Science to Support Plant Protection for Horticulture
AAFC’s Science & Technology Branch

Crop, Plant Protection and the Environment Committee
March 15, 2018

Dr. Della Johnston
Outline

- Strategic direction and governance
- Capacity across the country
- Research support for horticulture
The strategy matrix guides all our decisions

<table>
<thead>
<tr>
<th>Strategic Objectives</th>
<th>Sector Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cereals and Pulses</td>
</tr>
<tr>
<td>Increase agricultural productivity</td>
<td></td>
</tr>
<tr>
<td>Enhance environmental performance</td>
<td></td>
</tr>
<tr>
<td>Improve attributes for food and non-food uses</td>
<td></td>
</tr>
<tr>
<td>Address threats to the value chain</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Biodiversity and Bioresources</td>
</tr>
<tr>
<td></td>
<td>Agro-Ecosystem Resilience</td>
</tr>
<tr>
<td></td>
<td>Clean Technologies</td>
</tr>
</tbody>
</table>

AAFC Science Capacity Overview

• AAFC is the largest federal employer of research scientists, reflecting our focus on the medium and long-term profitability and sustainability of the sector.

• As of September 30, 2017, there were 2,147 employees* in the Science and Technology Branch, including 447 research scientists (404 indeterminate, 3 determinate and 40 postdoctoral researchers – PRPs) and 268 scientific professionals.

• As of September 30, 2017 this capacity was complemented by: 93 foreign research participants, 40 visiting fellows and 482 students.

* The population includes indeterminate and seasonal employees and term employees with a term greater than three months in their substantive positions, excluding employees on leave of absence, as of September 30, 2017.
AAFC’s Scientists Deliver On These Objectives Through Nine Sectoral Science Strategies

Number of Scientists* by Strategy

- OIlseeds
- Horticulture
- Forages and Beef
- Dairy, Pork, Poultry and Other...
- Clean Technologies
- Cereals and Pulses
- Biodiversity and Bioresources
- Agro-Ecosystem Resiliency
- Agri-Food

*Based on 404 indeterminate scientists, as of September 30, 2017
STB Strategic Objectives

*Increase agricultural productivity*

- Minimize losses due to existing and emerging biotic and abiotic stresses through integrated crop production and management, and develop knowledge and predictive tools
- Improve yield potential and tolerance to biotic and abiotic stresses for some major horticultural crops through genetics and germplasm development

*Enhance environmental performance*

- Improve efficiency of nutrient, water and energy utilization in horticultural practices
- Reduce environmental impacts of horticulture crop production through practices such as integrated pest management and integrated crop production

*Improve attributes for food and non-food uses*

- Address market demand for consistent supply, composition and quality traits through crop management techniques
- Improve crop attributes for some major horticultural crops through genetic advances and germplasm development

*Address threats to the value chain*

- Develop knowledge and predictive capacity to anticipate emerging biotic factors that threaten the horticulture value chain, and develop tools and practices to mitigate them
- Develop knowledge and tools necessary to meet safety and marketability requirements for horticultural products, from production practices through post-harvest handling, storage and distribution.
AAFC’s National Network of Science Capacity

Centres Supporting Horticulture Research

Coastal Region
Prairie Region
Ontario & Quebec Region
AAFC’s National Network of Science Capacity

Coastal Region
Prairie Region
Ontario & Quebec Region

Minor Use Pesticide Site

Summerland Agassiz
Lacombe Saskatoon Swift Current Brandon Morden

Scott

Lethbridge

Vineland Guelph London Harrow

Saint-Hyacinthe Sherbrooke Fredericton Charlottetown Kentville St-Jean-sur-Richelieu Ottawa Quebec St John’s

8
AAFC's Science Activities

Science and Technology Branch

Applied Research

Development

Knowledge & Technology Transfer

Upstream (Discovery Science)

Downstream (Near Market)

Partnerships

AAFC contributes to upstream and downstream activities within a broader research science ecosystem of partnerships
AAFC’s Science Support of Horticulture Crops

Canadian Agricultural Partnership (CAP) will focus on:

• The program aims to accelerate the pace of innovation by providing funding and support for pre-commercial science activities and cutting-edge research that benefits the agriculture and agri-food sector and Canadians.

