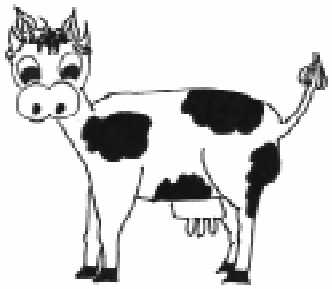
HARMONICS

The Engineering Explorations Newsletter

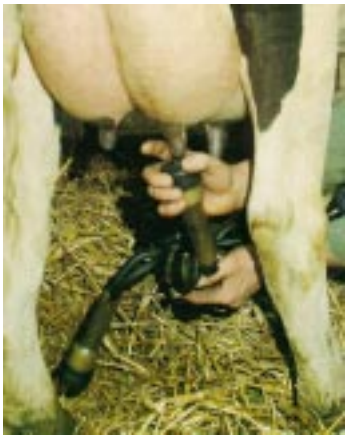
Volume 4, Issue 1
September 2000

WHAT IS AGRICULTURAL ENGINEERING?



Penelope

Farming in Canada has a long history which extends back to the arrival of First Nations peoples in the fertile lands of the eastern to central south. We hear so much about computers, communications and electronics these days that it is easy to forget the Canadian economy is still very strongly based on the land. In fact, agriculture and the agri-food industry is the third largest employer in Canada. Most people think of farming as hard physical work that has very little to do with engineering, but agricultural engineers play a vital role in the planning of farms, raising of crops and animals, and the processing and delivery of farm produce.



For instance, the process of getting milk from Penelope the cow on a dairy farm in southern Ontario to the shelves of a Northern store or local co-op in Nunavut is quite complex. First, Penelope has to be fed and properly taken care of in order to produce milk. Agricultural engineers have developed housing for livestock, including cows, that protects them from Canada's harsh winter climate. They have also helped to improve storage methods and structures for feed so that livestock can be well-fed throughout the year.

Next, Penelope has to be milked on a regular basis – usually twice a day. Her udder holds 11-25 kg of milk when full. Agricultural engineers have developed computerized milking machines which pump milk through tubing directly into storage tanks.

From the storage tank, the milk is picked up by a refrigerated tanker truck and shipped to a dairy where it undergoes a number of processes like homogenization (so it doesn't separate) and pasteurization (which kills bacteria). It is then poured into bottles or cartons for delivery to grocery stores. Agricultural engineers have contributed to the design of all of these processes and the machines in which they take place.

Finally, milk is shipped to the stores in refrigerated trucks or containers designed by engineers to keep the product fresh, even if it has to travel long distances for delivery.

As you can see, there are many roles for engineers in agriculture. They contribute to the enhancement of food and farm material production through:

- the design of farm and food processing equipment, like harvesters and tillers;
- the development of drainage, irrigation and waste disposal systems;
- the research of new methods for growing produce, such as hydroponics;
- the development of new technologies and instrumentation, for processes such as the processing of wheat into flour;
- the management of soil and water resources; and,
- the design of structures and controlled environments for plants, animals and crops storage.

NATIVE ENGINEERS & SCIENTISTS

A place to meet people from your community.

Name: Kris Frederickson
Nation: M**é**tis
Profession: Biosystems engineering student
Degree: B.Eng. Class of 2002
Favourite thing about school: The variety, "Biosystems Engineers can be found in many different fields of engineering, from nuclear research to agricultural and pharmaceuticals."

Kris Frederickson's parents always gave him the impression that engineers had an important job to do. Since he was also good with math and numbers in high school, engineering was a natural choice for him. Even so, he says his first year was pretty bad, "It wasn't what I expected. I was about ready to quit." His parents convinced him to go back and try it again before deciding to change fields. "It turns out I liked it," Kris explains.

