ASSINIBOINE
COMMUNITY COLLEGE

2021/22 APPLIED RESEARCH REPORT

Assiniboine Community College
School of Agriculture & Environment

TABLE OF CONTENTS

INTRODUCTION FROM OUR DEAN

Statement on 2021/22

Tim Hore, Dean School of Agriculture & Environment

Welcome to Assiniboine Community College's (ACC) second annual applied research report. The 2021/22 academic year was one of continued growth in partnerships, projects and student engagement.

Our strategic research plan and academic plan is providing the framework to support student success with real-world professional experiences through applied research projects and hands on learning with industry and community partners. We are expanding the number of faculty and students engaged in research activities and creating more opportunities for applied research experience within our agriculture, environment and technology programs.

Our research portfolio is growing and we have been successful in obtaining funding from national and provincial funding agencies. Our thanks to the Canadian Agricultural Partnership – Ag Action Manitoba for continued support of our field to fork initiative and research in horticulture and sustainable greenhouse and growing systems. As well, our thanks to the National Sciences and Engineering Research Council for IE Entry and Engage grants which provides funding and staffing to support ongoing research projects we continue to foster and expand relationships with industry and academic institutions building on our foundation in horticulture and sustainable agriculture applied research.

ACC has announced its plan to build the Prairie Innovation Centre for Sustainable Agriculture. This one-of-a-kind Canadian college project will combine indoor and outdoor learning spaces for seamless, hands-on experimentation and training experiences. The Prairie Innovation Centre will support the demand for skilled and experienced agricultural training, increasing ACC's on campus capacity to more than 800 students in agriculture and ag-adjacent programming. Through a combination of education, research and outreach, ACC is finding new ways to improve food security and do its part to help build healthier and stronger communities, an approach the college calls "field to fork". Our current sustainable greenhouse and experimental grow plots are the strong foundations we are building on.

We are excited about the future of applied research at ACC. We are seeing our vision in action with industry, producers and other external partners turning to the expertise, facilities and talent within ACC to achieve key business and enterprise goals.

Tim Hore

Dean School of Agriculture and Environment

WHO ARE OUR RESEARCHERS?

Who They Are

Sajjad A. Rao, PhD, P.Ag

An accomplished Agrologist with over 20 years of professional success in agricultural research innovation and academic development with broad experience in applied research and teaching. Provided strategic advice to public and private institutions and organizations in planning, developing and implementing new, and progressive academic programs and applied research projects. His applied research program focuses on new crop production technologies that can be utilized in rural and remote communities and food production systems that are economically viable and commercially feasible. As a scientist and commercial plant breeder, he developed wheat varieties in North America and developed the first feed wheat "WFT 603" for Canadian Prairies; and commercial corn hybrids in Asia Pacific. His research aims to solve real world challenges.

Poonam Singh Ph.D. P.Ag.

Dr. Singh's research focuses on developing sustainable technologies for the greenhouse production of horticultural crops, evaluating new soilless media/substrates, hydroponic crop cultures, vertical farming, and horticultural crop physiology. Dr. Singh aims at developing sustainable practices and improving the production efficiency of horticultural farms. Dr. Singh's provided Manitoba onion producers with critical information on the incidence and prevalence of Botrytis neck rot disease and options for its management. Dr. Singh has also developed sustainable pest management strategies for use in commercial floricultural greenhouses to provide customers organic, pesticide-free products. Dr. Singh's research is helping growers in reducing production costs, increasing resource efficiency, and contributing to long-term economic and environmental sustainability.

Dr. Poonam Singh with hydroponically grown kohlrabi

Baljeet Singh, Ph.D., P.Ag.

Dr. Baljeet Singh has experience working with various national and international initiatives, having worked in academic, research and consulting collaborations focusing on entomology, agronomy, soil, and pesticides sciences. Currently, Dr. Singh focuses on developing improved diagnostic tools (multiplex PCR based methods) for detection of soybean pathogens; the development of diseases and insect pest survey protocols; and agronomic research trials for soybean, peas and cereal crops. Dr. Singh is experienced in pesticide sorption and degradation research with a combination of Near-Infrared Spectroscopy. Partners include Agriculture and Agri-Food Canada-Brandon Research Station, Brandon University, University of Manitoba and McGill.

