Agriculture and Agri-Food Canada
Agriculture et Agroalimentaire Canada

The Lethbridge Research Centre

Journey to the Centennial and Beyond

Lethbridge Research Centre
1906 - 2006

A Century of Service to Agriculture

Canada

Centennial logo design by Byron Lee, Doug Friebel and Sheila Torgunrud; prepared by Byron Lee.
The design is a stylized sun that shines at the apex of the Palliser Triangle of southern Alberta. Each one of its ten rays represents a decade of agriculture research conducted at the Lethbridge Research Centre. The colours gold, blue and green symbolize the three essential elements: air, water, and land. One of the rays extends towards the location of the Research Centre. The water drop symbolizes the area's historical association with irrigation. "A Century of Service to Agriculture" is the theme for the centennial.

The triangle in the logo refers to a large climatically defined region described as -
"The true arid district, which occupies most of the country along the South Saskatchewan [River] ... has even early in the season a dry and parched look ... the grass is very short on these plains and forms no turf ... the district, although there are fertile spots throughout its extent, can never be of much advantage to us as a possession." (Captain Palliser in Spry 1963).

Don't tell this to the people at the Lethbridge Research Centre whose work is proving Palliser's outlook fictitious. And similarly, don't tell this to the Aboriginal people whose nomadic lifestyle was finely tuned to the seasonal availability of the region's resources.

Detail of images of buildings:
1926 - Office of the Dominion Experimental Station at Lethbridge
1948 - Science Service Laboratory (before this they were in the post office downtown)
1950 - Veterinary-Medical-Insect Laboratory
1959 - Lethbridge Research Station office; the flower display commemorates the centennial of the Royal Canadian Mounted Police (Act of Parliament on May 23, 1873)
1976 - Everyone is now housed in one building
2004 - The new multi-purpose research facility opened for business

Printed using chemistry free plates.

The Lethbridge Research Centre

Journey to the Centennial and Beyond

Johan F. Dormaar and Sheila M. Torgunrud

Dedicated to all of our predecessors and the agricultural community that trusted us to do the "Right Thing"

Fairfield farm

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Acknowledgements

Alex Johnston (1977) documented the Lethbridge Research Centre history from its birth in 1906 to 1976. Next, Sears (1986) moved this history along the time line from 1976 to 1986 as part of the Centre's contribution to the Centennial of the Research Branch. With the upcoming Centennial of this venerable institution, Dormaar and Torgunrud (2006) have now brought the history forward to the threshold of the Centennial (August 1, 2006). Outside amalgamation of the Science Service and the Experimental Farms Service in 1959, these last 20 years have seen probably more changes than the previous 80 years.

Of course, we had lots of assistance to put this story together. Individuals who helped us with information, pointed us into new directions, or cheered us on included Surya Acharya, Craig Andrews, José Barbieri, Karen Barby, Jean Berezan, Bob Byers, Chi Chang, Doug Colwell, Rosemarie De Clerck-Floate, Oriano Delbello, Ben Ellert, Dan Ethier, Kevin Floate, Doug Friebel, Rob Graf, Evan Gushul, Henry Janzen, Cathy Johnson, the spirit of the late Alex Johnston, Gail Jones, John Kastelic, Gavin Kemp, Tom Kveder, Byron Lee, Don Leger, Hugh McLean, Tim McAllister, Steve Morgan Jones, Henning Mündel, Doug and the late Sheila Petherbridge, Dave Quinn, Cheryl Ronning-Mains, Linda Sears, Chuck Wesselman, Walter Willms, Jennifer Yanish.

"The grandfather of oll, this ploins cottonwood poplor is one of the oldest and largest of its kind in southern Alberta. This tree is recognized os a living legacy to the optimism and forethought of our pioneer oncestors, particulorly Williom Hormon Foirfield, first superintendent of the Dominion Experimentol Station, circo 1900. Trovelling six miles to the river valley to harvest trees using horse ond wogon is an effort applouded ond appreciated by many generotions."

Message on the plaque beside this tree on the Lethbridge Research Centre grounds

Foreword

The year 2006 marks a watershed in the history of the Lethbridge Research Centre (LRC) as it celebrates the 100th anniversary of its existence. The Centre, the largest in the Research Branch of Agriculture and Agri-Food Canada (AAFC), outside Ottawa, has a proud tradition of providing excellent service to agriculture and to all Canadians, with substantial impacts on the global community.

This book reviews the history of the Centre, with an emphasis on the past 20 years. The strength of any institution is its people; their role has been well covered. In particular, a brief review of policies and initiatives undertaken at the LRC, some of which have been adopted nationally, provides clear insights into the creativity and commitment of the staff community.

