

**NOVA SCOTIA AGRICULTURAL COLLEGE
STRATEGIC RESEARCH PLAN**

OCTOBER 2008

INTRODUCTION:

The vision of the Nova Scotia Agricultural College (NSAC) is to be recognized for excellence in learning that builds leaders, for innovations that sustain communities and for the creation of opportunities that shape global agriculture. Accordingly, the research mission is to encourage, support and conduct research in agriculture, aquaculture, the environment, and related fields, recognizing that research and education are inextricably linked. The main objectives of research are to advance knowledge and new technologies for environmental sustainability, rural growth and bioresource innovation in support of the agri-food and aquaculture industries and society at large.

RESEARCH PRINCIPLES:

NSAC promotes fundamental and applied research. It believes that the agri-food industry and rural communities, the public, researchers and students are best served by a research atmosphere that allows for the pursuit of ideas on an independent basis. NSAC subscribes to the concept of academic freedom and encourages, promotes and supports excellence in all research programs. Ultimately, agri-food research must be interpreted in the broadest sense to fully understand its consequences, and a team approach is required to address its multi-faceted issues. Linkages among researchers, and between NSAC and private industry, are important features of this approach. The driving forces affecting further growth of Atlantic Canada's agri-food sector include the need for developing and adopting economically and environmentally sustainable agricultural systems, effective trade policies, food safety and security policies that instill public confidence, and overall development of the rural economy. Overall, NSAC's strategy has been formulated to address these challenges through research and graduate-level training.

RESEARCH TRAINING:

Researchers at NSAC involve undergraduate students, graduate students, , postdoctoral fellows, visiting scholars, technicians and technologists in their research. NSAC has educational programs at the technical, undergraduate and post-graduate levels focused on agricultural sciences and business, environment and rural issues. NSAC partners with Dalhousie University to offer a Master of Science program with specializations in agriculture. This degree provides formal research training in various subdisciplines of environmental, plant and animal sciences. Several NSAC researchers

partner with colleagues at other universities to supervise doctoral students on site, or host students and scholars from international partner institutions. All students in the Bachelor of Science in Agriculture program, our flagship degree, conduct an undergraduate thesis in their fourth year, providing a key research link between the main undergraduate study body and research. An increasing emphasis on international agriculture within curriculum paired with international recruitment and student mobility programs broaden student expertise and outlook.

Research and graduate student activities are housed in four academic departments: Plant and Animal Sciences, Business and Social Sciences, Engineering, and Environmental Sciences. The M.Sc. program has grown to just under 80 students since its introduction in 1994. It is the goal of NSAC to increase total graduate enrollment to 100 students by 2010 through recruitment of new students and research-oriented faculty and the introduction of additional graduate programming.

LINKAGES:

NSAC faculty have established links with researchers at other colleges and universities, with scientists at Agriculture and Agri-Food Canada (AAFC) research centers and other national and international agricultural institutions. NSAC faculty value their interaction with industry partners and technology transfer professionals, and are committed to the dissemination of research results. NSAC has recently established an Industry Liaison Office to expand industry sponsored research, to provide technology transfer and commercialization services, and to transfer research results from the laboratory to industry. NSAC has strengthened industry linkages by establishing industry and government supported research professorships in a number of areas. Current partnerships address applied research in farm energy conservation, edible horticulture, tree fruit and blueberry bio-product development, mink immunology, plant stress physiology, entomology, waste management, and precision agricultural systems. Several new partnerships are proposed. Past disciplines supported through this program include blueberry and carrot physiology and production, dairy cattle and mink genetics, fur animal nutrition and production, poultry products, potato physiology and molecular biology, cropping systems agronomy, turf grass production and breeding, and climate change. The most successful research professors have migrated to tenure-track positions at NSAC and continue to carry out research supported by industry partners.

