



# BIOTECHNOLOGY: ADVANCEMENTS IN AGRICULTURE

3  
FACTS

## ABOUT BIOTECH AND AGRICULTURE

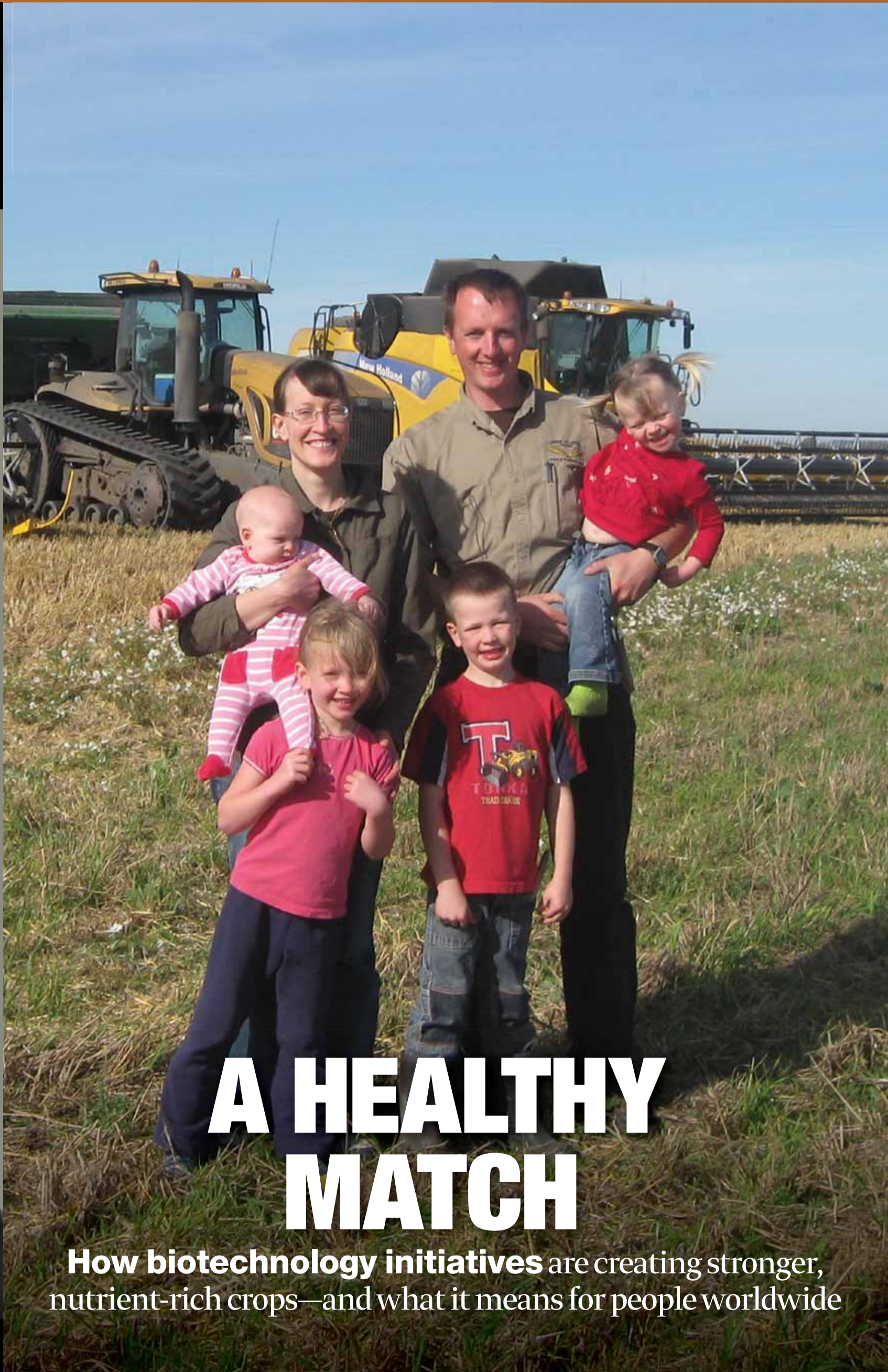
Bettering agriculture  
Biotechnology collaborating with nature

Growing sustainability  
The difference fertilizers make

Food vs. fuel  
The debate is over

GE crops  
What farmers really think

Golden rice  
The implications—and uncertain future—of this power crop



## A HEALTHY MATCH

How biotechnology initiatives are creating stronger, nutrient-rich crops—and what it means for people worldwide



OWEN ROBERTS, ED.D., P.AG. (HON)  
Director, Research Communications,  
Adjunct professor, Animal & Poultry  
University of Guelph



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## CHALLENGES



FACT

1

IF FERTILIZERS DID NOT EXIST, FARMLAND WOULD HAVE TO INCREASE BY 50 PERCENT

**Food for thought:** if it weren't for biotechnological advancements, we'd need twice as much farmland to produce the same output.

