



Agriculture and
Agri-Food Canada

Agriculture et
Agroalimentaire Canada



WORLD CLASS WATER QUALITY FACILITIES PROMOTE WATER AND NUTRIENT EFFICIENCY

Recognizing the need for new and refined agricultural production practices to reduce nutrient loss and promote more efficient use of crop nutrients and water, Agriculture and Agri-Food Canada's (AAFC) Greenhouse Processing Crops Research Centre (GPCRC) has come up with two world-class water quality study facilities: the Great Lakes Water Quality (GLWQ) facility and the Long-term Crop Rotation Water Quality facility. These facilities were designed and developed by Dr. Chin Tan, research scientist and water management specialist at the centre.

Located at the GPCRC research farm at Woodslee, Ontario, both facilities are fully automated, remotely monitored, and equipped with the most extensive and sophisticated run-off and water sampling capabilities. They can also monitor and collect surface runoff and sub-surface tile flow all year round. There is no other facility like these anywhere in the world.

GREAT LAKES WATER QUALITY SITE (GLWQ)

GLWQ was originally constructed in 1991 to investigate and later demonstrate the benefits of controlled drainage/sub-irrigation on water quality and crop production. In 2008, the GLWQ site was upgraded with the construction of four storage reservoirs designed to capture and recycle all surface runoff and sub-surface tile drainage waters from 16 replicated field plots.

The site can handle up to four separate treatments with four plots per treatment draining into each reservoir. These upgrades have allowed for more detailed investigations using the controlled drainage, sub-irrigation and water recycling systems to examine other soil and crop management practices. These include timing, methods and sources of manures, soil amendments and crop rotation. This information has helped develop best management practices.

Currently, researchers at the facility study the effect of controlled drainage/sub-irrigation and "closed loop" water recycling, combined with liquid and solid cattle manures, on water quality and crop production. The facility monitors surface run-off and sub-surface tile drainage water quantity and water quality for each plot.

The controlled drainage/sub-irrigation with "closed loop" water recycling system can increase crops' water and nutrient uptake efficiency and decrease environmental pollution by intercepting and storing runoff water from surface and tile drainage, eroded sediments, and leached nutrients before they enter streams, river and lakes. In fact, when tested on field and vegetable crops in southwestern Ontario, this system improved soybean yields by 50 per cent and grain corn yields by nearly 90 per cent. In a similar local commercial growers' field, processing tomato yields demonstrated an increase of 40 per cent. Likewise, this system also contributes up to 40 per cent reduction in nitrate and phosphorus losses.

Canada 

This world-class water quality facility provides the agricultural industry with new knowledge and technologies that will lead to enhanced sustainable agriculture environmental systems as well as improved field crop nutrient and water use efficiency. This technology could be used in any location where livestock manure application and intense field crop production occurs in climates that have annual water excess and deficits, particularly tile-drained agriculture areas. This technology has been accepted and implemented across North America.

LONG-TERM CROP ROTATION WATER QUALITY SITE

The Long-term Crop Rotation Water Quality site also helps AAFC researchers develop environmentally safe soil and crop production practices and study the long-term effects of soil management practices on water movement, nutrient concentrations and nutrient losses. This historical field site consists of 12 plots established in 1959 with the original purpose of demonstrating the benefits of crops rotations. It has been recognized by the Food and Agriculture Organization as one of the Global Terrestrial Ecosystem Monitoring sites.

With over 50 years of consistent management, this site gives researchers a time sequence that shows how the physical properties of the soil have changed over the last half century and how it is likely to change over time.

Crop management at the site includes six cropping treatments and two fertilizer treatments (fertilized and non-fertilized). The cropping treatments include conventionally tilled continuous corn, continuous bluegrass sod, and a four-crop rotation of corn-oat-alfalfa-alfalfa with each crop in the

rotation grown every year. The site is equipped with 24 auto-samplers and 24 runoff water quantity measurements.

As with the GLWQ facility, the site was upgraded in 2008. These upgrades saw the installation of instrumentation to monitor the timing, quantity and quality of surface runoff and sub-surface tile drainage water in real time, on a year-round basis. Now, scientists can better correlate the large differences in soil quality and crop yield at the field site to the timing, quantity and quality of surface runoff and sub-surface tile drainage waters.

The Long-term Crop Rotation Water Quality facility provides the evidence for a fundamental understanding of specific nutrient cycling processes so that we may more efficiently manage and regulate them. A solid understanding of long-term and base-line data on nitrate and phosphorus leaching into tile drainage water, both with and without annual application of fertilizer, contributes vital information and assists in the development of the Canadian Environmental Sustainability Indicators for nitrogen and phosphorus.

Both the GLWQ and Long-term Crop Rotation Water Quality facilities are critical components in ongoing research studies within the National Soil-Water-Air research program.

Additional funding for these facilities was provided by the Great Lakes Water Quality Preservation Fund, Green Plan Program Fund, Canada Trust Friends of Environment Foundation, Program for Energy Research and Development, AAFC Major Capital Grant, AAFC Peer Review Project Fund, and Sustainable Agriculture Environment Systems.

To learn more about research conducted by AAFC scientists, please visit:
www.agr.gc.ca/scienceandinnovation.com