INFRASTRUCTURE:

Development and maintenance of quality infrastructure is fundamental to the support of research. NSAC maintains a modern, well-equipped campus that includes various horticultural and field crop sites, an aquaculture facility, small animal and livestock units, a mouse colony, and a bio-environmental engineering facility. A 245-hectare farm complex supplies feed and housing for dairy cattle, sheep, poultry and fur animals used in research and teaching. The land base provides for conventional and organic crop

research and feed stocks for the research milking herd, beef animals and sheep flock. The university also has extensive pasture, field and turf grass facilities, an experimental orchard and a number of outlying research facilities including a wild blueberry research centre. The library houses the largest repository of agricultural resource material in Atlantic Canada and is a member of the Atlantic Scholarly Information Network with access to more than 27,000 electronic journals. A computer network and the integrated, automated library system are accessible from both local and remote sites. NSAC also runs AgriTech Park, an agricultural business incubator. The Atlantic BioVenture Centre is a self-managed entity to explicitly develop commercially viable products using the bio-resource assets in Atlantic Canada under the concept of “development requiring research”. The Organic Agriculture Centre of Canada was created at NSAC to enhance the environmental and social integrity of agriculture through the scientific analysis of methods to improve the sustainability of farming. This centre conducts research with collaborating institutions across the country.

NSAC is committed to supporting operational and maintenance costs that are associated with research infrastructure, and continues to improve its research capabilities. Significant recent improvements include extensive renovations of a suite of molecular genomics laboratories, construction of the largest fur animal research centre in North America, and development of a new poultry facility which includes an abattoir and food science laboratory for post-harvest food quality research.

PRIMARY RESEARCH AND RESEARCH TRAINING:

Canada Research Chairs Program

NSAC has been allocated three Canada Research Chairs (CRC), including one Tier I and two Tier II chairs, and has identified research thrusts where strengths and opportunities for success fit into the CRC program. NSAC has implemented the Chairs as indicated below in Table 1. In the first round, the Tier II Chair in Agricultural Resource Management was offered to an outstanding faculty member already at NSAC, while the Tier II Chair in Organic Farming was offered to an outstanding researcher who was in a contract position at NSAC. The Tier I Chair was recruited from outside the institution.

Allocation of Tier I and Tier II Canada Research Chairs by Year and Research Thrust

CRC Tier	CRC Title	Research Thrust	Appointment Date	Renewal Date
Tier I	Agricultural Biotechnology	Molecular Genetics, including molecular characterization and selection of animals	01-Apr-04	31-Mar-11
Tier II	Agricultural Resource Management	Agricultural resource and waste management	01-Apr-03	Completed & reassigned

Tier II	Organic Agriculture	Soil impacts and nutrient cycling in organic systems	01-May-05	30-Apr-10
Tier II	Aquaculture & Agriculture Resource Management	Waste water treatment research and development	Being recruited	

The Canada Research Chairs allocated to NSAC address the following major areas of research:

1. Applied Molecular Biology and Biotechnology: The objective of this research thrust is to build a strong team that effectively and efficiently uses the principles of molecular biology to solve biological, agricultural and environmental problems in a wide range of disciplines. Six faculty, including a Tier I Canada Research Chair, depend on molecular biology to support research in reproductive biology, animal breeding, animal molecular biology, potato physiology, nutrient-gene interactions and forage genetics. NSAC has excellent capital infrastructure for molecular biology research that has been acquired through a variety of sources, including the Canada Foundation for Innovation. The Tier I CRC will be instrumental in bringing this diverse group of researchers together into a successful research team and in initiating broader collaborations with other researchers at NSAC and elsewhere.

Researchers have been successful in obtaining research funding from national sources including NSERC, the Dairy Farmers of Canada and McCain's Foods. Current collaborations exist with Dalhousie University, Laval University, the University of Guelph, the University of Alberta, regional and national dairy sectors, the National Animal Genome Initiative, Agriculture and Agri-Food Canada research stations (Ste. Foy, Lethbridge and Fredericton), national breed organizations, provincial departments of agriculture, and the Institute of Agricultural Biotechnology in Seibersdorf, Austria. The Atlantic Innovation Fund has provided additional opportunities to leverage industry funding to create unique interdisciplinary partnerships between molecular biologists, other discipline specialists and industry to address industry problems, such as mink aleutian disease, or to develop and advance new products, such as feed supplements that enhance the nutritional value of milk products.