# Biotechnology: Collaborating with nature

Canadian farmers have helped to feed the world for many years. As the challenge of feeding the world's growing population without increasing the amount of farmland rises, farmers turn to innovations like plant biotechnology to help them continue to do the important work of feeding Canadians and the world.

This special feature takes a deeper look at plant biotechnology: what it is and what it means for the future of consumers, farmers and the environment.

## Collaborating with nature

**1** People have been selecting and breeding plants to improve quality, increase yields and reduce undesirable characteristics in crops for thousands of years. In the last few decades, plant breeders have been able to effectively transfer beneficial characteristics from one plant to another more precisely using a variety of tech-

niques commonly known today as plant biotechnology.

There are a number of processes that fall into the broader category of plant biotechnology. Three that are commonly talked about are: genetic modification, genetic engineering and mutagenesis.

## Altering the building blocks

**2** The terms genetic modification and genetic engineering are typically used interchangeably.

Specifically, genetic engineering is a set of laboratory-based methods used to alter the genetic makeup of plant cells by removing, moving or transferring genes within and between plants, in order to produce the desired effect. Plant products from this process have been federally regulated since 1988.

Mutagenesis is a process where the genes of an organism are altered. This process occurs in nature, but plant breeders can accelerate the alteration of a plant's genes experimentally by the use of chemicals or radiation. Mutagenesis as a science was



Lorne Hepworth  
President, CropLife

"People have been selecting and breeding plants to improve quality, increase yields and reduce undesirable characteristics..."

developed in the first half of the 20th century and many of today's varieties of crops have been derived using it.

## Consumer safety first

**3** In Canada, the Canadian Food Inspection Agency and Health Canada have been assessing tests on biotech crops for over two decades and the results have shown that these crops are safe for people, animals and our environment. Scientists here, and around the world, agree that biotech crops are just as safe as traditional crops.

Canadian farmers choose to grow biotech crops because they offer meaningful benefits such as increased yields and environmentally sustainable options to help reduce greenhouse gas emissions and use less water.

We hope you find this special edition interesting and informative. Canadian farmers and consumers around the world are benefitting a great deal because of these technologies and this insert will help you, the reader, to see how.

# Fertilizer: Nourishing the environment and economy

**The only connection most Canadians have with fertilizers is picking up a bag in the spring to make their lawns greener and their gardens more bountiful. Yet, as popular as gardening is in Canada, it is unlikely many people give fertilizers a second thought.**

However, with the world needing to feed a growing population - an estimated nine billion by 205 - a key challenge will be producing and using fertilizers in a way that is economically, environmentally, and socially sustainable. Fertilizer is a critical part of the solution to increasing crop yields and restoring soils in regions such as Africa.

Canada's fertilizer industry supports 4R Nutrient Stewardship, effective

product standards, safety and security codes of practice and healthy green spaces to ensure a sustainable future for our customers and the communities where they live.

## Nourishing our food source

Fertilizer is food for plants. It is a key ingredient used by farmers in the production of our food. As plants and crops grow, they take nutrients from the soil. A balanced supply of nitrogen, phosphorus, potassium and sulphur keeps soil fertile and able to grow healthy crops in the future. In fact, without using crop nutrients to keep farms around the world productive, it is estimated the amount of farmland would have to increase by 50 per cent. The Canadian companies that make and sell fertilizers create jobs and pay taxes.

## Feeding the economy

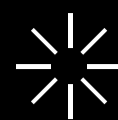
Canada produces about 24 million tonnes of nitrogen, potash, and phosphate fertilizers annually in some of the most technologically advanced and safest facilities in the world. Its economic activities contribute \$12 billion annually to the national economy. Canadian farmers spend about \$4 billion a year on fertilizers. Canada also exports fertilizers -- more than half of our total fertilizer production -- to more than 70 countries.

About 12,000 Canadians are employed directly by the fertilizer companies, working in mines, production plants, and farm supply outlets. During the last 40 years, the science-based use of fertilizers, including precision application methods, and other technologies have enabled farmers to triple crop production on a smaller land

base. That makes up for farmland lost to the expansion of our cities and towns and saves habitat for wildlife.

