University of Manitoba

RESEARCH NEWS

Comments, submissions and event listings to:
stefaniu@ms.umanitoba.ca
Phone: (204) 474-9020
Fax: (204) 261-3475

Working to stabilize Winnipeg's riverbanks

By Frank Nolan, Research Promotion Officer

In Winnipeg, a total of about 120 km of rivers wind their way through the city, and given our clay-rich soil, riverbank failure is an increasingly serious problem.

The biggest threat to our riverbanks is the movement that happens about 12 to 15 metres below the surface, where the soft clay meets the harder till material, which can cause entire sections of riverbank to collapse.

"For the last decade or so, the city has been using rockfill columns to stabilize riverbanks," said Marolo Alfaro, civil engineering. "Basically, what they do is auger down to where the clay meets the surface of the till material, and they fill this hole with crushed rock."

Alfaro is leading a project aimed at understanding how these rockfill columns work, so that the design can be refined to be both safer and more economical.

"The economic benefits could be enormous, especially when you consider that the city owns about 40 per cent of the riverbanks in Winnipeg, and it costs millions of dollars to reinforce them. Rockfill columns will also be used in the expanded floodway, as well as to stabilize the approaches to bridges, so there is a great deal of interest in anything that can improve our understanding of exactly how they function."

Alfaro's project, which includes co-investigator James Blatz, civil engineering, recently received new funding from the Natural Sciences and Engineering Research Council of Canada (NSERC). The project involves several research partners that have also contributed funding support and equipment, including the City of Winnipeg, Subterranean (Manitoba) Ltd, KGS Group, UMA-AECOM, and AMEC.

The first phase of the project, completed last year, involved characterizing both the clay and the rockfill material. Alfaro and his collaborators also wanted to characterize the rockfill and the clay together, so that they could understand how the composite material responded to shear, water pressure, and the other forces experienced in the field.

"We wanted to get undisturbed samples of the actual material from 15 metres down," Alfaro said. "We work with samples that are about 70 centimetres in diameter, and nobody had ever been able to get such a large sample from that depth. The contractor we work with found a very innovative way to collect these large samples, and we were able to characterize the exact material we would be working with in the field."

Once the materials were characterized, the data was fed into numerical modeling software that predicted how the columns would perform in the real world. The current phase of the project involves testing this data in the field.

Photo by: Frank Nolan

Marolo Alfaro, civil engineering

"We will install columns at real sites on riverbanks, and we may also use the floodway," Alfaro said. "We will place sensors in the columns to measure several parameters, including deformation and load, and then we will purposely load the stabilized ground until it fails. This will give us data about the exact mechanism involved, allowing us to refine the design of rockfill columns. This project is really about improving our understanding of this method, so that we can design rockfill columns that are more economical, and so we can determine accurate safety margins that will protect structures built near riverbanks."

Examining the health benefits of buckwheat

By Frank Nolan, Research Promotion Officer

A collaborative research program based in the Faculty of Human Ecology is examining compounds found in buckwheat that might prove useful in managing diabetes.

Carla Taylor, human nutritional sciences, is investigating bioactive components of buckwheat that may be able to reduce blood glucose levels. The three-year project, which recently received $528,000 in funding from the Natural Sciences and Engineering Research Council of Canada (NSERC), also involves Peter Zahradka, physiology, and Liam Murphy, internal medicine/ physiology.

The collaborating organizations include Kade Research Ltd., a buckwheat developer based in Morden, Manitoba, and the Canadian Special Crops Association.

"There are indications in the literature that buckwheat may contain compounds which are beneficial for lowering blood glucose in diabetes," Taylor said. "We have done some work with animal models of diabetes, and we showed that an extract prepared from buckwheat was effective in lowering blood glucose concentrations in animals that were a model for type 1 diabetes. These animals already had hyperglycemia, or high levels of blood glucose. We conducted what are called acute tests, and they involved giving the animals a dose of buckwheat extract, and then monitoring the blood glucose levels in those animals compared with the placebo group over a period of two hours."

These tests showed that animals given buckwheat extract experienced a blood glucose reduction of about 20 per cent over the two-hour monitoring period. Taylor's team is now using cell culture to study how the buckwheat extract affects specific signaling pathways, and whether or not it performs functions similar to that of insulin.

"That's the exciting thing about this project," Taylor said. "It spans the whole range from plant breeding, through to analytical chemistry, whole body and metabolism studies, to cellular and molecular levels. We are now focusing on whether or not certain compounds in buckwheat might be able to mimic the effects of insulin."

Over the next three years, Taylor would like to identify exactly which buckwheat compounds are insulin-mimetic, and possibly begin a pilot study in humans. She is quick to point out that even if buckwheat compounds prove effective in lowering blood sugar in individuals with diabetes, people should not expect it to replace insulin or oral diabetes medications. A more realistic expectation, she said, would be for the beneficial compounds to be incorporated as part of an overall diet management plan.

"Identifying functional foods which are helpful in managing blood glucose levels could be especially important for people with type 2 diabetes, since the early stages of this disease can be managed by diet and lifestyle changes," she said.

"As a nutritional scientist, I'm interested in disease prevention, not just management or treatment. From a functional foods point of view, if we know that we're consuming dietary components that are helpful for keeping blood glucose in its normal range, then that can have an overall benefit to the population."

Photo by: Frank Nolan

Carla Taylor, human nutritional sciences