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A Case for Reinforcing Agri-food Research and Development Spending: Where Does Canada Stand Internationally?

By Sabrina Gulab and Guillaume Lhermie

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EXECUTIVE SUMMARY

Spending on global agricultural research and development (R&D) increased from $31 billion in 2000 to $47 billion in 2016, highlighting the sector's critical role in addressing food security, climate adaptation and economic competitiveness. While countries like China, Brazil and Australia have made strategic investments that drive innovation and sustainability, Canada's agricultural R&D spending has declined significantly, falling from $0.86 billion in 2013 to $0.68 billion in 2022. This reduction has left Canada ranking lowest among the top seven OECD countries in agricultural R&D expenditures, jeopardizing its global competitiveness and resilience.

This policy brief looks at global trends, analyzes Canada's relative under-performance and proposes strategies to revitalize its agricultural R&D framework.

Canada needs increased investment, including a federal government commitment to spending at least 1.5 per cent of AgGDP on agricultural R&D to support innovation, productivity and sustainability. Investing in agricultural R&D yields significant long-term returns. Meta-analyses show a global median return on investment (ROI) of 10:1, and the benefits include increased crop yields, reduced input costs and better climate resilience. However, R&D investments often require long-term commitment, as returns take decades to manifest. Ottawa must prioritize funding and strategic partnerships to capitalize on these high returns and avoid losing its competitive edge.

International case studies demonstrate the beneficial impact of targeted R&D investments. For example, Australia's public-private partnerships and Brazil's focus on tropical agriculture and low-carbon innovations have strengthened their agricultural sectors. China's centralized investments have enabled rapid advances in crop yields and agricultural technologies.

Partnerships among government, academia and industry are essential to ensure research creates practical applications for agribusinesses and farmers. The research needs to focus on climate-resilient crops, efficient water use and green technology to make Canada a leader in sustainable agriculture. Canada also needs to develop innovation hubs and digital platforms to ensure widespread adoption of new technology.

Climate change, evolving market demands and resource constraints all pose challenges for Canada's agricultural sector. Increased investment in R&D will enhance productivity, strengthen food systems, create high-skill jobs and align agricultural practices with sustainability and climate goals. Failure to act risks lessening Canada's role in global agricultural innovation, food security and competitiveness.

POLICY RECOMMENDATIONS

Canada faces a pressing need to enhance its agricultural R&D investments to remain competitive on the global stage. The following recommendations aim to address this gap by building on international best practices:

1. **Increase Investment in Agricultural R&D:** Commit to raising Canada's agricultural R&D spending to at least 1.5 per cent of AgGDP. This target aligns with benchmarks set by leading OECD nations and would enable Canada to foster innovation and address emerging challenges in the agricultural sector.

2. **Enhance Public-Private Collaboration:** Establish incentives for partnerships among government, academia and industry. Such collaborations can drive the development and adoption of innovative technologies, ensuring that research outputs translate into practical applications for farmers and agribusinesses.

3. **Focus on Sustainable Practices:** Integrate sustainability as a core objective of agricultural R&D by prioritizing research in climate-resilient crops, efficient water use and green technologies. This will position Canada as a leader in environmentally conscious agriculture.

4. **Adopt Proven Policy Frameworks:** Draw inspiration from countries like China and Brazil, which have implemented decentralized governance models and targeted funding strategies. These frameworks have successfully boosted agricultural innovation and productivity.

5. **Strengthen Knowledge Transfer Systems:** Develop national innovation hubs and digital platforms to disseminate research findings and practical solutions to stakeholders. Enhancing knowledge transfer mechanisms and funding a formal knowledge transfer network will ensure that advancements in R&D are widely adopted and impactful.

WHY CANADA SHOULD INVEST MORE IN AGRI-FOOD R&D

Investing in agricultural R&D is essential for addressing these pressing challenges. Robust R&D efforts enable the development of innovative technologies, enhance productivity and support the transition to sustainable farming practices. Countries with strong agricultural R&D systems, such as China and Brazil, have demonstrated how targeted investments can boost food security, economic resilience and global competitiveness.