Grant Nicol, CET, INTET (Canada)

A full-time time college instructor in the Communications Engineering Technology Program involved in the development and redevelopment of the program as well as the development of the courses taught. Mr. Nicol has coordinated and advised on student applied research projects in the form of Capstone learning since 2010. Since 2015, Mr. Nicol has been the Faculty Advisor for the ACC Student Chapter of the Certified Technicians and Technologists Association of Manitoba. He is also the Faculty Advisor for the ACC Student Branch of the Institute of Electrical and Electronics Engineers (IEEE), since 2010. Mr. Nicol consults and collaborates on ACC applied research projects involving data communication and wireless systems.

James Hood, MNRM

James Hood is an instructor in the Agribusiness and Land and Water Management programs in the School of Agriculture and Environment. Mr. Hood has coordinated the Land and Water Management student capstone projects since 2019. In that time, he has managed student partnerships with environmental NGOs including Bee City Brandon, Ducks Unlimited, Manitoba Beef and Forage Initiatives, Manitoba Habitat Heritage Corporation, Manitoba Hydro and several Watershed Districts. His research interests include water quality monitoring and the use of citizen science approaches in student research.

ACC Sustainable Foods student assisting with varietal trial harvest at the North Hill Campus

WHAT HAVE WE BEEN DOING?

Project Spotlights

Changing the Face of Commercial Sweet Potato Production in Western Canada

Dr. Sajjad Rao and Industry Partner-T&T Seeds Ltd., Winnipeg MB

This project aimed to increase the capacity of local agricultural business and growers by demonstrating an efficient and affordable production system for propagating sweet potato planting material, commonly known as “slips”. This study evaluated the difference in the number of slips produced in two different growing environments and yields in field conditions. In addition, the quality of the slips produced were also assessed on the basis of appearance, length, colour, yield performance in field conditions. The research was carried out in collaboration and engagement of T&T Seeds Ltd. Sweet potato slip produced in a Growth Room System (GRS) was compared with production in a Passive Solar Greenhouse System (PGS). Slip performance and harvest yield was evaluated in field conditions, from slips produced in both systems. Sweet potato variety “Covington” seed roots were used for slip production and yield evaluation.

Enhancing Hydroponic Crop Production in the Manitoba Parkland

Dr. Poonam Singh and Industry Partner-Vermillion Growers, Dauphin MB

The study examined the response of horticulture plants to oxygen-enriched nutrient solution under different greenhouse environments-high technology and solar greenhouses. The roots and microbes of plants can exhaust oxygen to hypoxic (low) or anoxic (no oxygen) levels in hydroponic cultures. Supplemental oxygen in the root zone accelerates water and fertilizer absorption by the plants, increasing plant biomass, crop yield and fruit shelf life. Greenhouse design results in microclimates and the plants respond differently to these environments. Results showed the solar greenhouse produced a lower crop yield than high technology greenhouses and fruits produced in the solar greenhouse also had a lower shelf life. The oxygen enrichment of nutrient solution improved post-harvest quality of fruit in both the greenhouse environments.

Rootzone oxygen effect on hydroponic lettuce production

Developing an Irrigation Decision Tool for Manitoba's Commercial Potato Growers

Dr. Sajjad Rao, Dr. Baljeet Singh and Industry Partner-Manitoba Horticulture Productivity Enhancement Centre (MHPEC) Inc., Carberry MB

Accurate irrigation scheduling for the potato crop is a key component of optimal agronomic management because sufficient moisture decreases the pressure and damage of numerous pathogens, pests, and other stress-related problems observed in the field and storage. The need for accurate and precise irrigation scheduling has driven technological advances such as improved irrigation infrastructure, Variable Rate Irrigation, and numerous devices to automate moisture monitoring and irrigation. Despite these advances, Manitoba potato growers must assemble information from these disparate sources, equipment, and experiences to determine answers to basic questions such as what soil and weather conditions determine when to start irrigation for the season and when to start irrigation following rain events. Effective potato irrigation scheduling requires soil water level estimates in the root zone and weather parameter information, for example, rainfall in the next 24 hours. Compared to cereals and other crops such as forages, the potato crop is sensitive to soil water deficits. Typical to a cash crop, the potato's daily water use is variable from planting to maturity. Soil water should be maintained between 65 to 100 % of the available range during the tuber bulking growth stage depletion of the available water to less than 65% can heavily reduce the tuber quality and quantity. In addition to weather parameters such as temperature and relative humidity, many soil physical, chemical, and biological properties such as texture, salinity, and organic matter heavily impact the available soil water levels. Low soil water content, coupled with the practices that potato is grown on soils with low to medium water-holding capacities (sandy soils), requires potato growers to check soil water levels more frequently. There is need to develop systems that can frequently determine soil water levels coupled with weather information to trigger sprinkler irrigation systems on when crop needs water and keep irrigation systems off when there is enough water in the soil to support plant needs. The objective of this study is to evaluate levels of soil moisture in relation to agronomic and environmental factors from selected fields to develop a potato irrigation scheduling decision support tool to aid potato industry stakeholders with irrigation scheduling decisions for optimum plant and tuber growth.