Now in his third year of Biosystems engineering at the University of Manitoba, you only have to hear Kris talk about his co-op placement to know how much he likes it. He is working at the Prairie Agricultural Machinery Institute in Portage La Prairie developing a harvester for seabuckthorn. This shrub has been used for many years by farmers on the prairies in shelter belts - strips of trees planted between fields to block soil erosion from the wind. In other parts of the world the plant's berries and leaves are harvested for their medicinal properties: the oil they produce can be used to treat skin rashes, internal ulcers and radiation burns, it is also very high in vitamin C. Prairie farmers would like to grow the shrub as a commercial crop because it is many, many times more profitable than wheat and other traditional prairie staples. Kris is trying to help them by figuring out how to harvest seabuckthorn leaves without harming the delicate bark. "We're looking at brushing them off somehow," he says.

Although he still has two years to go before he graduates, Kris is already making plans. He would like to work in the area of environmental clean up or environmental impact assessment, and thinks he might apply to a non-profit development agency somewhere in Central America before returning to school for a Masters degree. "The thing about biosystems engineering is that it opens many doors, I could even choose to study medicine if I wanted."

Kris knows that perseverance has helped him get to this point, and he urges other Aboriginal students to stick it out. "Math and science may not be very exciting in high school. But if they knew how exciting it gets after the first elementary stage - Wow! It gets very exciting."

The University of Manitoba offers undergraduate programs in 15 faculties including arts, science, management, education, nursing, medicine and engineering. The university offers access programs for Aboriginal students entering professional programs. First Nations students interested in engineering should contact the Engineering Access Program (ENGAP) at 204-474-9872, or toll free at 1-800-432-1960 extension 9872. Email: engap@cc.umanitoba.ca.

The Three Sisters: Iroquois Engineering

Corn, squash and beans – the Three Sisters – have sustained the Iroquois for generations. It is said these gifts were given to the people when the daughter of Sky Woman died giving birth to twin sons. When she was buried, her body sprouted the sacred plants: corn from her breast, beans from her fingers and squash from her belly.

In the woods and open fields, hundreds, maybe thousands, of different plants grow together in harmony. Each of these plants asks different things of the environment. In healthy communities their needs are complementary: one plant may sink its roots deep into the Earth, while another finds nutrients closer to the surface; one may seek to sway with the wind, while another may prefer lying closer to the warm earth; balance is established and maintained.

When planted together the Three Sisters create a balanced system in which they sustain one another. The tall corn provides support for the delicate bean plant. It in turn fixes valuable nitrogen to the soil, fertilizing its sisters. Squash, planted at the base of the trio, shades the ground, controlling the growth of weeds and pests which might otherwise compete with the other plants for nutrients. Scientists call this type of combination planting "intercropping" and are studyng it as a tool to increase agricultural production, particularly in areas facing food shortages.

The Iroquois practiced intercropping in plots covering many, many acres. When eaten in combination, these plants provided a nourishing diet as complete in proteins as one based on meat.

Hydroponics

How do you grow crops in places like the Arctic or the Sahara – places where there aren't enough soil, rain or sunlight? You might try hydroponics.

Hydroponics is the science of growing plants without soil. It is used to overcome the limitations of traditional agriculture - inadequate water, poor soils, short growing seasons, excessive heat or cold, or inadequate light. Hydroponic produce – like lettuce and tomatoes - can be grown any time of year at any latitude, no matter the weather. Imagine going to the grocery store or co-op and buying a tomato marked "Product of Nunavut"!

In a hydroponics system, the plant roots are not in soil: sometimes they hang down into containers of water; other times they might be in some type of material, such as rockwool, which holds moisture really well. Water is delivered to the plants through tubes in automatically timed doses. All the nutrients and minerals normally found in soil are contained in solutions dissolved in the water. Where access to water is an issue, aeroponics might be used. In this process plant roots hang in mid-air and are continually sprayed with a nutrient solution mist.