The industry also promotes proper fertilizer use through 4R Nutrient Stewardship: Right Source, Right Rate, Right Time, Right Place. This protects the environment while helping farmers use fertilizers to increase their profits. The Canadian Fertilizer Institute has helped establish the Crop Nutrients Council and the Fertilizer Safety and Security Council to promote proper fertilizer use. The industry motto is "We're Growing Sustainability"

COURTESY OF CFI  
editorial@mediaplanet.com



WE RECOMMEND



**GE crops**  
What do farmers really think of genetically-engineered crops?

PAGE 3

"Prior to the introduction of BT varieties, we lost as much as 50 bushels per acre..."

**Golden rice** p. 5

Why this super crop is facing an uncertain future.

**Food vs. fuel** p. 7

Why the debate is over.

# MEDIA PLANET

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Responsible for this issue:

**Publisher:** David Shoemaker  
david.shoemaker@mediaplanet.com

**Designer:** Penelope Graham  
penelope.graham@mediaplanet.com

**Contributors:** Alex Binkley, Terry Daynard, Jessica Goodfellow, Kelly Green, Lorne Hepworth, Owen Roberts, Derrick Rozdeba

Agricultural Institute of Canada, BASF, Canadian Canola Growers Association, Canadian Farm Business Management Council, Canadian Federation of Agriculture, Canadian Fertilizer Institute, Canola Council of Canada, CropLife, Council for Biotechnology Information, Dow AgroSciences, FMC, Grain Farmers of Ontario, UAP, University of Guelph, University of Saskatchewan, University of Western Ontario

**Managing Director:** Gustav Aspegren  
gustav.aspegren@mediaplanet.com

**Business Developer:** Chris Vassallo  
chris.vassallo@mediaplanet.com

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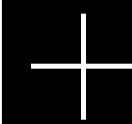


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## The positive effects of biotechnology

■ biotechnology could one day help people lead healthier lives through cancer-fighting tomatoes and oils with reduced levels of saturated fats.

■ biotechnology can help boost farm yields and improve diets in poor, developing parts of the world.

■ biotechnology is helping improve the environment by reducing plowing and the need for spraying; curbing erosion, conserving fuel and preserving wildlife habitats.

■ biotechnology can help farmers better manage water resources, particularly in the face of drought or water shortages.

■ biotechnology is helping to grow crops used for both food and production of biofuels.

■ biotechnology is improving farmers' bottom lines.

■ organizations around the world have declared that biotechnology developed foods are safe.

COURTESY OF THE COUNCIL FOR BIOTECHNOLOGY INFORMATION  
editorial@mediaplanet.com



NEWS

# FARMERS PRAISE GE CROPS

Since their introduction about 15 years ago, genetically engineered varieties of corn, canola and soybeans have grown quickly in popularity among farmers.

About 90 percent of the canola, 70 percent of the corn and 65 percent of the soybeans planted in Canada are GE varieties making it No. five among countries in terms of acres in modified crops.

The seed costs more than conventional varieties, but farmers like Bob Bartley, Dave Whaley and Jeff Davis say improved weed and insect control justifies the expense.

**What a blast**

Bartley, who farms about 80 kilometres southwest of Winnipeg, rotates corn, wheat, flax, canola and soybeans on his 1,400-acre operation. Planting GE corn and soybeans means he can spray the weed killer Roundup "and achieve superior weed control with less pesticide use."



"Prior to the introduction of BT varieties, we lost as much as 50 bushels per acre because of this pest."

**Bob Bartley**  
Crop farmer

He also uses BT corn, which is modified to resist the highly destructive European corn borer. "Prior to the introduction of BT varieties, we lost as much as 50 bushels per acre because of this pest. Now we have protection against it built into our seed."

Whaley grows corn, soybeans and wheat on 700 acres near Wheatley in Southwestern Ontario. He started planting GE corn about a decade ago to counter the corn borer. "It caused us a lot of grief and waste but those days are over. The alternative was to spray a lot of pesticides to control it. We didn't like doing that because it

kills all the beneficial insects as well."

He switched to Roundup Ready soybeans later to solve persistent weed problems along with damage that older pesticides caused to the soybean plants. "This way the soybeans don't even know they've been sprayed."

Davis grows wheat, corn and soybeans on 1,200 acres near St. Thomas, Ont. "The main reason is I get better weed and insect control. My costs are lower and I get higher yields."

Curbing the damage the borer and other pests create in crops reduces harmful molds, he says. That

means he's delivering a higher quality product to his customers.