Dr. Sajjad Rao collecting environmental data near Carberry, MB

Evaluating High Tunnel and Passive Greenhouse Growing for Early Harvest of Strawberry

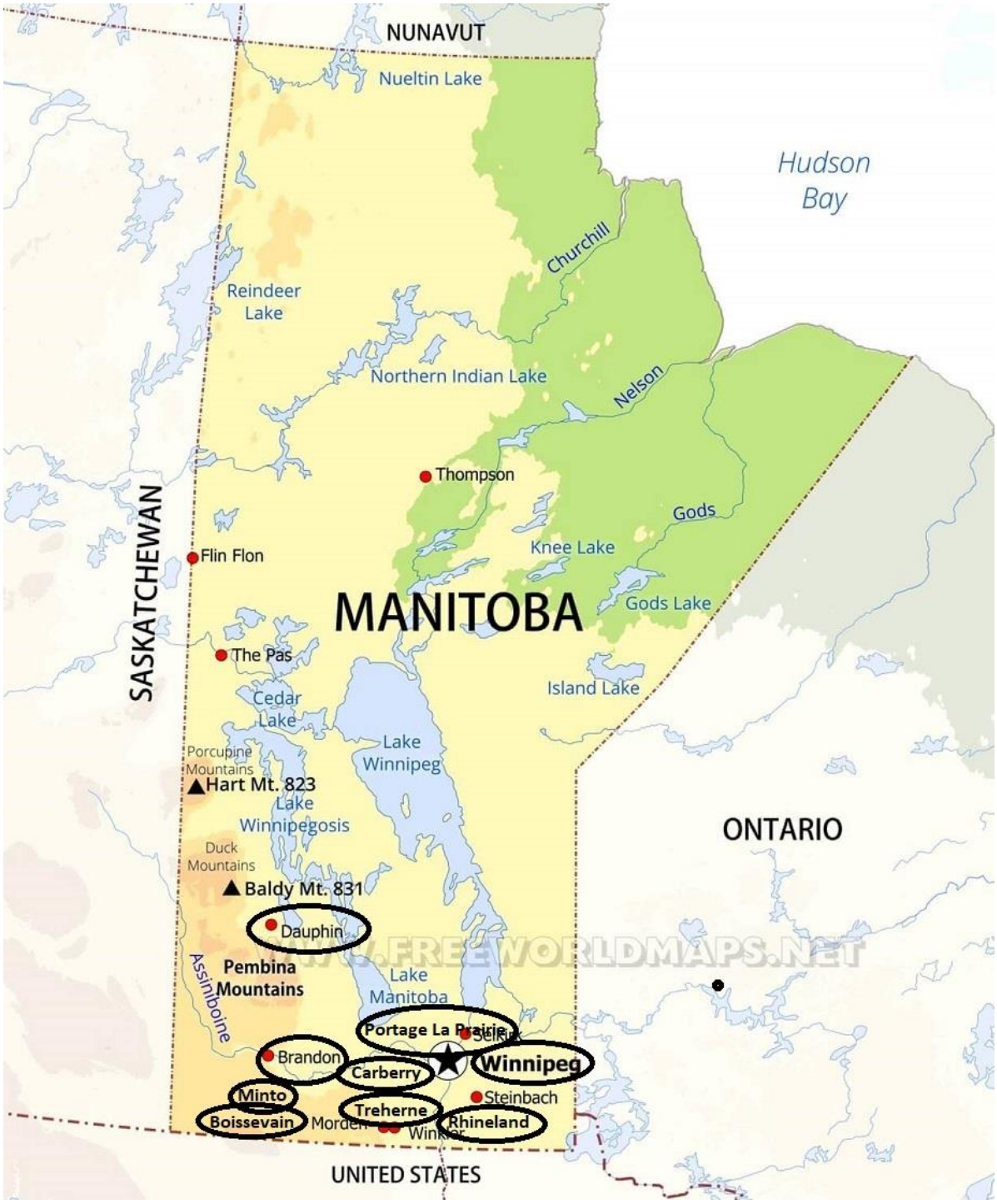
Dr. Sajjad Rao and Industry Partner- Prairie Fruit Growers Association (PFGA), Altona MB