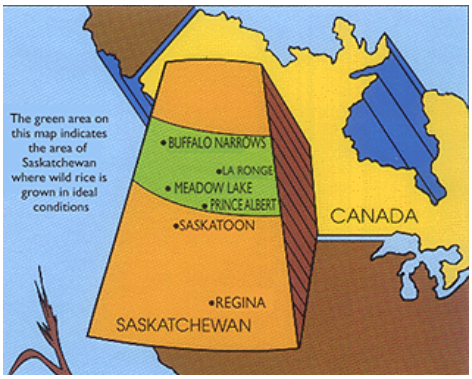
Because hydroponic plants are grown without soil, they are not exposed to weeds or soil-borne pests. Plants grown this way maintain ideal nutrient and moisture levels; they are healthier, more disease resistant and grow up to 30% faster than other plants. The root systems of hydroponically grown plants stay smaller, so the plant's growth energy is concentrated on producing plant mass. The small roots also allow the grower to have more plants per square foot of garden space.

Hydroponics may sound new and very scientific, and in fact it is one of the ways that astronauts on long space missions would grow food, but Aztec farmers used a system similar to hydroponics for growing maize and greens more than 700 years ago. By building sod bridges over freshwater lagoons, they ensured that crops would receive both nutrients and water on a ongoing basis.

Some of the information in this article was derived from http://www.interurban.com/hydroponics/index.html, and http:// www.agnr.umd.edu/users/mg/schfloa.htm.

COMMUNITY PROFILE

Saskatchewan Wild Rice: A Community Collaboration



The Federation of Saskatchewan Indian Nations (FSIN) represents 72 First Nations in that province including Cree, Saulteaux, Assiniboine, Dakota/Sioux and Dene/Chipewayan. The FSIN provides services which cover government, finance, culture, education, and economic development. One of the economic development initiatives is the Saskatchewan Indian Agriculture Program (SIAP).

SIAP helps Aboriginal farmers in the province to develop, expand and modernize. The program has played a significant role in encouraging the wild rice industry in Northern Saskatchewan. Wild rice – actually a water grass seed – is a traditional staple of the diet of plains people. It grows in cold water lakes, rivers and streams.

SIAP provides assistance to Aboriginal farmers in the harvesting and processing of wild rice. It has created or contributed to the creation of two Saskatchewan-based businesses: the La Ronge Wild Rice Processing Plant, which processes the harvest for market, and Grey Owl Marketing, which sells the end-product. While SIAP is non-profit, Grey Owl Marketing and the La Ronge plant generate income which returns to the communities, either through job creation in the businesses themselves or as funding sources for new economic opportunities in agriculture.

Sources of information: www.greyowlfoods.com/siap.html and www.agr.gov.sk.ca.

PEMMICAN: PRESERVED, PORTABLE ENERGY

Before refrigeration, supermarkets and corner stores, people had to use other methods for preserving food. Smoking and drying were very common. For hundreds of years, the Native peoples of the Americas have prepared meats in this manner in order to keep them for long periods of time.

One ingenious method of preserving dried meats, which is still used today, is the making of pemmican. Pemmican is a Cree word which originally signified a process of preparing animal bone marrow to be eaten with dried meat. The meaning has evolved to become the name for the combined end-product. Pemmican actually consists of three ingredients: dried meat, bone marrow grease (or any other animal fat), and dried wild berries.

To make pemmican, meat is cut into thin strips and set out to dry over hot coal embers, or simply in the sun and wind. Once it is sufficiently dried, it is shredded and crushed into fine pieces. Dried wild berries are added to it. Then hot marrow grease is added to the mixture. This is all put into a pouch made of animal guts (possibly a bison stomach or intestine), which is closed and sealed with hot grease. Once cool, the pouch hardens, and provides a hermetic (air tight) seal. This seal is the strength of pemmican; it keeps out air-borne bacteria which might spoil the meat. It's almost impossible to tell the difference between four-year old properly sealed pemmican and freshly prepared pemmican.

Pemmican was originally made as back-up for times when game was scarce, but because it was highly compact and a tasty source of energy and nutrition it soon developed wider use. Early fur traders and explorers of Canada consumed pouches upon pouches of it, and the Hudson's Bay Company had a high demand for it. As a precursor of canned foods, pemmican is practically a treasure of national heritage.