There is no doubt that people will continue to be the cornerstone of the LRC as it embarks on its second century. With the ongoing transformation of AAFC and its new vision of being "a competitive and innovative sector where partners work together to be world leaders in agriculture and agri-food research, meeting domestic and global customer needs while respecting the environment", the people at LRC will be integral in the implementation of AAFC's strategic framework to provide "the best quality of life for all Canadians."

In celebrating the centenary of LRC, I would like to thank Johan Dormaar, Sheila Torgunrud, and the Centennial Celebration Coordination Committee members, as well as many others, who contributed to this book. Furthermore, I wish the staff, students, guest workers and well wishers of LRC, a very happy Centenary celebration.

Zahir Mir, PhD
Research Manager
Agriculture and Agri-Food Canada
Research Centre
Lethbridge, AB

May 25, 2006

Genesis

Delon Shurtz of the Lethbridge Herald of May 29, 2000, took an interesting approach:

"It might be a stretch, but arguments can be made that coal mining was actually the forefather to agriculture in southern Alberta, particularly in the Lethbridge area.

One thing led to another as Elliott T. Galt, general manager of the North Western Coal and Navigation Company, exploited the coal resources in Lethbridge. Transporting coal to Medicine Hat by river proved unsuccessful, so the company built a narrow-gauge railway between the two points.

The Galts were granted one million acres (405,000 hectares) in land for their railway building activities, but the land had to be sold to settlers to make a profit. Galt formed an irrigation company to bring water to the semi-arid plains, and after the construction of canals, settlers began buying up land for farming ...

It soon became evident, as told in the Lethbridge News, January 10, 1901, that some kind of experimental irrigated farm was needed to address some problems with the new system."

There is an area on the southeastern outskirts of Lethbridge, now mostly occupied by commercial development around Costco Wholesale and Wal-Mart, that deserves an honoured place in the agricultural history of the province. The Canadian North West Irrigation Company, an organisation that brought water to the dry plains of southern Alberta in August, 1900, made land available for a "Model Farm" in the area. Charles A. Magrath, manager of the Galts' irrigation company, enticed William Harmon Fairfield, the Director of the Agricultural Experiment Station and Assistant Professor at the University of Wyoming at Laramie, to come to Lethbridge. He was "expected to run in ditches, plant trees, fence and break the property, seed it to suitable crops, and to demonstrate good irrigated farming practices by helping to solve any problems encountered by the settlers".

Fairfield accomplished all of this and more. The area was used in promotions advertised nationally and internationally to attract settlement. One event is worth repeating, since the present urban population may be virtually unaware of the immediate impact the Model Farm, then the Experimental Farm and now the Research Centre, has had, and still has, on the quality of agricultural practices and produce in southern Alberta. The sign that was along Highway 5 prior to the present day commercial development speaks for itself.

PROVINCE OF ALBERTA

Fairfield Farm

"In 1901 the Canadian North West Irrigation Company engaged William Harmon Fairfield to operate a Model Farm to demonstrate good irrigation practices to settlers. Fairfield soon recognized that local soils would not produce alfalfa, a valuable livestock feed. From an alfalfa field in Wyoming, he imported a few pounds of soil and scattered it near here, thus inoculating the soil with Rhizobium bacteria. Soil so treated was used to inoculate other fields throughout the region, assuring the success of alfalfa culture. In 1906 Fairfield became first Superintendent of the Dominion Experimental Station (now Agriculture Canada Research Station) at Lethbridge."

Next, Elliott T. Galt, now General Manager of the Alberta Railway and Irrigation Company offered in 1905 to the Dominion Department of Agriculture 130 ha of unbroken prairie land together with water rights for an experimental farm. Then on April 6, 1906, Senator L.G. DeVeber announced that a Dominion Experimental Farm would be located in Lethbridge. In June and July, parliamentary discussions confirmed that Lethbridge would be the location of Canada's sixth experimental farm.

The New Experimental Farm Will be Located (The Lethbridge Herald July 26, 1906, Vol. 1, No. 38, page 1.)

"The Dominion government has made official announcement (sic) *of the establishment of two branch experimental farms in Alberta.*

One of these will be located at Lethbridge. The other station will be at Lacombe in the north.

Saskatchewan has now got an experimental farm at Indian Head.

The Lethbridge farm will be located about midway between here and Coaldale on land donated by the Irrigation Company. There will be unirrigated and irrigated land, enabling experiments to be made in the classes of farming peculiar to Southern Alberta.

Dr. Saunders, superintendent of the Dominion Experimental farm at Ottawa is expected here any day now."

William Harmon Fairfield was hired on August 1, 1906, as the first superintendent. As first (1906-1945) and A.E. Palmer (1945-1953) as second Superintendents, they carried the ball for 48 years.