Producing strawberries using high tunnel technology and passive solar greenhouse to extend growing seasons has a great economic potential for Manitoba producers. However, information on best practises is rather limited. This study will compare the transplant, growth and yield of the June-bearing strawberry variety “Cabot” under both high-tunnel and greenhouse growing conditions. The High Tunnel study will be conducted at the AAFC Portage la Prairie, MB Research Station while the greenhouse work will be completed at the ACC greenhouse facility in Brandon, MB. Planting methodology will be based on research from Utah State. Data will be collected on yield, flavour, winter survival, best plug plant production method, transplant timing, production cycle (annual or multi-year).

Student in the Geographic Information System (GIS) program downloading and organizing data.

WHERE DO WE WORK?

Our Research Locations



What Have We Achieved?

New Partners

Memorandum of Understanding Signed

Manitoba Beef & Forage Initiatives (MBFI) Winnipeg/Brandon Manitoba

ACC is a member of the MBFI's Research Review Committee as well as conducting student-led research in developing a Hybrid Wireless Platform (HWP) based on the current sensor systems already in use at the MBFI research facility. The hybrid wireless system will 1) provide coverage of large sections of land; 2) provide connectivity of a variety of technologies; hybrid wireless network 3) support a range of data requirements; 4) facilitate a central data management center. The system will also provide network connectivity for workers while working in the field or throughout the facilities improving efficiency and safety.

University of Winnipeg Winnipeg, Manitoba

ACC and the University of Winnipeg will collaborate to develop deliver and utilize high tech digital tools in crop research and development and; support research and development in growing the digital agricultural industry in Manitoba. In particular, one project will explore the methodology for automating the process of outdoor crop and plant image collection and labelling.

Projects Funded

Exploring New Sustainable Growing Media For Ornamental Crop Production

Researcher-Dr. Poonam Singh Funding: NSERC Engage $24,954
Industry Partner-Vanderveen's Greenhouses Ltd., Carman Manitoba

Investigate different properties of new upcycled and locally available soilless media, explore the ability to replace typical peat-based media, and determine suitability for the crop cultivation in greenhouses and nurseries.

Enhancing Local Production Capacity for Propagating Commercial Sweet Potato Planting Material Through Improved Greenhouse Systems

Researcher-Dr. Sajjad Rao Funding: NSERC Engage $25,000
Industry Partner-T&T Seeds Ltd., Winnipeg Manitoba

Provide Canadian seed businesses/propagators an economically feasible process to grow sweet potato slips commercially in greenhouse systems with modified passive solar settings.

Publications

Response of cucumber plants to oxygen-enriched nutrient solution under different greenhouse environments

P. Singh, Assiniboine Community College, Brandon, Manitoba, Canada.
Acta Hortic. 1317. ISHS 2021. DOI 10.17660/ActaHortic.2021.1317.6 Proc. II Int. Symp. on Growing Media, Soilless Cultivation, and Compost Utilization in Hort. Eds.: B. Vandecasteele and J. Viaene.

Biocontrol in practice in Canadian floricultural greenhouses

P. Singh, Tiffany Nykolyshyn Assiniboine Community College, Brandon, Manitoba, Canada.
Ornamental Horticulture V. 27, No. 4, 2021 p. 544-555
ISSN 2447-536X | https://ornamentalhorticulture.emnuvens.com.br/rbho

Early detection of onion neck rot disease in Manitoba

Singh, P., Ahmad, F., Bisht, V., Thakkar, N., Sajjad, S, PhD.
Canadian Journal of Plant Science 101 (6): 919-932. DOI: 10.1139/cjps-2021-0064

On-Farm Network Soybean Row Spacing Trials-Tighten the row and watch yield grow?

