Bio-progress: What the world wants

Canada is in a good position to capitalize on emerging opportunities, thanks to its crop development research base.

Crop development researchers are tailoring new cereal varieties to capitalize on expanding potential in many areas. Here are just a few examples.

- **Harvesting new health value from grains.** Science has uncovered properties in grains that can enhance the health value of food products or be extracted for use in health supplements. A leading example is barley. This grain contains higher levels of beta-glucan, a type of fibre linked to reduced levels of blood cholesterol. Barley also contains several powerful antioxidants, most notably tocopherol, which is associated with reducing the risk of cancer. These properties already represent a rapidly growing sector of the emerging “nutraceuticals” market, a burgeoning market of the future expected to represent $250 billion by the year 2020.

- **Reducing livestock pollution with feedgrains.** Some simply call it manure, but to crop development researchers it’s a lost opportunity. The more livestock feed that passes through the animal, the less that is captured to produce meat and milk. That’s why researchers are taking a sophisticated approach to improving the feed value of common feedgrains such as barley. By tailoring the nutritional components of the feed to meet the digestibility and nutritional parameters of the animal, they can increase performance and reduce waste.

- **Kick-starting potential in alternative fuels.** Grain-based ethanol is just one example of the tremendous potential for crop-based bio-fuels. Not only can these fuels create valuable new markets for producers and industry, they can provide renewable, environmentally friendly options that reduce Canada’s reliance on foreign energy.

Researchers are working on crop varieties custom-made to get maximum energy value for fuel production, and this is just one example of the broad potential for crop-based bio-products. Today, 90 percent of fuels, chemicals and plastics are derived from oil and gas – a non-renewable resource with reserves shrinking every year. The International Energy Agency estimates the world will be at about 50 percent of its current oil and gas capacity by 2020, while energy needs are expected to double by 2050.

See more examples in the full version of this report, at www.meristem.com

The search for research excellence

Canada already has a strong anchor in its crop development network.

If Canada went shopping for research, it’s clear what it would look for – a proven track record, high return on investment and a critical mass of expertise, partnerships and resources. Canada already has all of these today in its network of cereal crop development research.

A good example is the Field Crop Development Centre (FCDC) in Lacombe, a key Alberta link in this network. The FCDC, an institution of Alberta Agriculture, Food and Rural Development (AAFRD), has helped drive more than three decades of progress, supporting the growth of Alberta’s livestock industry and keeping the province’s crop producers competitive. Independent analysis shows the Centre has delivered a minimum 10-fold return on investment in its research.

The Centre, with its multi-disciplinary team and network of international partnerships has the capacity to deliver world-class crop development programs. It emphasizes high quality feed, fodder and food crops, with strong programs in feed barley, winter wheat, triticale and malting barley.

To learn more, visit AAFRD’s “Roping the Web” site, at www.ropintheweb.com, and enter “Field Crop Development Centre” in the search field. The Centre also welcomes comments and questions directly. Phone: (403) 782-8696.

As Canada targets a globally competitive research base, crop development for cereals may be like “the elephant in the room” – the powerful force that’s overlooked.

The critical mass – top minds, manpower and resources – to compete globally and fuel Canada’s economy. Strong value-added potential. Production systems that are proud of, and one it will buy from.

Research funders, decision-makers and stakeholders have wrestled with the best research designed to meet these demands. They like the novel, the value-added, the quick payoff. But in their fascination with the futuristic, they may risk overlooking the value of the more traditional.

Crop development research for cereal crops – such as wheat, barley and oats – is an example. Though often under the radar, this is one of Canada’s strongest and most essential areas of agricultural research capacity, with a national network built over decades. The crops it supports dominate production, fuel several multi-billion dollar industries and are a critical foundation to the emerging revolution in bio-potential.

Canada owes itself to ensure the value of crop development is not overlooked. This report recapitulates some of the key points to consider, from what crop research is really worth and how it delivers value, to what Canada’s competitors are doing and what the world wants from bio-progress. When these points are taken into account, the search for research excellence may lead to a not-too-distant destination.