Agricultural R&D consistently delivers strong returns. For instance, research by CGIAR shows a $10 return for every dollar invested over the last 50 years, driven by advancements in crop varieties, pest management and sustainable practices. Similarly, investments in climate-smart agriculture and regenerative practices are particularly impactful for long-term sustainability and resilience to climate change, although they require upfront capital and patient investment approaches. Meta-analyses show that agricultural R&D investments yield a median ROI of about 10:1 globally, up to 20:1 in the U.S. These returns come from increased crop yields, reduced input costs and improved resilience to climate change (Alston, Pardey and Rao 2021; OECD 2022).

Yet, ROI for agriculture tends to manifest over decades, requiring sustained investment. Despite its high payoff, agricultural R&D remains underfunded compared to other sectors, especially in high-income countries like those in the G7. R&D is fundamental to ensure productivity growth, competitiveness and sustainability of the Canadian agriculture sector. While private-sector investment in agriculture, particularly in biotechnology, has grown significantly, public funding is crucial for addressing systemic issues, as well as for supporting discovery research.

Knowledge generated through R&D spills over into broader industries, requiring a workforce capable of adapting and applying new technologies, thereby increasing the demand for advanced education and specialized training. This is evident in regions with high R&D spending, which tend to form knowledge clusters and attract skilled talent.

Furthermore, R&D-driven industries, such as biotechnology and renewable energy, create high-skill, high-wage jobs that incentivize education and continuous professional growth. These industries also encourage universities and research institutions to align curricula with evolving industry needs, fostering a virtuous cycle of learning and innovation.

Canada's agricultural sector faces a critical juncture. Despite its vital role in ensuring food security, driving economic growth and supporting rural livelihoods, investments in agricultural R&D have not kept pace with global leaders. This under-investment risks diminishing Canada's competitive edge, particularly as other nations rapidly advance their agricultural innovation capabilities. Moreover, challenges like climate change, evolving market demands and resource constraints underscore the need for targeted R&D to develop sustainable and resilient agricultural practices.

A renewed focus on agri-food R&D offers an opportunity to:

• Improve agricultural productivity and resource efficiency;

• Strengthen food systems to withstand environmental and economic shocks;

• Foster innovation that supports rural development and job creation; and

• Align agricultural practices with sustainability and climate goals.

TRENDS IN GLOBAL AGRICULTURAL R&D

Global agricultural R&D spending rose from $31 billion in 2000 to $47 billion in 2016, reflecting the growing recognition of its critical role in addressing global challenges (Beintema, Nin-Pratt and Stads 2020). In 2018, five countries — China, the United States, India, Brazil and Japan — accounted for nearly 2/3 of global spending, with China leading at $8 billion (OECD 2022). These nations prioritize innovation through robust public-sector funding and strategic private-sector engagement, setting an example for others to follow. (See Figs. 1 and 2).

Figure 1. Public Spending on Agricultural Knowledge and Innovation Systems (in billion $) Across Leading OECD Countries

