#### SUSTAINABLE PROTEIN INNOVATION



# MANITOBA PROTEIN RESEARCH STRATEGY

## Defining the Research Ecosystem in Manitoba

Developed by Dr. James House, Professor at the University of Manitoba

Imagine Manitoba as the acknowledged global leader in sustainable protein. Though sustainability is our greatest challenge, it is also our greatest opportunity. The dream is an achievable one.

Industry, academia, government and non-profits are working together to strengthen Manitoba's position as a global leader in sustainable protein. Collectively, these stakeholders developed the Manitoba Protein Advantage Strategy – a comprehensive action plan to accelerate strategic sustainable protein initiatives. This strategy highlights the need for robust work on knowledge and information generation – one of the key pillars in the Manitoba Protein Advantage Strategy.

Manitoba has a robust research ecosystem, and with strategic direction and targeted resources, the province can advance its position as a leader in sustainable protein innovation. Dr. James House, professor at the University of Manitoba's Department of Food and Human Nutritional Sciences, with the support of Research Associate Dr. Erin Goldberg (University of Manitoba) developed the Manitoba Protein Research Strategy (MPRS) to help advance Manitoba's Protein Advantage. The MPRS will serve as a work plan for a Strategic Research Chair in Sustainable Protein.

The MPRS identifies priority research gaps and their connections to the four factors of sustainability: health, environment, sociocultural, and economic. Beyond specific research expertise, MPRS envisions the future Chair to be a nexus for research collaboration and knowledge translation activities. By doing so, the Strategic Research Chair in Sustainable Protein will foster important connections between academia and industry while leading strategic research priorities that will attract investment in the protein sector for long-term economic growth.

## The MPRS highlights 46 strategic research projects under four main themes:

- Climate resiliency of sustainable protein food systems
- 2. Novel sustainable protein product development and processing
- 3. Digital agriculture to enable sustainable food systems
- 4. Waste, water, by-product and co-product utilization



#### **Priority Areas in Sustainable Protein Research**



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Crop nutrient management aimed at the net-zero emissions

Relationship between a changing environment and genetics in yield, crop quality, and the nutritional, functional and

Z focus on soil health, including the use of cover crops, crop rotation and annual legumes to improve resiliency

weather events, and targeted breeding for climate stressors such as drought, heat, flooding etc.

indicators of climate stress below ground in

Focus on circular bioeconomy and the interface between livestock and plant protein sectors

Restoring natural cycles for carbon, nitrogen, water in regenerative agriculture and ecological restoration

industry, with a focus on the cow-calf relationship

(i.e. crop diseases with rotation limits such as peas)

Understanding the synergies between animal and plant based proteins

producers to support environmental sustainability and climate resiliency, while balancing profitability (ie. natural grassland habitat preservation)



**PROCESSING** 

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SUSTAI









reduction of greenhouse gases targeting

sensory properties of protein foods

Building resilient production systems with a

Crop and livestock \*adaptation to extreme

Understanding and overcoming early complex root systems

Breeding plants for quality and defined parameters focused on processing needs

Developing metrics for the ruminant

Balancing profitability with sustainability

Marketing research to translate knowledge base around sustainability and biodiversity to the public and industry

\*Valuing ecosystem services provided by

Reducing grain oil content to support efficient protein extraction

Development of ethical luxury food branded functional foods using traditional, minimally processed methods of production with recognition of Traditional Knowledge in collaborative efforts

Understanding processing impact on human health and consumer acceptability, and removal of undesirable flavours in both food and animal feed

Reducing allergens during processing

Understanding the interactions between protein and non-protein components to optimize novel product formulations

Understanding the potential health benefits of anti-nutrients

Development of sustainable and functional

More research into alternative protein (ie. single-cell) production to feed the growing world

Determining appropriate metrics to evaluate sustainability of protein production and processing

Optimizing quality and nutrition through next generation blends of animal, plant and alternative protein

Novel technologies to improve the functionality and purity of starch-rich concentrates and protein using clean label friendly processes

Optimized assessment measures for protein quality without the use of animal testing

Precision livestock farming, applied demonstration of feed efficiency in commercial herds, and enhanced knowledge S

Internet of things (IoT), connectivity of sensors and proper interpretation of data from sensors

Artificial Intelligence to target commercial traits associated with high quality seed protein

Technology to improve production performance

Defining a framework to conceptualize digital agriculture in its ability to improve efficiency, productivity and sustainability

Translating digital information into actionable management for producers

Defining the social aspects of digital agriculture including behavioural economics, and industry and consumer behaviour to understand which technologies are needed

Characterizing specific traits in pulse flours (beyond isolates and concentrates)

Demonstrating the economic value in digital agricultural tools to producers (i.e. pest surveillance)

Using digital agriculture and modelling in understanding the linkage between soil health, nutritional quality and human/animal Second generation biofuel development, like manure bioenergy

Life Cycle Analysis on waste, co- and byproducts (i.e. LCA on manure to demonstrate impact on soil health and carbon storing)

Full characterization of co-products and by-products and overcoming regulatory hurdles for their use in the animal feed industry

Relationship between feed and manure composition for further utilization

Fish by-product as fertilizers or other uses

Geographic indicators for identifying attributes and connecting them to intellectual property

Finding new uses for starch (i.e. new fermentation uses, pharmaceutical formulations, microbiological testing, packaging etc.)