About this report

This Perspective on Crop Development, “The elephant in the room,” is one in an ongoing series of Perspective reports produced by Meristem Land and Science, a Web-based, educational information service developed by Calgary-based Meristem Information Resources Ltd. This edition was supported by the Field Crop Development Centre.

To learn more or request reprint permission, visit www.meristem.com or e-mail info@meristem.com.

© 2005 Meristem Land and Science www.meristem.com

Meristem® is a registered trademark of Meristem Information Resources Ltd. All rights reserved.

Supported by: Field Crop Development Centre, Lacombe, Alta.

© 2005 Meristem Land and Science www.meristem.com
What's crop research worth?

A range of independent studies show cereal crop development delivers one of the highest investment returns of any type of research.

In the high-stakes game of global trade in agri-products, the players hold relatively few cards that separate the winners from the losers. For Canada, one of its most powerful cards is crop development research. This research is the factory that produces crop varieties require and markets demand. And Canada has built a network that is a long-standing world leader.

It’s why Canadian grains are preferred by top markets around the world, and it’s why Canada’s competitors have ramped-up their own research bases.

It’s also one of the best investments going in agriculture. Even at a very basic and narrow level of assessing research investment value – dollars invested vs. direct returns in yield and disease improvements – a range of independent studies show a minimum 10-fold return on cereal development research.

And that rate of return is fast rising. Equipped with the latest tools in biotechnology and bioinformatics, Canadian researchers have slashed years off the crop development process. They’ve also cracked the genetic codes of key traits and flagged them with genetic markers – meaning faster, more sophisticated and more dramatic improvements.

Case study shows 10-fold return

In 2002, Alberta Agriculture Food and Rural Development (AAFRD) commissioned a study to examine the economic returns to feed barley breeding and disease resistance research at the Field Crop Development Centre (FCDC) in Lacombe.

The study was conducted by agricultural economist Dr. Joseph Nagy and assessed the period from 1974 to 2001. It found that while the total investment in research during this period was approximately $8.6 million, the overall monetary benefit from that investment was $109.4 million from 1983 to 2001 alone.

The internal rate of return was estimated at 29 percent, which Nagy reported is an excellent rate of return for an agricultural research and development program. The FCDC has since added significant staff and biotechnology resources to bolster the speed, power, efficiency and payoff of the research.

How research delivers value

Canada has already built the base. Now it needs to leverage that into new opportunities.

Canada delivers over $24 billion worth of agriculture and food products to more than 180 countries around the world every year.

These big drivers of that are wheat production, barley production and livestock production, which account for a large portion of that total. Livestock production counts on barley and wheat as major feed sources and all three sectors of production depend heavily on crop development research to be successful.

Adding value to Canada’s high-volume crops

And this research has delivered. Take yield jumps for example. Crop development advances have ensured a steady rise in yield potential, to the point where today's cereal varieties yield 10 to 20 percent higher than varieties did 10 years ago. That alone represents profits to the producer that far exceed the initial investment in this research. It also ensures supply to anchor the grains industry as a whole.

Disease resistance has also improved dramatically in that timeframe. Today's varieties now have genetic resistance to many key diseases that previously required costly herbicide treatment or resulted in major production losses. That again would alone return far more than the initial research investment.

These are just two examples that are repeated many times over in other areas of genetic improvement, including: grade potential, pest resistance, time to maturity, straw stature and strength, drought tolerance, and several others.

Diversifying the quality portfolio for top markets

For the cereals sector as a whole, crop development has strengthened and diversified the quality of these grains to bolster Canada's competitiveness both at home and in key world markets.

Wheat and barley are leading examples. In wheat, white-seeded hard wheat has been added, which is preferred by several markets over Canada’s traditional red-seeded wheat. Gluten strength has been increased in durum wheat to position it for a greater share of higher quality, more lucrative markets. New classes of slightly lower protein wheat have been added to diversity options for milling wheat markets. And new winter wheat classes have been added to offer producers a new option for improved production flexibility and soil conservation.

