

Presentation to the Senate Committee on Agriculture and Forestry
Research and Innovation in the Agricultural Sector
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Thank you for the opportunity to speak to the Committee on behalf of the Agricultural Institute of Canada about the importance of research and innovation in the agricultural sector.

The Agricultural Institute of Canada was founded in 1920 and today represents individual agricultural professionals, research scientists and consultants, as well as the major scientific societies with an interest in the agricultural sciences. Societies include the Canadian Society of Agronomy, the Canadian Society of Soil Science, the Canadian Society for Horticultural Science and the Canadian Society of Animal Science. Collectively AIC represents over 1,500 agricultural science professionals.

It is appropriate that AIC's longest history with agricultural professionals is related to a most important current function - the communication and transfer of research and innovations to others in the industry. AIC began publishing agricultural research in 1921, and in the 1950s expanded to three scientific journals: the Canadian Journals of Animal Science, Plant Science and Soil Science. The journals, which are produced in cooperation with our scientific society members, published a combined total of almost 3,000 pages of peer reviewed research in 2011; they are read in more than 100 countries. It is their very purpose to publish research findings that will help address many of the challenges facing our society, including food security, climate change mitigation and adaptation, energy demand and the bioeconomy, links between human and animal health and quality food and feed, and conservation of our soil, water, air and biodiversity resources. The January 2012 issue of the Canadian Journal of Soil Science is a special issue on land reclamation – a growing challenge nationally and internationally.

Our international development work has provided us with direct evidence of the stark realities of food shortages. Today, nearly 1 billion people are food impoverished. Many millions more have dietary deficiencies (consumption of low levels of essential proteins, minerals and vitamins) resulting from restricted or insufficient diets. This impoverishment will double in the next 15 years. The population is growing in areas least capable of supporting agricultural expansion.

The world population is expected to top 9 billion by 2050. Globally food production will need to increase by 50 percent to keep up with population growth. As emerging populations become more affluent, they are turning from diets based on grains to greater meat consumption. Meat requires feed in the form of grains and forage with conversion ratios of 2 to 10 kg grain consumed per kg of meat produced, depending on the animal. With increased meat production there are increased environmental stresses associated with the disposal of waste, the consumption of water and the production of greenhouse gases. There are also major post-harvest losses of crops and produce around the world. Every tonne of preserved produce will contribute to food security. Canada has a reputation for environmentally sustainable production of safe food and feed. Canadian researchers have made, and will continue to make, significant contributions to food sufficiency in rural areas around the world.

The area of arable land in Canada and globally is static. Marginal lands are marginal for a reason - usually insufficient nutrients, drainage, topography or texture (rockiness). Northern Canadian soils will never be highly productive because of physical or chemical limitations. With population growth and arable land static, the amount of land for food production on a per capita basis is currently going down and will continue to go down. In 2050 the amount of land will have declined to 1.6 ha per person, compared with 2.0 ha per person in 2005 and 5.2 ha per person in 1950. More staple food crops will have to be produced on less land. Currently four billion people survive primarily on corn, wheat and rice. Other staple food crops are potatoes, cassava, soybean, sweet potatoes, sorghum, millet and grain legumes.

Climate change, and climate variability, will exacerbate the challenge of food production and issues relating to food security. An increase in average growing season temperature of 2°C can reduce yields of rice in tropical regions by 20 percent. Higher temperatures result in increased water use by plants. Higher temperatures result in shifts in pest pressure (for example the movement of soybean rust from South America through the United States into Canada). The interaction between the decrease in arable land and climate change will put enormous pressures on agricultural production because in most areas climate change will ultimately have negative effects on crop yields. Canada may be more fortunate with an increase in temperature resulting in longer growing seasons on the prairies. However, problems associated with the affects of heat stress on yield are associated with higher temperatures.

Major rivers are fed from mountain glaciers which are rapidly receding. This will result in reduced river flow in Asia, Europe, North America and South America. Much of the geological water, stored in aquifers, has been depleted by irrigation. Climate change will cause shifts in rainfall patterns resulting in droughts and floods.

Farming can be detrimental to soils. It reduces organic matter content, changing nutrient cycling. Farming can result in increased erosion, salinity, sodicity (increased sodium when the Cl has been washed out, resulting in increased erosion and lower nutrient exchange capacity). Soil can become contaminated with detrimental substances like cadmium as a by-product of super phosphate fertilizer and industrial pollution. Farming flourishes on healthy soil and maintenance of healthy soil under intensive production is a product of long-term research.

The public is very much more aware of the environment and the causes of environmental problems. Evidence has pointed to agriculture in cases such as the Walkerton tragedy, which was caused by poor manure management practices, or phosphate fertilizer loading in Lake Winnipeg in Manitoba. The public will demand that the 'environmental footprint' of agriculture be as small as possible.

These factors make it clear that in the next few years we will need to dramatically increase agricultural production. This is particularly true as more and more arable land is lost to expansion of cities. Our production systems will become increasingly dependent on water, healthy soils, fertilizers, pesticides, and more efficient plant genetics. We will also need to be as environmentally 'neutral' as possible. Research from the past will not suffice as these circumstances and stresses have never occurred before. Research will be required in all aspects of our food production value chain to guard Canada's food security.

The success of Canadian agriculture in supplying us with safe, nutritious, abundant, and inexpensive food for the past one hundred and twenty-five years has been largely due to the investment the federal and provincial governments have made in agricultural research. This is not discounting the monumental work that farmers put into growing the food that sustains us. Farming is not an easy business, nor is it one for faint-hearted souls unwilling to gamble on the next innovation. The predominant form of government investment in agricultural research has been made in research stations across the country, in university agricultural programs, and in the research scientists they employ.

