



COUNCIL FOR
BIOTECHNOLOGY
INFORMATION
Good ideas are growing

BIOTECHNOLOGY DROUGHT

ADDRESSING THE CHALLENGES OF DROUGHT

How Biotechnology Can Help



Did You Know?

“Drought is a complicated issue; it is not simply a matter of too little rain. It involves evaporation, transpiration, ground water and snowfall...no farmer lost a crop in January.”

—The Canadian Encyclopedia ¹

➤ Drought comes in degrees and duration. Canada’s western prairie provinces have an area of 2 million square kilometers that lie in the rain shadow of the Rocky Mountains, and as a result are the driest large area of southern Canada. The area most prone to drought is Palliser’s Triangle, which is north of the American border to Cartwright, MB in the east, Lloydminster, SK to the north and Calgary and Cardston, AB to the west. This is the area notoriously known as the dustbowl of the Dirty Thirties.²

➤ The impact of climatic variability on the environment is of great importance to Canadian agriculture. Monitoring the impacts on water supplies, soil degradation and agricultural production is essential to the region’s preparedness for dealing with drought. Agriculture and Agri-Food Canada offers a “Drought Watch”³ risk assessment service by monitoring moisture levels and comparing them to historical data.

➤ Since 1996, Canadian farmers have been using plants improved through biotechnology to protect land in a drought situation by using low soil-disturbance seeding methods, reducing tillage, more effectively controlling weeds, and spraying herbicides judiciously.





*“Transporting
food is virtually
transporting water.”*

—World Water Council ⁶



*“The agricultural
sector accounted for 9
percent of all water
used in Canada....the
three westernmost
provinces accounted
for 92 percent of total
national agricultural
water use.”*

*—EnviroStats, Statistics
Canada, Spring 2008⁷*



Managing Drought

Biotechnology is a valuable tool being used to develop plants that can:

- 1) Escape drought – with plants bred for shorter life cycles, which come to harvest sooner
- 2) Endure water shortages – with plants bred to endure dry periods by maintaining favourable internal water balance without yield loss
- 3) Require less water

Researchers have identified the genes responsible in flowering plants such as canola and corn that switch off and on their own defenses against drought at earlier stages of moisture deprivation.⁴

The ability to close the plant’s leaf pores during drought conditions is particularly critical at flowering time. With this genetically programmed ability to conserve energy for setting seed, plants are able to increase yield by 15 to 25 percent.⁵

“More Crop Per Drop”

The United Nations anticipates that one in five countries will face water shortages by 2030. At the same time, unabated growth in the global population will require more food.

Canada’s rich endowment of water resources and drought management expertise has the ability to increase food yields. In Canada, irrigation is not used widely except in southern Alberta and Saskatchewan drawing from the Oldman and Bow Rivers. Producers rely on the weather to deliver rain and moisture at critical times, with the knowledge that improved plant genetics will help crops withstand weather variability.

Biotech Crops: Already Helping Reduce Agriculture's Environmental Footprint

Historically, farmers have used tillage, or plowing, to control weeds. Tillage, however, can have unintended consequences that include greater wind and soil erosion and significant water runoff—consequences that can, in turn, reduce yields.

ADOPTING CONSERVATION PRACTICES

- 🌱 The combination of using minimum or zero-tillage, biotech-improved seed and one-pass herbicides has resulted in an unprecedented reduction in fuel and herbicide use.
- 🌱 Over the last two decades, farmers have adopted minimum or zero-tillage equipment that plants seed into stubble without disturbing the soil. While conserving soil moisture, this method still requires weed control to allow the crop the best chance for nutrients and moisture. In the mid-1990s, genetically engineered seed was introduced that could tolerate specific herbicides without damage to the seedlings. This means less spraying and therefore less fuel use. Together, all these practices have maximized plant yields while conserving water and soil resources.
- 🌱 Researchers in both academia and industry are continuing to improve crop yields through drought conditions.

New Technologies Will Help Farmers Cope with Drought

Better crop yields, more productivity—Canada's short-growing season means that farmers must contend with extremes of frost and drought while optimizing fertilizer and herbicide inputs. Researchers in both academia and industry are continuing to adapt crops to these environmental stresses.





Researchers in both academia and industry are continuing to improve plants and are developing a new generation of plants optimized to maintain crop yields through drought conditions.





The Future is Right Around the Corner

 **Drought-tolerant crops are already being tested** – Field testing is well underway on drought-tolerant corn, soybeans and canola in Canada. Monsanto's drought-tolerant corn is projected to be the industry's first biotechnology drought project commercialized in the early 2010s.⁸ BASF, Bayer, and Syngenta are also working on technologies that promise higher yields while saving resources and protecting the environment.⁹

 **Sharing technology around the world** – Canadian biotech company, Performance Plants Inc has signed an agreement to share its drought-fighting seed technology with Africa Harvest Biotech Foundation International.¹⁰

Several multinational companies are equally involved with sharing drought-tolerant technology around the world. For example, Monsanto has announced its development of water-efficient maize for small-scale farmers with the African Agricultural Technology Foundation, royalty-free.¹¹

COUNCIL FOR BIOTECHNOLOGY INFORMATION

The Council for Biotechnology Information is a NAFTA-aligned, non-profit association whose mandate is to communicate science-based information about the benefits and safety of agricultural and food biotechnology. CBI members are the leading agricultural biotechnology companies.

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1 Drought in Palliser's Triangle

<http://www.thecanadianencyclopedia.com/index.cfm?PgNm=ArchivedFeatures&Params=A220>

2 The Dirty Thirties

<http://www.canadianencyclopedia.ca/index.cfm?PgNm=TCE&Params=A1ARTA0002401>

3 Drought Watch

http://www.agr.gc.ca/pfra/drought/nlpay08_e.htm

4 Biotechnology Backgrounder, Performance Plants

http://www.performanceplants.com/documents/techbackgrounderfinal_09_11_07.pdf

5 Biotechnology Backgrounder, Performance Plants

http://www.performanceplants.com/documents/techbackgrounderfinal_09_11_07.pdf

6 Virtual Water Trade: Conscious Choices

http://www.worldwatercouncil.org/fileadmin/www/Programs/Virtual_Water/virtual_water_final_synthesis.pdf

7 Agricultural Water Use in Canada

<http://www.statcan.ca/bsolc/english/bsolc?catno=16-002-X200800110541>

8 Drought-tolerant corn

<http://www.monsanto.com/droughttolerantcorn/default.asp>

9 Plants with improved drought tolerance

<http://www.corporate.basf.com/en/produkte/biotech/plantscience/effizienterelandwirtschaft/trockentoleranz.htm?id=V00-G2FSQCGsIbcp11a>

10 Technology without borders

<http://www.performanceplants.com/newsrelease240907.html>

11 African Agricultural Technology Foundation to develop drought-tolerant maize varieties for Small-Scale Farmers in Africa

<http://www.monsanto.com/droughttolerantcorn/WEMA.asp>