**Location, location, location**

Farmers rotate their crops to improve soil quality and control weeds and insect pests. Craig says rotation also prevents weeds from becoming resistant to herbicides because they're exposed to different chemicals on a regular basis.

Farmers are well aware of the controversy surrounding GE crops. Bartley notes, "We readily accept the use of biotechnology in medicine, so why the double standard with the use of the same science in agriculture? If you think about it, the products and traits that benefit crop health are really just 'medicine' for our crops."

He says the environment gains from GE crops. Farmers spend less time working their fields, which means lower greenhouse gas emissions, soil compaction and water erosion.

As the world population keeps growing toward nine billion by 2050, farmers will need tools like

GE crops to increase production to feed them all, Bartley says. "GE crops are an option that will give us the opportunity to keep pace. Research is ongoing that will allow us to grow more with less. More efficient nitrogen and water use on less land will help feed the world as our cities and towns expand."

Whaley and Davis would be interested in a GE wheat that controlled fusarium headblight that creates mycotoxins, which can be fatal to humans.

More fusarium resistant conventional varieties have been developed, Whaley says. "We're better off than we used to be. But if a GE variety would let us stop using the fungicides we now have, I would say bring it on. Show me the science that says GE isn't safe for consumers."

**ALEX BINKLEY**  
Agriculture writer  
editorial@mediaplanet.com

- 43,000 Canadian farmers grow canola
- Canola is a Canadian innovation
- Heart-healthy canola oil has only 7% saturated fat
- 228,000 Canadian jobs rely on canola
- Canola generates \$15.4 billion in economic activity

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**Picture** a program that partners with communities to create focused solutions to local watershed issues. Agrium's *Caring for our Watersheds*™ encourages environmental stewardship by students.

**Picture** a partnership with *Millennium Promise* that believes in reducing extreme hunger while improving education, health, gender equity and environmental sustainability. Agrium invests funds and fertilizer to help African farmers become more productive.

**Picture** an educational program to help young people understand the elements that grow healthy crops and healthy bodies. Agrium's *Seed Survivor*™ interactive display is curriculum-based and travels to schools and communities throughout North America.

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# HARVESTING THE BENEFITS

**Question:** How is the increasing use of biotechnology in farming practices affecting consumers?

**Answer:** Healthier crops and increased food security are among the benefits

**As the world moves towards an expected population of nine billion by 2050, biotechnology is being held out as one answer for tough issues such as food security, sustainable production and environmental degradation. Its success depends on its uptake by farmers, and so far, the future looks bright.**

Biotech came to Canada back in the late 1980s, via agricultural crop production. At the time, the farming sector didn't say much about it—speaking with the public about production practices is only now becoming part of farming culture. And until the shift towards local food occurred, the public appeared mostly blasé about how farmers grew food.

But there's no question farmers have embraced it. Over the past two decades, they've come to see biotech as a safe, effective tool for producing low-cost, high-quality food. Many biotech crops contain a gene that makes them tolerate specific, effective herbicides. Farmers, then, can spray and kill weeds, but not their crop. In other



cases, crops are genetically modified to create their own pesticides and kill the bugs that start to eat them. All in all, biotech benefits food production because farmers can use less pesticide, and they don't have to disturb the soil as much to control weeds. Environmentally and economically, they say it's a sound approach.

#### The growth of innovation

Really, biotech's uptake is not a surprise in agriculture. Farmers have a long history of embracing new technology, particularly for plant and animal breeding, mechanization and crop protection. In agriculture, it's a relatively short distance from the lab to the field, and once biotech developments that occur in university

and government labs clear regulatory hurdles—a significant feat in itself—they can quickly become adapted by industry and used by farmers.

Canada is just one of many important agricultural countries where biotech continues to gain momentum. This fall, Canadian farmers will harvest about eight million hectares of biotech corn, soybeans, canola and sugar beets. That's over one million more hectares than last year. Canada ranks fifth in the world in biotech crop acreage, according to the International Service for the Acquisition of Agri-biotech Applications. Only the United States, Brazil, Argentina and India are ahead.

#### The seeds of understanding

**“In some circles, biotech has been criticized because its obvious and immediate benefits are mostly accrued to farmers.”**

In some circles, biotech has been criticized because its obvious and immediate benefits are mostly accrued to farmers. However, field trials are underway for plants with traits that will provide consumer benefits too, such as increased levels of healthier oils. Crops from biotech could go a long way to increase food security worldwide, too, first for crops grown in dry or drought-prone areas in North America, then with lessons learned here, for more challenging scenarios in underdeveloped countries.