The expected outcomes of this research specialization include increased effectiveness in the generation of new knowledge related to environmental, agriculture and food issues, and new products arising from bioresource development. This would be reflected by an increase in the number of NSAC researchers using molecular techniques to address research questions, a doubling of the number of graduate students supervised by members of this research team, and an increase in overall research funding associated with molecular biology.

2. Agricultural Resource Management: The objective of this research thrust is to develop programs on air and water quality management and monitoring as related to

agricultural and aquaculture resources and wastes. This collaboration involves at least seven faculty, including the previous Tier II Canada Research Chair. Specific projects address greenhouse gas emissions from agricultural systems, pathogen, nitrogen, and phosphorus management in surface and groundwater, bioremediation, agricultural systems modeling at regional, watershed and farm levels, soil conservation, soil quality, alternate energy sources in agriculture, soil-plant-environment interactions, soil fertility and nutrient management, composting, and wastewater and waste management. Technical and infrastructure resources include analytical, atmospheric, and environmental monitoring capabilities. Infrastructure at the Bio-Environmental Engineering Centre includes manure storage structures, a compost facility, constructed wetlands, wastewater treatment systems and tile drainage water monitoring sites.

Collaborations exist with regional and agricultural universities, and several government departments and organizations including the Resource Stewardship branch of the Nova Scotia Departments of Agriculture, of Natural Resources and of Environment, Agriculture and Agri-Food Canada, and Environment Canada. Extensive and diverse industry involvement includes partnerships with the Nova Scotia Federation of Agriculture and several Nova Scotia commodity organizations, including Pork Nova Scotia, the Dairy Farmers of Nova Scotia, the Wild Blueberry Producer's Association of Nova Scotia, Horticulture Nova Scotia, and the Annapolis Valley Growers Water Group. Other partners include industry such as Stella Jones Inc, Agra-Point International, Atlantic Land Improvement Contractors Association, and international collaborators at the Swedish Agricultural Institute, North Carolina State University, Tartu Agricultural University in Estonia, and the Soil Fertility Institute in the Slovak Republic.

The expected outcomes of this research thrust include an increase in the number of graduate students supervised by members of this research team, an increase in overall research funding associated with waste management issues, and an expansion of the list of collaborators associated with this research. The first Tier II CRC in this area provided a coordinating and integrative role in this diverse research area, and was highly successful. Additional faculty were and continue to be recruited to support those efforts. The second Tier II chair in resource management is expected to strengthen the efforts of the group, and to broaden the capacity of the institution to address aquaculture waste water management, an emerging area of concern.

3. Organic Farming: The objectives here are to develop and improve the science of organic agriculture, to support the research objectives of the Organic Agriculture Centre of Canada (OACC), which is based at NSAC, and to link with other established NSAC research and emerging research needs. NSAC can play the leading role in developing science-based knowledge and providing education for students, farmers and others regarding the production of safe and nutritious food according to organic principles. Current organic farming research involves at least 13 faculty members, including the Tier II Canada Research Chair. Faculty expertise includes animal science, horticulture, agronomy, soil science, compost science, engineering, pest management, history, geography, extension research, ethology, and economics. Infrastructure is derived from several sources, including the Canada Foundation for Innovation. The Tier II CRC

associated with this research thrust will be the team leader in many of the research projects undertaken by this group.

Among NSAC's collaborators in organic research and knowledge transfer are faculty and scientists at Dalhousie University, Laval University, McGill University, University of Guelph, University of Manitoba, Agriculture and Agri-Food Canada research stations in Alberta and Saskatchewan, University College of the Fraser Valley, University of British Columbia, Mount Allison University, the Atlantic Veterinary College of the University of Prince Edward Island, Memorial University, University of New Brunswick, and York University. Collaborations with universities in Europe that belong to The Common European Specialization in Ecological Agriculture program have been initiated. The Canada Research Chair supports the research objectives of OACC and is evaluated in this regard with advice from OACC's advisory board.