Megan Bourns, MSc, Agronomist-On-Farm Network, MPSG and Baljeet Singh, PhD, Assiniboine Community College
Manitoba Pulse & Soybean Growers; pulsebeat; Issue 92, March 2021
https://www.manitobapulse.ca/wp-content/uploads/2021/03/Pulse-Beat-92_March-2021_FINAL-WR.pdf

Knowledge Transfer

Papers Presented

Singh, P., Bisht, V., and Gonsalves, T. (2021). Direct-seeded versus transplanted onions: Varietal Performance in Canadian Prairies. Paper presented at the Annual General Conference of the American Society of Horticulture Science, Denver, Colorado, USA, August 5-7, 2021.

Singh, P. (2021). Response of cucumber plants to oxygen-enriched nutrient solution under different greenhouse environments. Paper presented at II International Symposium on Growing Media, Soilless Cultivation, and Compost Utilization in Horticulture, Belgium, August 22-27, 2021.

Extension-Results Transfer

Rao, S. *Speaker:* 2021 NAMAL Institute Agribusiness Seminar- *Advancing Agriculture to Agri-Business Learning and Innovation*, October 12, 2021

Rao, S. "Virtual workshop on Microgreens – as part of our Gardening 101 series"; By Prairie Mountain Health and City of Brandon; December 16, 2021-https://www.youtube.com/watch?v=hsrUsmPXGhc

More Knowledge Transfer

Rao, S. "*Hybrid High Tunnel/Passive Solar Greenhouses",* Direct Farmers Market conference. Description: Hybrid High Tunnel/Passive Solar Greenhouses for year round fruit and vegetable production that operates with lower operational management and budgets. February 5, 2022

Singh, P. *Speaker:* Manitoba Agriculture, MB webinar-*Hydroponic cultivation of vegetables,* March 24, 2021

Singh, P. *Speaker:* University of Manitoba Entomology Speaker Series. Nov. 23, 2021.

Singh, P. *Speaker*: Third Age Learning Cooperative. Seminar-Sustainability in Horticulture. Jan 7, 2022.

Singh, P. "Hydroponic Basics and Techniques" presentation to faculty, and M.Sc. and Ph.D. students of Department of Landscaping and Floriculture, Department of Vegetable Science, and Department of Soil Water Engineering, Punjab Agricultural University on March 10th, 2022

Media

Rao, S. "*Funding boost for sweet potato research*". The Brandon Sun, Thursday March 18, 2021. https://www.brandonsun.com/local/funding-boost-for-sweet-potato-research-574013572.html

Singh, P. "Researcher digging up sustainable growing medium for bedding plants" Manitoba Co-operator, December 30, 2021. https://www.manitobacooperator.ca/news-opinion/news/researcher-digging-up-sustainable-growing-medium-for-bedding-plants/

Technology Developed

Molecular Diagnostic Tools for Onion Neck Rot

Using microbiological and molecular techniques, identified the Botrytis spp. to species level

Understanding timing of infection in the field helps producers to develop and evaluate field and crop management strategies while predicting storability and availability of quality bulbs for sale.

Ideal Planting Methods for Optimum Onion Growth and Yield-Direct Seeding versus Transplanting

Field testing to optimize yield and storage quality

Transplanting onion seedlings in the field produced significantly higher yield (total and marketable), and larger, heavier, firmer, and uniform bulbs as compared to the direct seeding method of planting.

Evaluation of Onion Germplasm for Onion Neck Rot Disease Susceptibility

Examination of correlations between genetics, the environment, and onion neck rot disease prevalence in Manitoba.

Prairie growers of Manitoba are able to select the best varieties and management practices to achieve higher bulb yields and quality while minimizing post-harvest losses in storage.

Students

Student-Industry Sponsored, Applied Research

15 students engaged in student-led applied research to address priority issues for industry.

Land & Water Management Program

- *Interpretive Programming for Manitoba's Native Tree Arboretum*
- *Native Plant Supplement to the Existing Rain Garden Guide Available through the Brandon Environment Committee*
- *Identification Guide for Hazardous Plants in Southwestern Manitoba with a Focus on Educating the Public*
- *Constructing Nesting Habitats for Purple Martin at the Brandon Discovery*
- *Soil Erosion Mapping on Willow Creek*
- *Updating Tree Inventory in Grid Cells e10, e11, f10, f11, and g10 at Canadian Forces Base Shilo*
- *Educational Guide to Link the Interactions between Pollinators, Shelterbelts and Crops and Their Benefits across Manitoba*
- *Landscaping with Native Plants-ACC Medicine Garden*
- *Invasive Species Management Plan for Spruce Woods Provincial Park*

ACC Horticultural Production student working in the North Hill campus greenhouse complex.