Then there are pharmaceutical and medical uses. A company called Plant-Form in Guelph, Ont., is growing cancer-fighting antibodies in, ironically, genetically modified tobacco plants. The huge leaves make them ideal and economical candidates for the job—in fact, the company says it can produce fully active versions of approved antibody drugs for as little as 10 percent of the manufacturing cost of brand-

name products. And in Saskatoon, Prairie Plant Systems has created bio-secure plant growth chambers to produce therapeutic and industrial proteins. The key now is to make them economically viable.

In livestock, Canada has taken the lead globally with a genetically enhanced line of Yorkshire pigs trademarked Enviropigs. They're equipped with a gene that lets them digest plant phosphorus more efficiently than conventional pigs (phosphorus, in run-off, promotes algae growth in water). In fact, Enviropigs, developed at the University of Guelph, excrete 30 to 70 per cent less phosphorus in manure, depending upon the age and diet. Enviropigs have been plodding their way through the regulatory process, and along with the fast-growing AquAdvantage salmon, could be the first genetically modified animals to enter the food chain.

Farmers have bought into biotech. Investors are being courted. The industry still needs to convince consumers biotech is the way to go, but the evidence is there that it works.

**OWEN ROBERTS, ED.D., P.AG. (HON.)**

Director, Research Communications  
Adjunct professor, Animal and Poultry Science  
University of Guelph  
editorial@mediaplanet.com



Through relentless innovation, we help Canadian farmers feed a growing world.

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NEWS IN BRIEF

Sustainability's must haves

**Our own sustainability as a race is intimately intertwined with the sustainability of our food production systems.**

The global situation we face today seriously threatens both. Food production will have to increase 70 per cent by 2050 to accommodate the world's population and our natural resources are being depleted, so we must produce more food on less land with less water.

**Working with what exists**

How? Food production needs to be intensified on existing farmland, rather than expanding into natural habitats, which are crucial for biodiversity and carbon storage. The Canadian Federation of Agriculture, the country's largest farmers' organization, believes agricultural research and technology are a necessary part of the solution and should be a priority investment for political agendas and budgets.

The CFA maintains biotechnology must be developed with sound and rigorous science and must respect the interests of the developers as well as the farmers who may use the product. Consumer information and education on the benefits of new crop varieties must be central in its development. Continued investment and a strong regulatory system will ensure approved biotechnology products increase food production, while protecting consumer health and the environment.

COURTESY OF CFA  
editorial@mediaplanet.com

# The uncertain future of Golden Rice

**Answer:** Why is Golden Rice, a vitamin-enriched superfood, unable to reach those who would benefit from it most?

**Question:** Varying political and trade issues are keeping it shelved.

**To millions of people in underdeveloped countries, local food means rice. It's one of their main sources of sustenance, and thanks to technology, a new breed of rice has been developed with beefed-up levels of Vitamin A.**

This vitamin helps promote healthy skin, teeth, brain development and soft tissue. It's readily available from beta carotene, and it's badly needed in underdeveloped nations—as many as 190 million children under five years old there suffer from Vitamin A defi-

ciency, and many die. Medical authorities say Vitamin A supplements could save their lives.

**Hitting roadblocks**

Enter Jay Bradshaw, president of Syngenta Canada, whose Swiss-based parent company had a lead role in developing the enhanced Vitamin technology. Bradshaw, an Ontario Agricultural College graduate, envisions a scenario in which this enriched grain—popularly known as Golden Rice, because its active ingredient, beta carotene from daffodils, gives it a yellow colour—is grown by local farmers in paddies next door to those who could use it most.

But for now, that's not to be. Golden Rice hit a regulatory roadblock a decade ago, and has never got back on track. Through the 1990s, scientists working for Syngenta and other institutions collectively developed the

crop, and then donated it for humanitarian use in underdeveloped countries. However, for varying political and trade reasons, GMO crops are unwelcome in many such countries.

**Shelving opportunity**

So instead of saving lives, this technology continues to sit on the shelf. Meanwhile, Vitamin A's attributes grow. A recent review in the British Medical Journal of Vitamin A literature by the Centre for Evidence-Based Intervention at the University of Oxford said the proof Vitamin A helps fight disease is so strong that it's unethical to continue comparing supplements to placebos, a standard scientific practice.