For more information and how to make pemmican visit http://collections.ic.gc.ca/notekeu/pemmican_e.htm and http://collections.ic.gc.ca/notekeu/pemmican_e1.htm

FUN FACTS AND THINGS TO THINK ABOUT

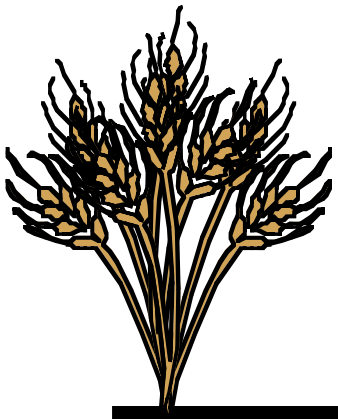
Each year close to 6 billion eggs are laid by the 22 million chickens on Canadian farms. That's more than 270 eggs per chicken!

Agriculture and Agri-Food Canada

www.agr.ca/facte.html

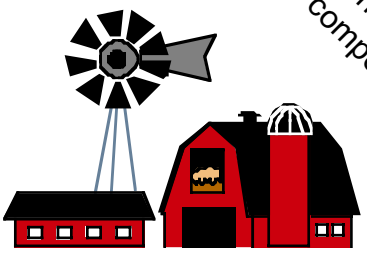
The Aboriginal people of the Americas cultivated and processed many crops which were unknown to Europeans before contact. These crops included:

Potatoes
Cucumbers
Peanuts
Tomatoes
Yams
Chilies
Sunflowers
Avocado
Cacoa



Take rest; a field that has rested gives a bountiful crop.
- Ovid

All over the world agricultural and chemical engineers are working together to convert animal fats and vegetable oils into biodiesels, a type of biodegradable fuel. THEIR CHALLENGE: to make this environmentally friendly fuel cheap enough so that it can compete with fossil fuels.



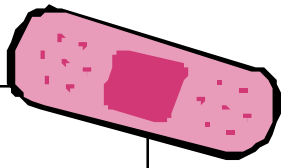
There are about 37,000 bison on farms in Canada (and another 8,000 or so in parks and zoos). Bison is farmed for both its meat and hides.

Agriculture and AgriFood Canada

www.agr.ca

The Iroquois were accomplished farmers and agricultural engineers. They cultivated more than 15 species of corn, including 61 varieties of sweet corn and 25 varieties of popping corn. They also grew more than 60 varieties of beans, including over 8 varieties each of bread beans and soup beans.

PUZZLES & GAMES



Slurp, slurp, slurp … Part I

Agricultural scientists have discovered that when regular corn starch is mixed with a synthetic chemical, they produce a substance so thirsty it can hold up to 2000 times its weight in water!!! Named the “Super Slurper”, this stuff is used in the production of wound dressings, baby powder, and fuel filters. The Super Slurper can also be found as an absorbent compound in electrical conductors in batteries.

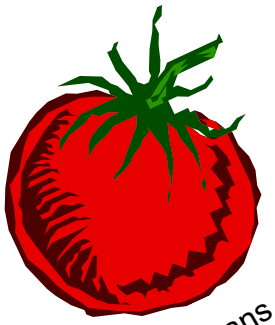
Can you think of any other absorbent products that are contain of compounds just like the Super Slurper?

ANS.: sponges, diapers, paper towels

Slurp, slurp, slurp … The Sequel

There is a soft drink bottling plant in your community. On its way from the plant to make deliveries, a truck filled with cherry cola loses control and overturns, spilling all of its contents. If 40,000 kg of cherry cola were spilled, how many people would be needed to carry all the Super Slurper needed to absorb the spill?

ANS. KEY: Probably just 1. Super Slurper absorbs up to 2000 times its own weight in liquid. You would need a 20kg. bag to absorb 40000kg of cherry soda. One person can generally carry 20 kg. You would need more people to mop it up once it absorbs all the soda!



Are cucumbers, beans, squash and tomatoes fruits or vegetables?