors a driver's eyes to detect eye movement that would indicate behavior of a tired driver and alert the driver and others in the vehicle.



Land and Water Management
Led by James Hood

The Case for Bison Farming to Restore and Protect Native Prairies-An education guide for current and future bison producers on the importance of prairie restoration and bison for their ecological and historic importance to native prairies.

Strategy for Leafy Spurge control on the Southern reach of the ACC North Hill Campus Creek-An integrated weed management strategy to control leafy spurge (*Euphorbia esula*) on the ACC North Hill campus; includes distribution maps and control options.

Prairie Sage: Traditional and Conservation Practices-A guide to the growing prairie sage in private gardens and the purchase from reputable sources that practice sustainable harvesting, to reduce the demand for wild-harvested sage, protect its natural habitats and reduce cultural appropriation.

r(e-cycling)@ACC Electronic Waste Diversion Drive-A project plan to promote the recycling of electronic waste in the Assiniboine Community College campus community. The pilot diverted 110 kg of e-waste from the landfill.

Buffer Zones for Field Runoff Control-Recommendations for developing buffer zones for field runoff control in the Souris River Watershed District. Includes two plans outlining species blends and buffer locations.

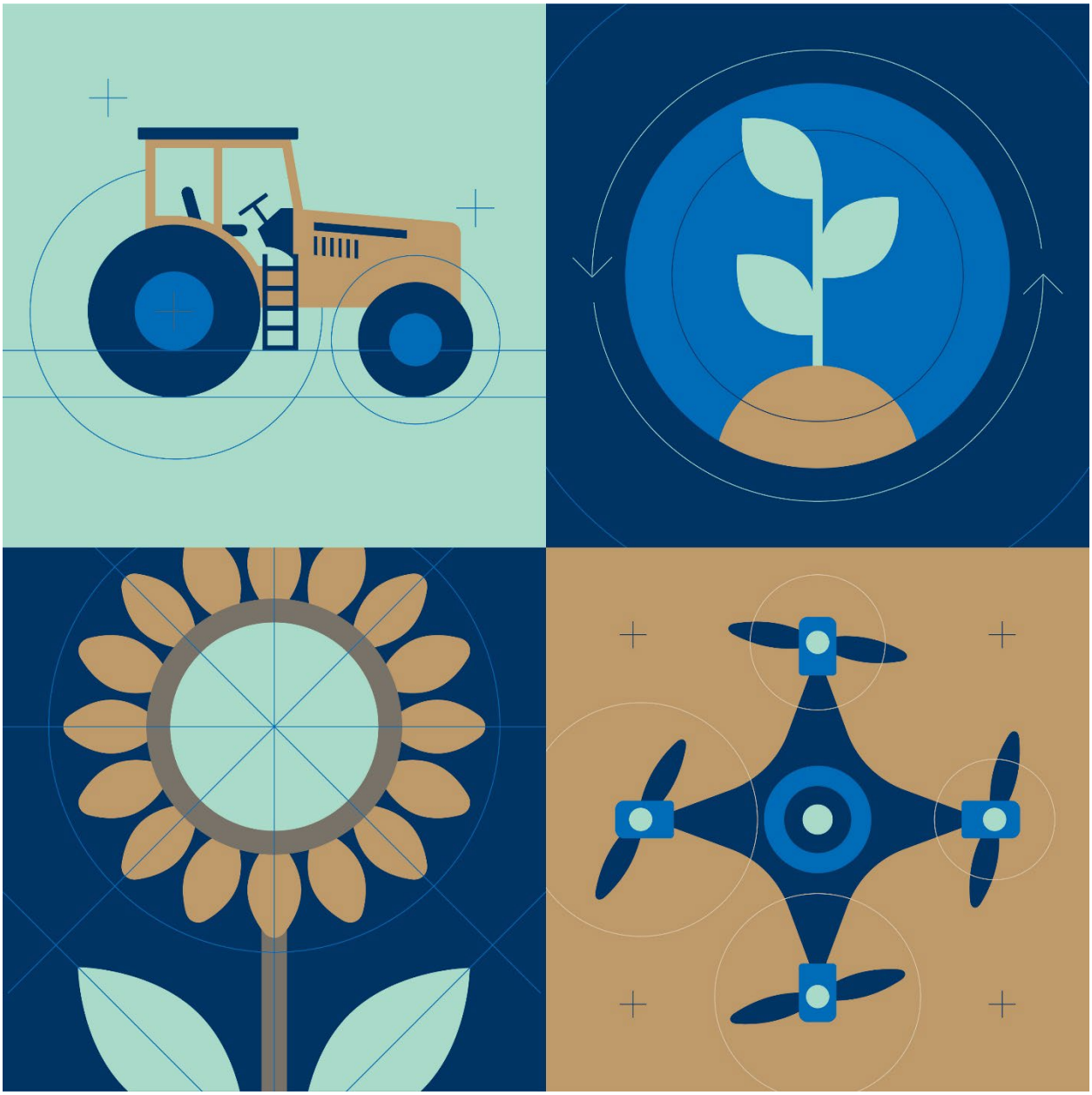
Mapping the Spread of Whirling Disease (*Myxobolus Cerebralis*)-Providing Parks Canada with the Information to Educate the Public of Spread and Prevention in Riding Mountain National Park. Developed an ArcGIS story map detailing the spread of whirling disease, and how to prevent the spread.

Brook Trout (*Salvelinus fontinalis*) Habitat Restoration Plan for Stony Creek in the Upper Whitemud Watershed-Providing stream restoration strategies for a stream impacted by flooding and erosion to promote the reestablishment of brook trout.

Erecting educations signs for the Canupawakpa walking trail, Metigoshe natural area and Sweetgrass Meadow walking trails in the Souris River Watershed District-Created and placed educational signs on 3 walking trails in the Souris River Watershed District (SRWD).

Gallery

And Finally……..



The Russ Edwards School-Agriculture & Environment is a leader in hands-on education and training, using technology and innovation to effect change and better outcomes, recognizing the interconnectedness of agriculture and the environment.