More Students

Communications Engineering Technology Program

ACC Smart Campus / Lora Soil Sensor-13 (LSS-13)

The ACC Smart Campus is an IoT network which will support labs and projects for students as well as IoT solutions for the College. In agriculture, one of the biggest uses of IoT sensors is for monitoring soil temperature and moisture. The LSS-13 is a soil sensor built for use on the ACC Smart Campus network. It features multiple moisture and temperature sensors at different depths in the ground and a LoRa radio for transmitting data to the cloud. This data can then be processed and turned into charts and graphs for analytics and automation.

ACC Low Power Wide-Area Sensor (LPWAN)

ACC LPWAN Sensor is a system for the intelligent management of greenhouses and grow chambers, the storage and analysis of data. It consists of three main components: Sensor, LoRa Gateway and Azure Cloud. Different types of sensors are programmed via Arduino to connect to a microcontroller with LoRa Radio. The LoRa Radio sends the transmission to the LoRa Radio which sends the data to the LoRa Gateway, which in turn correlates the collected data to the Azure Cloud for data analysis and storage. Currently, ACC's greenhouses and grow chambers have simple sensors to collect data and study the plants and growing environment; the completion of this system makes the management of greenhouses and grow chambers more intelligent, collects a large amount and more types data and is more accurate for research, while reducing manpower needs.

ACC Agribusiness student collecting field data

Student Training

Horticulture Production and Sustainable Food Systems students completed classroom and practicum hours in applied research projects in the greenhouse complex and/or the field grow plots. During 2021 six ACC students were involved in work and training in applied research through work in the Weed Garden, the Native Plants Garden, onion Botrytis Neck Rot Disease trails, strawberry varietal trials, sweet potato slip development and several other projects.

WHERE ARE WE GOING?

Research Focus

- Soil less crop cultures/production systems
- Greenhouse crop production systems/hydroponics/vertical gardening
- Native plants garden
- Hybrid High Tunnel (HHT) technologies for year around crop production
- Improved agronomic practices with increased input-use efficiency
- Develop and evaluate crop genetics having superior traits
- Crop diversification for Manitoba
- Soil and Soil Fertility
- Crop Pest Management
- Wireless sensor networks (WSNs)
- Geographic Information System (GIS) -based statistical models for crop production optimization

Applications Under Review

B. Singh (Co-applicant), Brandon University (Lead Applicant). Letter of Intent-Canadian National Barley Cluster (2018-23)
Improved monitoring and the development of economic thresholds and risk forecasting tools for wireworms in the Canadian Prairies

B. Singh (Co-applicant), Brandon University (Lead Applicant). Letter of Intent- Canadian Pulse Science Research Cluster Next Policy Framework (2023-2028)
Development of genetic control approaches for the major wireworm pest species in the Canadian Prairies

NSERC Mobilize

Applied research funding to acquire necessary operating resources to address applied research priorities in industry, health, and not-for-profit community-based organizations. Submission early 2022.

Canada Foundation for Innovation

Investments in research infrastructure at Canadian universities, colleges, research hospitals and non-profit research institutions. Application in process to the CFI College Fund to secure funding to expand the current greenhouse complex and establish a horticulture plant health laboratory.

WHAT DOES THE FUTURE LOOK LIKE?

The Prairie Innovation Centre

A New, Leading-Edge Agricultural Training Centre

The College is working to raise $65M to build the Prairie Innovation Centre which will be an integrated learning environment with a mixture of collaborative learning spaces, applied research labs, multipurpose spaces and amenities. The Centre will repurpose the 76,000 square-foot Valleyview building on the North Hill campus, joining the Manitoba Institute of Culinary Arts, the Len Evans Centre for Trades and Technology, the sustainable greenhouse, grow plots, orchard and the weed identification garden to provide interdisciplinary training and practical education. This one-of-a-kind Canadian college project will combine indoor and outdoor learning spaces for seamless, hands-on experimentation and training experiences. The Centre will bring together programming currently split between the Victoria Avenue East campus and the North Hill campus in Brandon, Manitoba, creating efficiencies and streamlining capital and operating expenses. The college is anticipating that the federal and provincial governments will contribute $50M while the College will contribute the remaining $15M through philanthropic efforts. Within the last year, the College has raised over $11M towards its $15M commitment.