The expected outcomes of this research focus include an increased transition to scientifically-based organic agriculture and associated support industries, and increased scientific development and assessment of organic practices that increase the economic, social and environmental sustainability of agriculture at large. These outcomes will be indicated in part by an increase in the number of undergraduate and graduate students supervised by members of this research team, an increase in overall research funding associated with organic agriculture issues, and an expansion of the list of collaborators associated with this research.

All CRC positions are further evaluated individually based upon the number of referred publications, the impact rating of the journals in which they publish, the number of graduate students supervised or co-supervised, and the level of research funding attained. A review committee will be appointed by the Vice-President Academic to evaluate the CRC position one year prior to the end of the incumbent's term.

Additional Research Thrusts:

NSAC supports a broad range of activities in agricultural research and encourages diversity in its activities. Consequently, in addition to the above research areas that are supporting Canada Research Chairs directly, there are several additional major research thrusts at NSAC that will benefit from collaborations with the CRCs. These include the following three areas of research:

1. Environmental Sustainability is a major area of research at NSAC that includes the agricultural resource efforts described above as well as a broader effort in climate change, energy utilization and management and ecologically focused production research using both plant and animal systems.

2. Bio-Product and Bio-Resource Development is emerging as a strong area of research focus at NSAC. Through the efforts of three research professors, research currently focuses on product development for the poultry industry and on bio-product

development for the blueberry and tree-fruit industries. This area is expanding, and depends up the fundamental expertise present in the plant and animal systems areas described below. NSAC focuses on innovative research that will lead to the creation or development of novel technologies, processes or products that can be applied to food quality and safety, functional foods and nutraceuticals, novel bio-products and aquaculture. NSAC's connection with the newly established Atlantic BioVenture Centre is expected to greatly enhance activity in this area of research over the next five years.

3. Plant Systems research provides the core knowledge and technologies to enable the environmental sustainability and bioresource innovation initiatives. This work focuses on fundamental research in the areas of plant physiology, plant stress physiology, and nutrition, and on industry priorities for specific commodities groups, such as the wild blueberry, processing carrots, rhubarb, potato, grains, cereals, tree fruits, and other fruits and vegetables. Example approaches include concentrating on improving crop yields, reducing the application of agro-chemicals, developing sustainable management systems, assessing and developing new cash crops for the region, and studying cropping systems from soil fertility through to plant nutrition. This research area is well-developed and supported by 17 researchers. Although there is no CRC assigned to this research thrust, there are four Agricultural Industry Research Chairs working on plant systems and the CRC in Organic Agriculture and the previous CRC in Agricultural Resource Management overlap with these activities. Collaborators include the Wild Blueberry Producers Association of Nova Scotia, Nova Scotia Wild Blueberry Institute, Nova Scotia Fruit Growers Association, Scotia Gold, Oxford Frozen Foods, Bragg Lumber Company, McCain Foods, Knol Farms, the NB, PEI, and NS Cranberry Grower Associations, University of Guelph, University of Prince Edward Island, Dalhousie University, Agriculture & Agri-Food Canada, Horticulture NS, and University of Manitoba.

4. Animal Systems research, like the plant systems research, enables the primary sector and the other strategic research areas. Objectives include addressing problems in animal production for food and non-food uses, creating novel food products for the dairy and poultry industries, developing new feeds from waste by-products of other industries, and addressing health-related and nutrition problems for animal producers. Specific research programs exist in animal nutrition, genetics, physiology and ethology as related to the dairy, fur, poultry and sheep industries. Although there is no CRC assigned to this research thrust, there are several AAFC-funded researchers at NSAC who are working on animal systems and the CRCs in Molecular Biology, Organic Agriculture, and Agricultural Resource Management. Researchers in the animal sciences have well established links with producer organizations, such as the Nova Scotia Mink Breeders Association, Canada Mink Breeders Association, Dairy Farmers of NS, Dairy Farmers of Canada, Atlantic Poultry Research Institute, the poultry and egg producers of the four Atlantic Provinces.