This figure highlights Canada's position as the lowest spender among the top seven OECD nations, emphasizing the need for increased investment. (Source: OECD 2022)
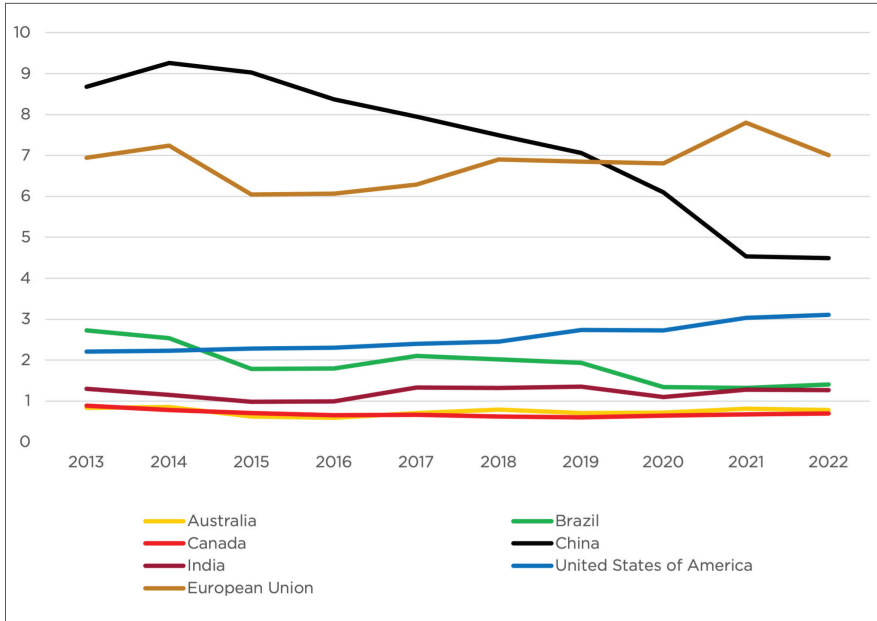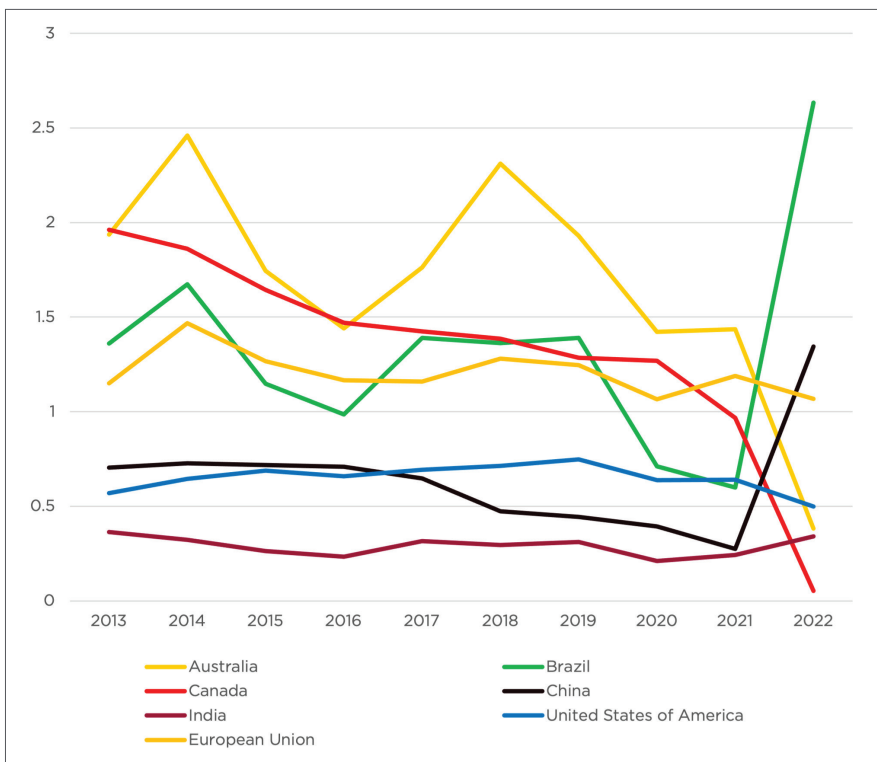

Figure 2. Agricultural R&D Spending as a Share of AgGDP (%)

This chart illustrates Canada's relatively strong research intensity ratio compared to other nations but underscores the inadequacy of absolute spending. (Source: OECD 2022)

CANADA'S POSITION IN AGRICULTURAL R&D

Despite Canada's strong research intensity ratio, measured as the percentage of R&D expenditures over the AgGDP (1.33 per cent on average), absolute spending has declined, dropping from $0.86 billion in 2013 to $0.68 billion in 2022 (OECD 2022). This downward trend places Canada at the bottom among the top seven OECD countries in agricultural R&D spending. In contrast, Australia leads in R&D spending as a share of AgGDP at 1.68 per cent, highlighting the potential for targeted investment to achieve competitive advantages.

KEY HIGHLIGHTS FROM LEADING NATIONS

AUSTRALIA

A well-developed public-private partnership ecosystem ensures targeted investments in R&D, creating a balanced and efficient research framework. Federal funding and tax incentives drive substantial private-sector contributions. Australia's R&D system benefits from collaborative research facilitated by research and development corporations (RDCs). Key priorities include climate resilience, digital agriculture technologies and biosecurity enhancements. Recent investments, such as the Sowing the Seeds of Farming Innovation Fund, demonstrate Australia's commitment to boosting agricultural production through partnerships between farmers and universities.