However, over the past twenty years, publically supported agricultural research in the western world has steadily decreased. The federal government Science and Technology Strategy does not even identify agriculture and food as areas for research and development through its research funding programs. The number of scientists employed by Agriculture and Agri-Food Canada (AAFC) is less than 50% what it was in 1992. Provincial governments have reduced their staff, often cutting research out entirely or shifting it to the university system. Universities with agricultural programs have also reduced their staff. Only two Canadian universities are left that have soil science departments.

Farm productivity has continued to increase since the mid 1990's, but there is growing evidence that the rate of increase in farm yields is slowing. There is a time lag between innovation and application in agricultural research just as there is in other areas of research. Farm production is catching up to the reduction in agricultural research.

We would argue that agricultural research, and decisions on research priorities, are increasingly being dictated by the interests of private for-profit companies. A-based (direct) funding of research is drying up. Federal government scientists must either find funding from companies that will financially support their work or undertake research projects that these companies consider a priority. These priorities are strongly oriented to short-term, profit-making ventures.

What is being lost is long term, basic "public good" research. Research that can be made freely available to all producers in Canada. Companies would not have invested in cold tolerant corn and soybean research in Canada 35 years ago because of limited acreage and there would be no soybean and corn in eastern Ontario and Quebec today. There would not have been 350,000 acres of soybean grown in Manitoba in 2011.

The dissemination of research findings to producers is also critical, and is increasingly being lost. Both federal and provincial governments have virtually eliminated extension departments and staff. Travel budget restrictions are so onerous that most scientists are unable to participate in meetings and conferences at which they could share their research.

The idea that research is available internationally that could be applicable to Canada is attractive, but we still need experts who have done research in the field to apply that knowledge to Canadian conditions. We will never be able to buy state-of-the-art research, but only last year's science. If the Canadian brand of sustainably produced safe quality food and feed is to be maintained, Canada needs its own balanced research capacity to carry out long-term public good knowledge generation as well as short-term mission-oriented profit-driven research.

When budgets are tight, it is particularly important that there be coordination of research. Agriculture and Agri-food Canada has recently proposed, through its Science Scan project, to develop a database of research and development activities in the agriculture sector in Canada. As AAFC notes in its documentation on the project: "Research and innovation are key to continued progress and productivity in the agricultural, agri-food and agri-based product sector. However, complete baseline information on research activities and science capacity in the sector is currently not available." Its functions are critical: to identify strategic strengths and weaknesses, opportunities and threats; identify strategic gaps; ensure funding and development support are better coordinated and duplicative efforts avoided; facilitate strategic alliances and collaborations.

Research partnerships are increasingly critical to maintaining an effective research capacity. Rate of return on investment dollars is important to both public and private research partners. Historically, publically funded research has focussed on public good – where the return to investors is longer term and not easily captured. However, a 2007 analysis by the Canadian Agriculture Innovation Research Network calculated returns averaging 30-50% on public funding. Development of canola as a food crop is an interesting case study - with original funding almost entirely from public sources but current funding predominantly from the private sector. Although many crops owe their origin to federally funded research, more recent developments include research from provincial and international public institutions, with funding including producer and industry check-offs. With the creation of Plant Breeders' Rights, the private sector has made significant investment in crop research, and patents now given on biotech processes to develop new varieties further increase payback to private sector investment. As a result, there is increasing private sector involvement and new roles and relationships for public research.

Summary and Recommendations

1. Effective research requires stable funding and decisions on research funding need the perspectives of both the public and private sectors. Historically, agricultural research investment has provided a remarkably high return (30-50%) but there is a continual need to evaluate the best return on investment. This requires a coordination of research effort to ensure there is no duplication and that there is adequate effort available. The other consideration is that a balance is maintained between the shorter-term interests of the private sector and the longer term public good. This is particularly true of research related to conservation of natural resources (soil, water, air, biodiversity) and innovations that will be utilized without direct compensation to the developer. Neither public nor private perspective alone can effectively allocate research funding. While it is not effective to have public research institutions deciding on the best allocation of budget to meet the country's needs without input from the private sector, it is also not effective to have research funding allocated based only on the private sector's shorter-term goals. The pendulum has swung too far toward short-term private sector goals and a balance needs to be re-established.
2. Canada has a reputation for safe food and quality animal and cereal products produced in an environmentally sustainable manner. Canadian agricultural researchers participate in the global scientific community and as participants have direct and timely access to innovations potentially beneficial to Canada's production and processing systems. This position is a result of long-term investment in the agricultural research. Continuing investment is needed to maintain Canada's competitive advantage internationally and to guard Canada's own food security. The need for Canadian researchers to communicate with other scientists and with the rest of the ag sector has never been greater. It is important that impediments to communicating research results – with scientific colleagues and with producers and other industry stakeholders - be removed, and that transfer of innovation to users is a priority of researchers and is facilitated by institutions.
3. We also support the recommendation made to you by Richard Phillips of the Grain Growers of Canada on October 25, 2011 that the federal government allow all royalty streams generated by AAFC discoveries to be added on top of the AAFC research budget; as he notes, it is the royalties paid by whoever wants the discoveries that will increase the budget. We also support his suggestions for other models to put more money into research, including farm group check-offs and

tax credits that will encourage more use of new products such as seeds. Producers, private industry and governments should all contribute to supporting research and innovation.