Using lignocellulosic biomass in food and non-food applications (i.e. packaging, adhesives, platform chemicals, industrial chemicals, biomaterials)

\*Improving management of plant by-products and finding new uses for plant protein ingredients



Reducing water and energy use in food processing through novel technologies (i.e. dry fractionation) and improvements to existing technologies (i.e. wet extraction)

The role of water management in environmental sustainability and climate resiliency (i.e. water remediation, reuse, waste water reduction, water reuse in extraction solvents, water usage, water infiltration, water reduction in processing, impact of water management on carbon content)

Investigation of environment x genotype x processing interactions

Processing optimization of protein foods for high quality biofuels and livestock feed

Note: \*In addition to the research gaps identified through the gap analysis, top priorities from our initial surveys were included if they were not already represented.



#### **Rising Global Demand**

With a growing world population and increasing income levels in emerging markets, the global demand for sustainable protein is continually rising. Protein produced and processed in Manitoba is among the world's highest quality. Identifying key research opportunities and potential challenges in the protein sphere is critical in advancing Manitoba's position as a global leader of sustainable protein.

Rising consumer awareness regarding adequate protein intake and the associated health benefits, concurrent with rising wealth in developing nations, has also contributed to this rise in demand for high

quality sustainable protein. The overall sustainability of the full production and utilization cycle is a key challenge facing the protein supply sector. Sustainability, as defined by the FAO/WHO, strives to achieve a balance between four factors:

- 1. Place minimal pressure and impact on the environment
- 2. Promote all aspects of an individual's health and wellbeing
- 3. Be accessible and culturally acceptable
- 4. Be economically viable and affordable

### **Key Recommendations**

The key MPRS recommendations focus on the need for funding, collaboration with industry, training of highly qualified personnel and better understanding of provincial infrastructure.

- Manitoba should focus efforts on the research priorities identified under the four themes of climate resiliency of protein food systems; novel protein product development and processing; digital agricultural and food systems; and management and utilization of waste, water, byproducts and co-products.
- Manitoba should develop targeted programming to advance the identified research priorities.
  Program design should consider both the capacity of enterprises and the public versus private outcomes.
- 3. Manitoba should continue to evolve the MPRS under the leadership of a Strategic Research Chair in Sustainable Protein.

- 4. Manitoba should leverage existing committees and structures to support the Strategic Research Chair in Sustainable Protein to strengthen collaboration within Manitoba's robust protein research ecosystem and guide programming to advance the MPRS.
- 5. Manitoba should strengthen synergies between government, the research community and industry through networking opportunities and digital tools via the development of a Sustainable Protein Research Network.
- To build momentum on the MPRS, Manitoba's protein research community should collaborate with global experts and institutions to advance common strategic priorities in protein research and innovation.



#### **Conclusions**

The MPRS identified key priorities such as increased collaboration between academia, industry, and government, and a focus on sustainability throughout the food system. Government is seen as a facilitator to advance research priorities through appropriate funding programs, a connector between industry and researchers and a provider of strategic policy direction.

Appropriate funding programs remain an important component to advance the strategy. Programs such as public/private cost-sharing and the partnerships needed to advance shared priorities must be further evaluated. In particular, the current 50:50 cost-matching structure may not be suitable for all project priorities and partnership structures.

Upon reflection of the research gaps identified through the MPRS, it is recommended that the province considers supporting a Strategic Research Chair in Sustainable Protein to advance the Manitoba Protein Advantage Strategy. The Chair will focus on

the areas of sustainability, particularly in relation to the four themes identified by the MPRS including: climate resiliency of sustainable protein food systems, novel sustainable protein product development and processing, digital agriculture to enable sustainable food systems, and waste, water, by-product and co-product utilization. The Chair should possess a strong record of past research funding, training HQP to advance sustainable protein research in Manitoba, and be a focal point for knowledge translation and training activities.

The Manitoba Sustainable Protein Research Symposium is an important element in knowledge transfer, placing local research at centre stage of the changes sweeping the global sustainable protein food system, and creates opportunities for collaboration with industry and other researchers across the entire protein research ecosystem in Manitoba, Canada, and the world.

#### **Contact**

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