Bradshaw, like others in agribusiness, is frustrated with the inertia. "This presents a very real, very serious moral dilemma," he says. "It's not enough to just develop the tech-

nology. In order to make a difference, those technologies need to exist in an environment where they can be put to good use—especially when lives are on the line."

But no one's giving up. Judy Shaw, government relations manager for Syngenta Canada, sees a day when such technologies are coveted by consumers because of a value-added health or environmental trait.

"Golden Rice is an example of what's possible," she says. "This technology can help people right now, and there are numerous studies that show it's safe. Withholding it from those who need it raises a lot of questions."

OWEN ROBERTS, ED.D., P.AG. (HON.)  
Director, Research Communications  
Adjunct professor, Animal and Poultry Science  
University of Guelph  
editorial@mediaplanet.com

## Canadians have access to one of the safest, most abundant food supplies in the world, thanks in part to plant biotechnology.

Without tools like plant biotechnology and pesticides, Canadian farmers would have to cultivate **37 million more acres of land** to generate the same amount of food as they do today. That's about four times the size of the farmland in Ontario.

The higher yields farmers achieve using plant biotechnology and pesticides help Canadian families save **58%** on their weekly grocery bills.

**DID YOU KNOW...**

Scientists are using plant biotechnology to develop more nutritious foods that can help fight diseases and deliver other health benefits. Currently in development are corn and soybeans with higher levels of vitamin C and E.



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# SCIENCE, TECHNOLOGY & HUMAN INTELLIGENCE DEVELOP SUSTAINABLE SOLUTIONS



**By 2050 the world's food production systems must support an estimated 9 billion people while the available agricultural land base and water resources continue to shrink.**

Combining science and technology with human intelligence to develop innovative and sustainable solutions to help maximize agricultural food production is critical to meet the challenge of feeding a growing world.

"We are committed to increasing crop productivity through higher yields, better varieties, and more targeted pest management control," says Jim Wispinski, president, Dow AgroSciences Canada Inc. "Our diverse portfolio of leading-edge insecticides, herbicides, fungicides, fumigants and seed technologies addresses some of the world's most challenging agricultural issues."

Research and Development in the industry is focused on developing the next generation of breakthroughs in agricultural science. "At Dow AgroSciences alone, there are approximately 1,800 researchers at work in more than 40 countries finding solutions to support food production. They also conduct research in cooperation with scientists at universities, government-sponsored research institutes and private companies around the world,"

says Wispinski.

## Investing in the future of food production

No crop is as synonymous with the Canadian prairies as canola. In Ontario and Quebec, the crop is corn. World-class research and breeding facilities established in the heart of both growing regions are producing important developments in plant genetics and biotechnology.

In St. Mary's, Nairn, and Blenheim, ON, you'll find Seeds Breeding Stations that take a disciplined approach to product research, listening to what farmers say they need to be successful and translating it into products.

"Our hybrid breeding program works toward satisfying growers' need for increased yield and agronomic advancements," says Pat Corbett, Mycogen® and Hyland™ brands Seeds Business leader. In response to farmers' demand for corn seed with herbicide and insect resistance, Dow AgroSciences and Monsanto co-developed SmartStax™—a trait combination that delivers increased yield and the broadest spectrum of insect control available. SmartStax offers multiple modes of action for above- and below-ground insect control and reduced potential for insect resistance.

## Canadian research improves health world wide

At the Global Canola Research Center in Saskatoon, SK., researchers are working to develop improved canola varieties that support increased canola production and improved human health benefits.

Their number one success story is heart-healthy Omega-9 Canola Oil, produced from Nexera™ canola grown in western Canada. Omega-9 Canola Oil offers improved health to consumers through zero trans-fat, low saturated-fat and high heart-healthy monounsaturated fat. Since its introduction, Omega-9 Canola Oil has already removed one billion pounds of bad fat from the North American consumer diet.

"We will continue to invest in developing crop protection solutions, while also focusing intensively on advancing science in plant genetics, biotechnology and healthier oils," says Wispinski. "Our investment in sustainable production will continue to help agricultural producers accomplish more to feed the world's growing population."

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right source



right rate



right time



right place



The fertilizer industry's commitment to sustainable nutrient management utilizes the **Canadian Fertilizer Institute's (CFI) best management practices** which ensure nutrients are applied with the **4R Nutrient Management System – the Right Source @ Right Rate, Right Time, Right Place®**. This provides growers with sustainable economic returns while protecting the environment and providing people with the nutrients they need.



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Visit [www.whybiotech.ca](http://www.whybiotech.ca) for more information on the benefits of plant biotechnology.