5. Aquaculture is a developing area of research at NSAC. The objectives of this research are two-fold. First, NSAC wishes to integrate the environmental research needs of the aquaculture industry with the agriculture resource management group

through assignment of the CRC Tier II renewal to this area. Second, NSAC researchers are working to define the nutritional requirements of marine finfish and shellfish, establish alternative protein sources for carnivorous fish, and develop salmonid diets that satisfy the changing nutritional needs of fish with respect to season. The aquaculture research program includes a multimillion dollar aquaculture centre with fresh- and salt-water facilities for finfish, shellfish and algal culture. The Tier II CRC associated with this research thrust will be instrumental in organizing the research team required to address this thrust and in acquiring additional collaborators.

Inter-institutional collaborations in aquaculture research include those with Memorial University, Department of Fisheries and Oceans, National Research Council of Canada, St. Francis Xavier University and University of Prince Edward Island. Private sector partners include Coastal Zones Research Institute, Shur-Gain, and the fish farming industry.

6. Rural Growth is an emerging area at NSAC, emphasized as a strategic focus in the 2008 NSAC Strategic Plan for Research. This includes a diverse group of researchers with the core value that NSAC's research must contribute to the intellectual capital necessary to grow a viable and environmentally sustainable rural economy. This group addresses economics, business, social sciences and humanities. As researchers begin to focus on rural health initiatives and animal health research that has applications to human health and disease, linkages have formed with faculty at Dalhousie University and researchers are jointly collaborating on CIHR-funded projects. A CIHR-funded researcher joined NSAC in 2005 to address rural health issues. Animal disease research is being explored for implications to human health issues.

MEASURING THE PLAN'S SUCCESS:

The success of the Strategic Plan for Research will be measured on an annual basis using several numeric indicators. These include both general indicators, such as the number of industry sponsored research chairs, the number of graduate students enrolled at NSAC and within each of the areas of research thrust, the number of industry and other collaborators, total research dollars and the ratio of research dollars per faculty member, and discipline-related indicators, such as the number of publications, grants, contracts, awards, and honours. Increases in infrastructure for research and national rankings of research intensity will also be used.

PLANNING AND APPROVAL PROCESS:

Strategic planning for research is initiated within the Office of Research and Graduate Studies and will be overseen by the Vice President of Research. The strategic planning process involves the Research Committee, which is a standing committee of NSAC's Faculty Council. This Committee solicits input from researchers across campus and from industry and government co-operators.

Canada Research Chair positions are advertised nationally and internationally. Position advertisements are approved through NSAC's Human Resources office and are further screened by the Nova Scotia government. Employment equity issues are addressed in the advertisements to ensure that applications are encouraged from all qualified individuals. An interdepartmental selection committee is formed and screens and evaluates all candidates. This committee also interviews selected individuals and acts as an editorial board for subsequent CRC nominations and CFI applications. CRCs are assigned the appropriate academic department.

CFI applications are coordinated through the Office of Research and Graduate Studies and are subject to both internal and external review. The NSAC Executive is consulted on all aspects of CRC and CFI initiatives.

AFFIRMATIVE ACTION AND GENDER REPRESENTATION IN RELATION TO CRC NOMINATIONS:

NSAC has an Affirmative Action Program that promotes equity and diversity in the workplace for visible minorities, aboriginal people, persons with disabilities and women. NSAC takes positive steps to ensure that designated groups are represented in all positions and at all levels to no less than the same extent they are represented in the general population.

With specific regards to the Canada Research Chairs (CRC) program, NSAC encourages persons within all groups, including women and others generally under-represented in academia, to apply for Canada Research Chair positions. Where possible, NSAC solicits applications from women and minority groups.

FOR MORE INFORMATION:

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