In barley, new feed types have been developed that offer sophisticated tailoring to meet the nutritional needs of livestock, resulting in higher performing animals that produce less waste. A new generation of malting barley varieties has also been launched, which reflects widening international preferences and has renewed demand for Canadian barley to supply top malsters and brewers. At the same time, innovative “hulless” and specialty starch barleys have been developed to capitalize on expanding opportunities in human food, health and industrial markets.

This progress is mirrored in crop development for other important cereal crops, such as oats, flax, rye, and triticale.

Driving progress in new economic battlegrounds

Unquestionably, progress in variety development is a major driving force in Canada's agriculture success, with an influence that is becoming more dramatic every year as science continues to rapidly advance.

 Innovations in new crop varieties have caused flip-flops in the leadership positions of Canada and its competitors in many long-standing, multi-billion dollar markets, and at the same time have opened new opportunities that have become key economic battlegrounds of the future.

Crop-based bio-products, including health supplements, functional foods, nutraceuticals and alternative energy – these are just a few of the emerging opportunities anchored by today’s crop development progress.

What are our competitors doing?

With more than five times our investment, Australia is threatening to take our markets.

Canada’s major competitors in the grain trade have ramped-up their investment in crop development research, recognizing its critical and rapidly expanding importance to production and market success.

Australia, for example, Canada’s key rival in wheat and barley export markets, has increased its investment in crop development research for these crops to well over five times Canada’s current investment, through a system initiated by growers and coordinated by the Grains Research and Development Corporation (GRDC).

The U.S., Europe and other key players have also strengthened their efforts and are out-investing Canada.

Canada has managed to keep pace in terms of innovation, owing to its long history as a crop development leader with a wealth of expertise and well-established network. But this competitive capacity is limited without strong investment to bolster the network and nurture a new generation of scientists.

Canada has already built the base. Now it needs to leverage that to new opportunities.
What's crop research worth?

A range of independent studies show cereal crop development delivers one of the highest investment returns of any type of research.

In the high-stakes game of global trade in agri-products, the players hold relatively few cards that separate the winners from the losers. For Canada, one of its most powerful cards is crop development research. This research is the factory that produces crop varieties farmers require and markets demand. And Canada has built a network that is a long-standing world leader. It’s why Canadian grains are preferred by top markets around the world, and it’s why Canada’s competitors have ramped-up their own research bases.

It’s also one of the best investments going in agriculture. Even at a very basic and narrow level of assessing research investment value – dollars invested vs. direct returns in yield and disease improvements – a range of independent studies show a minimum 10-fold return on cereal development research.

And that rate of return is fast rising. Equipped with the latest tools in biotechnology and bioinformatics, Canadian researchers have slashed years off the crop development process. They’ve also cracked the genetic codes of key traits and flagged them with genetic markers – meaning faster, more sophisticated and more dramatic improvements.

Case study shows 10-fold return

In 2002, Alberta Agriculture Food and Rural Development (AAFRD) commissioned a study to examine the economic returns to feed barley breeding and disease resistance research at the Field Crop Development Centre (FCDC) in Lacombe. The study was conducted by agricultural economist Dr. Joseph Nagy and assessed the period from 1974 to 2001. It found that while the total investment in research during this period was approximately $8.6 million, the overall monetary benefit from that investment was $109.4 million from 1983 to 2001 alone.

The internal rate of return was estimated at 29 percent, which Nagy reported is an excellent rate of return for an agricultural research and development program. The FCDC has since added significant staff and biotechnology resources to bolster the speed, power, efficiency and payoff of the research.

How research delivers value

Canada has already built the base. Now it needs to leverage that into new opportunities.

Canada delivers over $24 billion worth of agriculture and food products to more than 180 countries around the world every year. Three big drivers of that are wheat production, barley production and livestock production, which account for a large portion of that total. Livestock production counts on barley and wheat as major feed sources and all three sectors of production depend heavily on crop development research to be successful.