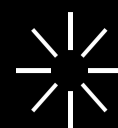
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Good ideas are growing



# INSPIRATION



**WORKING THE FIELD**  
Groeneweg combines canola, one of Canada's most prominent prairie crops.  
PHOTO: PRIVATE



DON'T MISS!

## Thank a farmer

**Have you ever thought about where your food comes from? I didn't—until I started working in the agriculture industry nine years ago.**

I had a number of misconceptions about farming. I thought it was simple. You take a seed, plant it, watch it grow, harvest it, and then you sell the fruits of your labour. This is the process, but the complexities are enormous. There are endless circumstances that need to be evaluated and responded to—most of which the farmer has little control over. What other entrepreneur builds a business model without knowing what the selling price for their product will be when they bring it to market? Weather can make or break a season. Inside of a short 120-day window (which is the average number of frost-free days in Canada), the grower must get his crop from seed to market, despite whatever unusual weather patterns may be in the cue.

### An evolving role

Today, farming is more science than art. A grower has to be a climatologist, an agronomist, a commodities futures expert, a chemist, an electrician, a mechanical engineer, a banker and a trouble-shooter. So why get into this business? In many cases, farmers were born into agriculture and just don't know anything else. They grew up on the farm and are the next generation of many generations of farmers. Ask them why they stay and you'll hear about the freedom that comes with being a steward of the land. They take great pride in raising animals and crops to literally feed the world. Interestingly, most farmers have convinced their children that farming isn't a viable career. As a result, a large percentage of farms are owned and operated by farmers in their 50's and older.

### Keeping food affordable

Ever worried about the cost of food? Lost sleep about the price of your next loaf of bread? Probably not. We take for granted a plentiful supply of safe, healthy and inexpensive food every day. How does this happen with so many other things continuing going up in price? Successful farmers have had to build a business model based on economies of scale: become large enough to utilize massive equipment to reduce your overhead costs and use high tech seeds and input products to maximize crop yields.

Technology has been the biggest advancement in agriculture in the last 20 years. GPS technology has created precision farming which has reduced input costs. Biotech seeds have dramatically increased yields in corn, soybean and canola. Crop protection products have also become more selective and are used less because of the biotech crop systems that have been developed.

This also means that growers must continually educate themselves on new technologies. While we all have images of farmers sunbathing in Mexico all winter, in reality they are going back to school constantly to learn about new technologies and management skills. They use down time to assess global markets to determine their next year's crops, decide what nutrients and crop protection products are required to ensure the best yields, manage their fixed costs of labour and equipment, and take inventory of their financial capital and supplier relationships. All with the anticipation of what Mother Nature will do to help or hinder their business goals. It's a thankless job.

So the next time you see a farmer, give him or her a hug. Say thank you for the food that they put on your plate. It's only because there's so much on their plate, that there's so much on yours.

**DERRICK ROZDEBA**  
editorial@mediaplanet.com

# Best practices and good science make a healthy match

## HOW MADE IT

- **Question:** What farming advancements are creating real change for processes and products?
- **Question:** Methods to preserve the source—nutrient-rich soil—are reaping sustainable rewards.

### Farmer Franck Groeneweg believes feeding the world requires finding a delicate balance between maximizing production and maintaining the long-term sustainability of a farm's resources.

In an environment where climates are shifting and food demand continues to rise, achieving this means employing the best farming practices available.

### Caring for the soil

Groeneweg continually feeds his soil with healthy nutrients. "Growing food crops like canola and wheat takes nutrients out of the soil, so farmers have to replenish the losses. I use a combination of farming practices that rebuild soil nutrition and complement that with commercial fertilizers," says Groeneweg. He plants a variety of crops in rotation including



"By changing the crops I grow each year, I maximize the quality of my soil."

**Frank Groeneweg**  
Crop farmer

a legume like peas that put nutrients back into the soil, followed by wheat, followed by canola.

"By changing the crops I grow each year, I maximize the quality of my soil, creating an environment less likely to experience stress from an overabundance of insects, plant diseases or weeds,"—something that can happen if the same crop is grown year after year.

Groeneweg employs science on his farm in many ways. When pests such as insects, weeds or plant diseases threaten his crop, Groeneweg utilizes plant protection products such as fungicides and insecticides to stop them from spreading. "It's like medicine for our crops; we only use as much as needed and no more," he says.

### Saving the structure

Another farming practice that is ad-

vancing sustainability is farming without tilling the soil. Canada's pioneers tilled the land extensively; and while it spearheaded food production in Canada there were some detrimental effects including soil erosion from wind and rain.

