



UNIVERSITY OF MANITOBA

CANADA FOUNDATION FOR INNOVATION 13-12

Innovation Fund

Notice of Intent

- Completed NOIs must be submitted by the Associate Dean (Research)/Research Liaison Officer of the "Lead" Unit to the Office of Research Services to: Birtukan.Gebretsadik@umanitoba.ca by May 15, 2018.

Proposed name of project: Plant and Soil Resiliency Research Center	Estimated Total Project Costs: \$10,000,000
Designated Project Leader/Faculty/Dept: Dr. Mark Belmonte / Science / Biological Sciences <input type="checkbox"/>	
CV:	
List Principal Users/Faculty/Dept:	
1. Dr. Steve Whyard/Science/Biological Sciences	<input checked="" type="checkbox"/> CV:
2. Dr. Anita Brule Bable/Agriculture/Plant Science	<input checked="" type="checkbox"/> CV:
3. Dr. Rob Duncan/Agriculture/Plant Science	<input checked="" type="checkbox"/> CV:
4. Dr. Jake Stout/Science/Biological Sciences	<input checked="" type="checkbox"/> CV:
5. Dr. Mario Tenuta/Agriculture/Soil Science	<input checked="" type="checkbox"/> CV:
6. Dr. Ivan Oresnik/Science/Microbiology	<input checked="" type="checkbox"/> CV:
'Lead' Unit ADR/RLO: Faculty of Science	
Name: Dr. Ivan Oresnik	

Briefly describe (max 1 page, 12 pt. font size, 2 cm margins):

- The proposed research and how it is world-class, innovative and demonstrates clear benefits to Canada.
- The infrastructure and how it will enhance the University's existing research capacity.
- The excellence of the team, including expertise and existing collaborations necessary to conduct the proposed research.
- Plans to secure matching funds and the potential funding sources for the operation and maintenance of the infrastructure.

Plant and Soil Resiliency Research Center

Proposed research and how it is world-class, innovative, and demonstrates clear benefits to Canada

During the next 35 years we will need to produce more food than in the entire history of humankind. A critical challenge is to understand how we can improve crop production on a decreasing amount of farmable land and better understand how crops can adapt and withstand adverse abiotic and biotic conditions while maintaining soil health. Thus, there is a critical and immediate need to find new and innovative ways to sustain the agro-ecological environment through fundamental and applied knowledge in plant and soil biology also described as resiliency. We propose an innovative Plant and Soil Resiliency Research Center that will bridge plant and soil biology with microbiology, ecology, genomics, biotechnology, chemistry, and informatics to understand how plants and soils interact to influence the agro-ecological environment. World class researchers at the Plant and Soil Resiliency Research Center will broadly focus on i) improving crop yield and ii) improving soil health. This work is innovative in that this research center will serve as a hub to develop novel crop protection technologies using RNA interference, bacterial biocontrol systems, and anti-viral strategies that require state-of-the-art biosecurity facilities. This work will also improve crop yield through conventional breeding and genome editing technologies. To improve soil health, researchers will have access to instrumentation that tracks nutrient cycling between the atmosphere, soil, and plant in addition to housing microsensor infrastructure to track soil freezing properties, fertility, and soil-microbe-plant interactions over time.

Taken together, this innovative research center will house cutting-edge infrastructure necessary to address one of the world's most pressing challenges – to feed 9 billion people by the year 2050. It will allow Canada to remain at the forefront of the food production industry. Further, this infrastructure will enable a pan-prairie research team to establish scientific leadership in the areas of plant and soil resiliency that will be translated to real-world applications and disseminated to growers and researchers across Canada and beyond. Its location in Manitoba will enhance the existing seed and chemical industries in the Canadian prairies and technologies developed here will lead to job creation in a large number of related biosciences fields.