Adding value to Canada’s high-volume crops

And this research has delivered. Take yield jumps for example. Crop development advances have ensured a steady rise in yield potential, to the point where today’s cereal varieties yield 10 to 20 percent higher than varieties did 10 years ago. That alone represents profits to the producer that far exceed the initial investment in this research. It also ensures supply to anchor the grains industry as a whole.

Disease resistance has also improved dramatically in that timeframe. Today’s varieties now have genetic resistance to many key diseases that previously required costly herbicide treatment or resulted in major production losses. That again would alone return far more than the initial research investment.

These are just two examples that are repeated many times over in other areas of genetic improvement, including: grade potential; pest resistance; time to maturity, straw stature and strength, drought tolerance, and several others.

Diversifying the quality portfolio for top markets

For the cereals sector as a whole, crop development has strengthened and diversified the quality of these grains to bolster Canada’s competitiveness both at home and in key world markets.

Wheat and barley are leading examples. In wheat, white-seeded hard wheat has been added, which is preferred by several markets over Canada’s traditional red-seeded wheat. Gluten strength has been increased in durum wheat to position it for a greater share of higher quality, more lucrative markets. New classes of slightly lower protein wheat have been added to diversity options for milling wheat markets. And new winter wheat classes have been added to offer producers a new option for improved production flexibility and soil conservation.

In barley, new feed types have been developed that offer sophisticated tailoring to meet the nutritional needs of livestock, resulting in higher performing animals that produce less waste. A new generation of malting barley varieties has also been launched, which reflects widening international preferences and has renewed demand for Canadian barley to supply top malsters and brewers. At the same time, innovative “hulless” and specialty starch barleys have been developed to capitalize on expanding opportunities in human food, health and industrial markets.

This progress is mirrored in crop development for other important cereal crops, such as oats, flax, rye, and triticale.

Driving progress in new economic battlegrounds

Unquestionably, progress in variety development is a major driving force in Canada’s agriculture success, with an influence that is becoming more dramatic every year as science continues to rapidly advance.

Innovations in new crop varieties have caused flip-flops in the leadership positions of Canada and its competitors in many long-standing, multi-billion dollar markets, and at the same time have opened new opportunities that have become key economic battlegrounds of the future.

Crop-based bio-products, including health supplements, functional foods, nutraceuticals and alternative energy – these are just a few of the emerging opportunities anchored by today’s crop development progress.

What are our competitors doing?

With more than five times our investment, Australia is threatening to take our markets.

Canada’s major competitors in the grains trade have ramped-up their investment in crop development research, recognizing its critical and rapidly expanding importance to production and market success.

Australia, for example, Canada’s key rival in wheat and barley export markets, has increased its investment in crop development research for these crops to well over five times Canada’s current investment, through a system initiated by growers and coordinated by the Grains Research and Development Corporation (GRDC).

The U.S., Europe and other key players have also strengthened their efforts and are out-investing Canada.

Canada has managed to keep pace in terms of innovation, owing to its long history as a crop development leader with a wealth of expertise and well-established network. But this competitive capacity is limited without strong investment to bolster the network and nurture a new generation of scientists.
Bio-progress: What the world wants

Canada is in a good position to capitalize on emerging opportunities, thanks to its crop development research base.

Crop development researchers are tailoring new cereal varieties to capitalize on expanding potential in many areas. Here are just a few examples:

- Harvesting new health value from grains. Science has uncovered properties in grains that can enhance the health value of food products or be extracted for use in health supplements. A leading example is barley. This grain contains higher levels of beta-glucan, a type of fibre linked to reduced levels of blood cholesterol. Barley also contains several powerful antioxidants, most notably tocopherol, which is associated with reducing the risk of cancer. These properties already represent a rapidly growing sector of the emerging “nutraceuticals” market, a burgeoning market of the future expected to represent $250 billion by the year 2020.