BRAZIL

Brazil's agricultural R&D is characterized by strong public funding and a focus on sustainability and productivity. The Brazilian Agricultural Research Corporation (EMBRAPA) plays a central role in developing technologies suited to tropical agriculture, contributing to Brazil's status as a leading exporter of various agricultural commodities. Policies promoting low-carbon agriculture and technological innovation in rural areas underscore Brazil's commitment to sustainable development. Their approach demonstrates the impact of dedicated funding for strategic research areas. Over 50 per cent of Brazil's public innovation funding focuses on crop-related advancements (Dalberg Asia 2021).

CHINA

China has emerged as a major player in agricultural R&D, with substantial public-sector investments driving its advancements. The government's focus on food security and rural development has led to significant achievements in crop yields and technological innovations. Centralized governance and significant public investment have driven rapid growth in agricultural innovation, focusing on both traditional and emerging technologies. Public-sector dominance ensures sustained progress. China's agricultural R&D system saw investments grow from 4.8 billion yuan in 2001 to 43.6 billion yuan in 2018, with an annual growth rate of 13.9 per cent (World Bank 2021). China's commitment to agricultural research is evident in its increasing number of scientific publications and active participation in international collaborations.

EUROPEAN UNION

The European Union adopts a forward-looking approach to agricultural R&D, emphasizing sustainability and rural development. Programs like Horizon Europe allocate significant funds for food, agriculture and rural development projects, while the Common Agricultural Policy (CAP) supports rural development through various measures aimed at improving competitiveness,

environmental management and quality of life in rural areas. The European Partnership on Agroecology and the European Partnership on Animal Health and Welfare have been initiated as part of the European Union's Framework Programme for Research and Innovation, Horizon Europe. The partnerships aim to integrate funding organizations, research institutions, laboratories, universities, industrial partners and other key stakeholders from EU member states and Horizon Europe-associated countries. Their objectives are to advance research and deliver practical innovations, including decision-support systems, methodologies and tools for long-term monitoring and evaluation of farming practices. They will also focus on developing products and services such as candidate vaccines and fostering capacity-building initiatives.

INDIA

India's agricultural R&D system, led by the Indian Council of Agricultural Research (ICAR), emphasizes crop productivity and resource efficiency. Initiatives like the National Agricultural Innovation Project aim to strengthen research-extension linkages, while the Digital Agriculture Mission introduces advanced technologies to enhance productivity. Despite these efforts, challenges remain in terms of funding and infrastructure to fully realize the potential of agricultural R&D.

UNITED STATES OF AMERICA

The United States has historically been a leader in agricultural R&D, with significant contributions from both public and private sectors. However, public funding has declined in recent years, leading to concerns about maintaining its competitive edge. Despite this, the U.S. remains a top contributor to global agricultural science publications and patents, reflecting its ongoing innovation capacity. The U.S. Department of Agriculture (USDA) continues to support various programs aimed at enhancing agricultural productivity and sustainability.

RECOMMENDATIONS FOR CANADA

To enhance its agricultural R&D framework, Canada can implement the following strategies:

1. **Funding Commitment:** Increase federal funding and introduce tax incentives for private-sector contributions. By boosting financial resources, Canada can foster innovation and meet the demands of a rapidly evolving agricultural sector.

2. **Strategic Partnerships:** Foster collaboration across government, academia and industry through dedicated programs and research hubs. These partnerships can create synergies and accelerate the translation of research into real-world applications.

3. **Sustainability Focus:** Align R&D priorities with environmental goals. Canada can leverage successful practices from European Union countries or Brazil, which prioritize climate resilience and sustainable resource management.

4. **Governance and Policy Integration:** Implement decentralized governance and establish dedicated funding streams for priority research areas. Adopting proven frameworks from China and Brazil will enhance policy effectiveness and efficiency.

CONCLUSION

Global agricultural R&D trends highlight the need for sustained investments and innovative policies to address food security, climate change and economic challenges. Canada is lagging among the top seven OECD countries, with the lowest spending on agricultural R&D. It should prioritize agricultural R&D in national budgets, focusing on areas like enhancing innovation, sustainable practices, climate resilience and food security.

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