There are two components:

• AgriScience – Clusters component: Proposals are intended to mobilize industry, government and academia through partnerships, and address priority themes and horizontal issues that are national in scope.

• AgriScience – Projects component: A single project or a smaller set of projects that would be less comprehensive than a Cluster.
Making the science happen

AAFC supports industry focussed science through:

– Annual internal funding for more upstream research and can be coordinated with CFIA scientists
– Clusters and Projects in partnership with industry and academia
– Collaborative Framework for projects with industry partners
– Exploring federal genomics funding initiatives for federal science in coordination with Genome Canada
Distribution of Projects and Planned Expenditures by Sub-Sector

Budget Expenditure 2017-2018

- Potatoes: $3,500,000
- Field Vegetables: $500,000
- Greenhouse Vegetables: $1,000,000
- Tree Fruits: $1,500,000
- Small Fruits: $2,000,000
- Ornamentals: $2,500,000
- Herbs and Spices: $3,000,000
- Multiple Horticulture Crops: $3,500,000

Sub-Sector
Distribution of Horticulture Projects by Strategic Objective

Distribution of Horticulture Projects by Strategic Objective 2017-2018 (% of Projects)

- Productivity: 50%
- Environment: 20%
- Attributes: 17%
- Threats: 13%
Horticulture Projects

Strategic Objectives In Each Sub-Sector 2017-2018

Sub-Sector

# of Projects

Potatoes
Field Vegetables
Greenhouse Veg.
Tree Fruits
Small Fruits
Ornamentals
Herbs and Others
Multiple sub-sectors

Productivity
Environment
Attributes
Threats
Research for healthier crops

• Develop bio-control agents and IPM strategies to reduce impacts of insect pests
• Analysis of host-pathogen interactions to reduce impacts of fungal, bacterial and viral pathogens of high value fruit & vegetable crops
• Identify pathways for reducing nutrient losses to the environment and greenhouse gas emissions
• Improve yields and quality of berries and greenhouse vegetables
• Assess berry varieties that adapt well to Pacific Northwest for disease and pest resistance
Improving the sector’s capacity to resist climate change and its ability to respond to disease and other biological threats

- Integrated soil management to suppress soil-borne pests and optimize soil fertility, root-microbe symbioses and early growth of perennial fruit crops
- Wine grape and fruit tree rootstocks that resist/tolerate pests in soils, use water/nutrients more efficiently, and produce better quality fruit
- Develop biocontrol agents for major pest of crops in the region & Canada
- National/regional responses to emerging crises (virus, fungal, bacterial) affecting high-value horticultural crops

Supporting opportunities to grow agriculture’s contributions to the economy and society

- Molecular markers to select potential tree fruit cultivars with desirable traits
New possibilities, practices and perspectives

• Integrated crop management research to produce crops suitable for dry and irrigated lands and sustainably adapted to the Canadian prairies
• Breeding crop varieties (dry beans, forages, potatoes, triticale, wheat) with improved yield, quality, and disease and insect resistance
• Conducting research on soil fertility and conservation of soil and water resources
• Conducting research on new management strategies to control weeds and crop pests, while maintaining environmental quality
**London RDC**

**Working with nature**
- Biological control of insect pests
- Studying crop pest populations and their movements; investigating chemical controls for short-term use in crops of small production volume
- Breeding tree fruits to produce selections and varieties that can better resist diseases and pests

**Biotechnology at its best**
- Automated DNA sequencing and biological information systems, databases, indexes, bioinformatics to solve problems in crop production
- Knowledge of genetic composition of plants so traits can produce novel value-added products to improve plant performance under adverse conditions or provide food with improved nutritional qualities
Harrow RDC