- Reducing livestock pollution with feedgrains. Some simply call it manure, but to crop development researchers it’s a lost opportunity. The more livestock feed that passes through the animal, the less that is captured to produce meat and milk. That’s why researchers are taking a sophisticated approach to improving the feed value of common feedgrains such as barley. By tailoring the nutritional components of the feed to meet the digestibility and nutritional parameters of the animal, they can increase performance and reduce waste. A leading example is low phytate (LP) barley now in development. LP barley is low in phytic acid – a form of phosphorus that is almost indigestible by monogastric livestock such as hogs and poultry, and typically ends up in manure. LP barley varieties contain the same amount of phosphorus, but in a form that is more available to the animal, improving feed efficiency and reducing phosphorus waste by 50 percent or more.

- Kick-starting potential in alternative fuels. Grain-based ethanol is just one example of the tremendous potential for crop-based bio-fuels. Not only can these fuels create valuable new markets for producers and industry, they can provide renewable, environmentally friendly options that reduce Canada’s reliance on foreign energy. Researchers are working on crop varieties custom-made to get maximum energy value for fuel production, and this is just one example of the broad potential for crop-based bio-products. Today, 90 percent of fuels, chemicals and plastics are derived from oil and gas – a non-renewable resource with reserves shrinking every year. The International Energy Agency estimates the world will be at about 50 percent of its current oil and gas capacity by 2020, while energy needs are expected to double by 2050.

The search for research excellence

Canada already has a strong anchor in its crop development network. If Canada went shopping for research, it’s clear what it would look for – a proven track record, high return on investment and a critical mass of expertise, partnerships and resources. Canada already has all of these today in its network of cereal crop development research.

A good example is the Field Crop Development Centre (FCDC) in Lacombe, a key Alberta link in this network. The FCDC, an institution of Alberta Agriculture, Food and Rural Development (AAFRD), has helped drive more than three decades of progress, supporting the growth of Alberta’s livestock industry and keeping the province’s crop producers competitive. Independent analysis shows the Centre has delivered a minimum 10-fold return on investment in its research.

The Centre, with its multi-disciplinary team and network of international partnerships has the capacity to deliver world-class crop development programs. It emphasizes high quality feed, fodder and food crops, with strong programs in feed barley, winter wheat, triticale and malting barley.

To learn more, visit AAFRD’s “Ropin’ the Web” site, at www.ropintheweb.com, and enter “Field Crop Development Centre” in the search field. The Centre also welcomes comments and questions directly. Phone: (403) 782-8696.

As Canada targets a globally competitive research base, crop development for cereals may be like “the elephant in the room” – the powerful force that’s overlooked.

The critical mass – top minds, manpower and resources – to compete globally and fuel Canada’s economy. Strong value-added potential. Production systems that are economically, socially and environmentally sustainable. An industry the world can be proud of, and one it will buy from.

Research funders, decision-makers and stakeholders have wrestled with the best research designed to meet these demands. They like the novel, the value-added, the quick payoff. But in their fascination with the futuristic, they may risk overlooking the value of the more traditional.

Crop development research for cereal crops – such as wheat, barley and oats – is an example. Though often under the radar, this is one of Canada’s strongest and most essential areas of agricultural research capacity, with a national network built over decades. The crops it supports dominate production, fuel several multi-billion dollar industries and are a critical foundation to the emerging revolution in bio-potential.

Canada owes itself to ensure the value of crop development is not overlooked. This report recapitulates some of the key points to consider, from what crop research is really worth and how it delivers value, to what Canada’s competitors are doing and what the world wants from bio-progress. When these points are taken into account, the search for research excellence may lead to a not-too-distant destination.

About this report

This Perspective on Crop Development, “The elephant in the room”, is one in an ongoing series of Perspectives reports produced by Meristem Land and Science, a Web-based, educational information service developed by Calgary-based Meristem Information Resources Ltd. This edition was supported by the Field Crop Development Centre.

To learn more or request reprint permission, visit www.meristem.com or e-mail info@meristem.com. © 2005 Meristem Land and Science. www.meristem.com. Meristem® is a registered trademark of Meristem Information Resources Ltd. All rights reserved.

Supported by: Field Crop Development Centre, Lacombe, Alta.