The infrastructure and how it will enhance the University's existing research capacity

The proposed infrastructure will be used for breakthrough science in the domain of sustainable agriculture. Controlled environment facilities are absolutely critical in the study of plant and soil resiliency, especially those requiring flexible environmental conditions, biosecure facilities or those using sophisticated biological systems that require precise environmental controls and microsensors – all of which are unavailable at U Manitoba. To realize the growing need of controlled environment facilities, the Plant and Soil Resiliency Research Center will be located at the Crop Technology Center on the Fort Garry Campus which is currently shared between the faculties of Science and Agriculture and Food Science. The two-story Plant and Soil Resiliency Research Center will house state-of-the-art controlled environment chambers on the ground floor and multi-room glasshouses on the second level of the facility. This innovative research center, the first of its kind on the Canadian prairies will: i) house flexible controlled environment chambers that can independently control soil and plant growth and atmospheric conditions; ii) be biosecure and control pollen and genetic contamination between growth areas and the outside environment, iii) house facilities to conduct high-throughput plant, microbe, and soil phenotyping experiments, iv) use low output and efficient LED lighting for soil and hydroponic applications, and v) offers experiment protection in case of emergency shutdown. The current research facilities are not equipped to enable this type of research, especially those that require separate atmospheric conditions to trace nutrient mobilization between the atmosphere, soil, and plant; develop RNA interference technologies to track plant-microbe and plant-insect interactions, or prevent the contamination of genetic material to the outside environment. In fact, some industries will not release material to the applicants because of the lack of biosecurity, thus preventing advances in scientific discovery and application.

The requested infrastructure will foster new collaborations and be a draw for world-class researchers interested in studying plant and soil resiliency on the Canadian prairies. The University of Manitoba will benefit from the proposed research center which will bridge units across campus through interdisciplinary collaborations and serve as the premiere plant and soil resiliency research hub in Canada. A recent survey of plant and soil biologists in both units revealed a critical need to increase controlled environment facilities by 250 percent (5000 ft sq²) to meet current and projected needs. This center will also ensure growing strength of the University that has established 'Food Systems' and the research that falls under this broad umbrella as a research priority and for which the University was founded over 140 years ago.

The excellence of the team, including expertise and existing collaborations necessary to conduct the proposed research

The proposed work will provide an innovative research facility to support our pan-prairie team. The team consists of leading plant and soil biologists engaged in sustainable agriculture from the University of Manitoba (Science, Agriculture and Food Science) as well as U. Regina (Yost), U. Winnipeg (Good), Brandon U (McGonigle), U. Saskatchewan (Kochian; Kutcher; Bonham-Smith; Germinda), U. Calgary (Samuels). This team will provide a central role in the design and needs of the facility. The collective efforts of our team aim to maintain an international presence while pursuing research critical to the strategic research framework of the University of Manitoba and beyond. For example, researchers have a strong history of successful research funding, training, publications and collaborations. Together the six researchers that form part of this notice of intent have published XXX times, presented their work at National and International meetings XXXX times, collaborate internationally, and secured tens of millions of dollars in research funding over the past 6 years. Researchers in Science are already collaborating within and between units (Science: Belmonte, de Kievit; Agriculture: Fernando), others between universities (UM: Oresnik; UR: Yost), and all with strong industry collaborations (see list of industry collaborators below). Researchers have a strong history of interdisciplinary research with successful funding support from regional, national, and international agencies including the Province of Manitoba, Saskatchewan Ministry of Agriculture, Agriculture and Agri-Food Canada's Canadian Agriculture Policy Framework, NSERC (DG, Engage, CRD, CRC programs) and from special interest grower groups.

Plans to secure matching funds and the potential funding sources for the operation and maintenance of the infrastructure

Funding partners include the Faculties of Science and Agriculture and Food Science, provincial funding agencies (Research Manitoba), and the suppliers of the equipment (Conviron or BioChambers) to be housed in the Plant and Soil Resiliency Research Center. Those that are currently studying in the areas of plant and soil resiliency and related fields have established partnerships with the Province of Manitoba through Manitoba Agriculture, grower groups (Manitoba Pulse and Soybean Growers, Canola Council of Canada, Canadian Field Crop Alliance, Manitoba Corn Growers), and industry (Monsanto, Syngenta, Bayer, Manitoba Hydro, DL Seeds, Bunge, Stoller Enterprises, ATP Nutrition). We anticipate these partners will have keen interests in this project.

Both Units have technical support specifically dedicated to plant care and will be used to aid in the day-to-day maintenance and management of the facility. Moreover, all applicants have significant funding from sources like NSERC Discovery, Collaborative Research and Development programs, in addition to Canadian Agriculture Policy cluster funding from Ag Canada in collaboration with special interest grower groups and industry partners. Importantly, given the immediate need of this research facility, all controlled environment rooms and research space will generate a continuous stream of funding through a user fee structure that will sustain the infrastructure over time.