Today, farmers use specialized planting equipment that cuts narrow slices into the soil, places the seed and fertilizer into a seed row, and then carefully packs the soil back into the empty space. "Zero-till farming has made a tremendous difference in the consistency and quality of our crop yields because we're able to preserve soil moisture, structure and nutrients so much better."

### Creating more with less

Biotechnology has also dramatically improved sustainability. "It's an important advancement that will help

farmers meet the challenge of feeding more people, on less land, in an economical way," says Groeneweg.

For example, the introduction of herbicide tolerance in canola has allowed farmers to economically grow the crop under zero-till production practices. In addition to the soil benefits, researchers have also learned that growing herbicide tolerant canola requires less herbicide than conventional canola, resulting in a dramatic drop in the amount of fuel being burned so more carbon can be sequestered by the soil. These types of leading-edge science is critical to finding solutions to grow more food under shifting climates such as more heat, less rain and new plant pests.

Groeneweg sums up the way he farms. "The tools and practices that I employ on my farm work together like a well-performing team so that I can continue growing affordable and nutritious food for consumers around the world."

*Franck and Kari Groeneweg own a 9,000 acre grain farm near Regina, Saskatchewan. They live on the farm with their four young children.*

**KELLY GREEN**

Director of Communications  
Canadian Canola Growers Association  
editorial@mediaplanet.com

# Food vs. fuel debate – The case for Ethanol

### The addition of grain-ethanol to Canadian gasoline is a major contributor to environmental improvement for a survey of research done recently for the Grain Farmers of Ontario.



**Terry Daynard**  
Former Associate Dean for Research and Innovation, University of Guelph; Former Chair of the National Working Group on Agriculture & Climate Change

Ethanol from grain has meant a 62 percent reduction in net greenhouse gas emissions on a per-litre, per-calorie-of-combustible-energy basis. This Canadian-made fuel contains 1.6 times the energy content that is required to grow the grain.

Ethanol production from grain has been blamed by some for increasing food prices. Available analyses, while wide-ranging, do suggest that ethanol is responsible for about one-third of North American price spikes in recent years for corn—though not for other grains.

### Out of pocket

In Canada the effect of higher corn prices due to grain-ethanol production may have raised food costs by up to \$35 to \$60/year per average Canadian family. The result is a delay of about four hours on January 9, the day when average families have earned enough money to pay the farmers' share of all food purchases for the year. But this is more than offset by a \$100 to \$180 per-year average reduction in annual

family gasoline purchase costs due to the addition of lower cost ethanol fuel.

Worldwide, the higher corn prices paid to farmers as a result of the increase in grain ethanol production have been blamed for increased world hunger. However, deeper analysis shows the effect on world hunger has been minute. Most of the world's hungry eat rice and wheat rather than corn, especially the yellow corn used to make bio-fuels. Food price fluctuations in most developing countries depend far more on local price, subsidy and export/import policies and on petroleum prices.

### Recovering from economic damage

Many of the international voices criticizing ethanol for raising grain prices are the same ones that expressed outrage about the public policies to lower grain prices and enable exports of cheap North American grains to developing countries—which had a damaging effect on the ability of third-world farmers to earn a sufficient income. Indeed, as the report for Grain



**AN EFFICIENT CROP**  
Ethanol fuel contains 1.6 times the energy content that is required to grow grain.  
PHOTO: COURTESY OF GFO

Farmers of Ontario shows, the developing-world's agriculture and food self-sufficiency suffered badly when real grain prices were low enough to enable cheap grain imports during most of 25 years prior to 2007. Unfortunately, those 25 years of cheap grain imports did nothing to diminish the number of globally undernourished that remain still today at nearly 900 million.

Many voices are calling for a return to the disastrous policies of the past quarter century, that enabled low grain prices for developing countries, as the "solution" to prevent global hunger. But farmers and many experts know the real solution will involve increased agricultural and food production in the developing countries themselves. Developed countries can help by sending

money, expertise and training, but not farmer-depressing supplies of cheap grain.

As developing countries become more self-sufficient, it will leave nations like Canada, where agricultural productivity continues to grow faster than food consumption, opportunities to use this capacity for other societal needs, like environmental improvement and supplying biofuels and other biomaterials to reduce demands for petroleum.

**TERRY DAYNARD**

Former Associate Dean for Research and Innovation, University of Guelph  
Former Chair of the National Working Group on Agriculture and Climate Change  
editorial@mediaplanet.com





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