*Healthy crops in healthy environments*

- Research to improve efficiency and marketability of crops, while maintaining soil quality
- Optimizing greenhouse crop management through improved production practices, energy conservation, and greenhouse environment control

*Protecting and preserving greenhouse and field crops*

- Best management practices for greenhouse and field crops to control insect and mite pests, plant diseases, weeds and invasive pests
- Alternative methods to control insects including physical, cultural, and biological strategies
- Preserving the genetic diversity of Canadian fruit crops by acquiring and maintaining plant material in the Canadian Clonal Genebank
Biovigilance of horticultural crop pests

- Early detection, monitoring and characterization of bio-aggressors at spatial, temporal and quantitative levels to assess the risk they pose.
- Use of detection, quantification and prediction tools to identify problems and define intervention strategies in plant protection.

Precision Horticulture

- Valorization of information derived from technologies for decision-making.
- Use of high spatial and temporal data, including climate and remote sensing data.
- Precision control and input management to optimize interventions in a mosaic of diversified and intensive horticultural crops.
Fredericton RDC

Agri-based science solutions for the environment

• Assessing chemical and non-chemical methods for controlling insect pests
• Finding new methods to reduce the use of agri-chemicals (pesticides and fertilizers) to lower production costs and environmental risks

Leading edge research for better products

• Developing new methodologies for early detection of viruses in seed potatoes
• Evaluating new potato lines and cultivated varieties for yield, quality and disease resistance
• Gene mapping of traits and cloning of potato plants with important characteristics needed for processing, disease and pest resistance
Pest management: maximum benefit, minimal risk

- Determining the most favourable conditions and timing for applying pesticides to control weeds, disease and insects
- Bioprospecting for biopesticides
- Understanding disease, weed, and insect life cycles to develop integrated pest management strategies

Improved food production for the future

- Evaluating new potato lines and cultivated varieties that will have a higher yield, improved quality and better resistance to blight
Kentville RDC

**Improvements in crop production, handling and storage**

- Technologies for producing and managing tree fruits, berries and vegetables, including organic fruit
- Developing technologies to enhance the storage of horticultural crops
- Methods to control microbes and decay of freshly harvested produce

**Protecting our food in a sustainable environment**

- Reduce movement of pesticides, nutrients and other materials from agricultural lands into nearby waters
- Pest management to control threats caused by insects, fungi, viruses and bacteria
- Adapting international pest management programs for effective application in Atlantic Canada
St. John’s RDC

Primary Production Agriculture

• Lead role in production production systems for berry crops adapted to culture in the northern, boreal ecozone.

Environmental stewardship

• Expertise in developing best management practices for farms and primary production systems in Newfoundland and Labrador.
Examples of areas of national expertise

• Pest biovigilance
  – study the complex relationships between cultivated plants, pests and their natural enemies and biological/chemical/physical/cultural methods of control
  – Anticipation and early detection of pest problems and implementation of appropriate mitigation strategies (avoid useless pesticides)
  – Based on advanced knowledge on genomic, ecology and epidemiology, and modeling (e.g. CIPRA)

• Precision horticulture
  – Use high-spatial-density data to make production decision
  – Support decision of highly diverse and intense hort crops with specific water/nutrients requirement and weeds/pest constraints
  – 5R’s - apply the Right Input at the Right Time in the Right Amount in the Right Manner and at the Right Place.
    • Precision plant protection: weed, disease and insect pests
    • Precision fertilization input use: e.g. SCAN for nitrogen
Thank you!

For more information contact:

Christiane.Deslauriers@AGR.GC.CA, DG Champion - Horticulture
Della.Johnston@AGR.GC.CA, Science Strategy Lead - Horticulture
Sylvie.Jenni@AGR.GC.CA, Partnerships- Horticulture