This ended a year of speculation, often accompanied by the Editors of The Lethbridge News and The Macleod Gazette abusing each other at length, as to where it ought to be located (Johnston 1977). The news of the establishment of the Experimental Farm at Lethbridge was greeted with much enthusiasm by the early settlers in the Lethbridge area when reality set in as the challenges dealt by a short growing season, lack of moisture, high winds, different soils, and lack of adapted crop varieties had their toll on these early settlers. These newcomers had roots in many parts of the world, primarily continental Europe, the United Kingdom, the United States, and eastern Canada.

Being a pioneer institution, the Station at first dealt with pioneer problems such as wind erosion, how to use irrigation water, the varieties of grain that could be grown, proper rates of seeding, dates of seeding and selection of hardy vegetables, shrubs and trees. Practically every tree and shrub planted at the Experimental Station has been an experiment, sometimes with mixed results (Palmer 1949).

Furrows listed at right angle to the prevailing winds trapped the drifting soil (1952)

Fairfield house (far left) at the "Model Farm" (1904)

Fairfield's house at the Experimental Farm (1938)

Now the rest of the story ...

Although the story presented below records what has happened over the last 20 years at the Lethbridge Research Centre, it may also guide us to better research over the next 20 years and beyond, not only for those directly involved in the production of crops, meat, milk, etc., but also in the service of the consumer and of society as a whole.

Agriculture in western Canada is rapidly changing; indeed, there has been more change in the last 20 years than in the previous 80 years. The North American Free Trade Agreement (NAFTA) was implemented, the Crow rate (subsidised movement of feed grains) has been discontinued, and there has been a general trend towards global markets for all products and services. Multi-national companies increasingly invested in food production, many farms have become larger corporate entities (i.e., as witnessed by the growth of the feedlot and potato industries in southern Alberta), and huge grain handling terminals have largely replaced the familiar country elevators. The Centre saw major changes as well, including reductions in staff, increased work space, addition of new facility, and re-organisation of Agriculture Canada (now Agriculture and Agri-Food Canada), including the Research Branch.

At the turn of the millennium one could ask who will be the future users of the information and technologies produced by the research programmes at the Lethbridge Research Centre. For much of the history of the Research Branch, this was not a difficult question to answer. The Centre was established to develop farming practices so that farmers could produce crops and animals and maintain the soil in a relatively harsh environment with a short growing season. That is, the main client was the farmer or rancher and indirectly the Canadian consumer who was able to buy wholesome, safe food at a reasonable price. However, in the past 20 years, the client has become less clear.

With the ability to develop collaborative research agreements and the initiation of the Matching Investment Initiative (MII) programme in 1994, funding came increasingly from industry. If an outside partner was willing to invest in research, in essence the results were pre-sold to the investor. It was expected that this would lead to more effective adoption, greater competitiveness in the agricultural sector, and stability and growth in the agricultural industry. That is, the overall wealth of the country as a whole would be increased. However, it was almost inevitable that the research would tend to follow the money.

In spite of all this, research conducted at the Centre ultimately benefits both the producers and consumers. The output from the research programme encompasses a huge range, from scientific papers to oral presentations, extension articles, and personal contacts. It is noteworthy that this output is disseminated not only nationally, but also internationally, as witnessed by the invitations for our staff to give presentations in far-flung corners of the world and the requests from scientists from around the world to visit the Centre and to conduct collaborative activities.

Although we all need to eat, the farming community currently comprises only 2 to 3% of the Canadian population. Therefore, most of those funding agricultural research are urban taxpayers. While cheap food continues to appeal to the average taxpayer as a rationale to continue funding government research in agriculture, this argument is losing strength as the agri-food industry becomes more corporate. In other words, should the federal government be investing tax dollars in advancements that have more benefit to the industry (particularly corporate agriculture) rather than the consumer?

Perhaps as a result of agriculture becoming an increasingly corporate-dominated industry, the consumer is becoming more and more concerned about the impacts of agriculture on the environment, food quality and safety. Canadian consumers are becoming acutely conscious of how their food is

Winter along Elm Drive looking south

produced and the environment in which they live. It may no longer be good enough to have research findings delivered directly by the agri-food industry, since there are apparent conflicts of interest.

As we embark on a second century, it may be prudent to re-evaluate our priorities so that we can respond to the needs and realities of 2006 versus those of 1906. We may want to elevate to highest priority research on environmental sustainability, including, for example, using fewer contaminating substances, building soil, water and air quality, plant and environmental diversity, finding alternatives to antibiotics and hormones, and using manures and other residues more efficiently. On a larger scale, research may need to aid in reducing greenhouse gases and examine adaptations required to potential climate changes on the prairies. Fortunately, most of the elements are already in place to address these new directions.

There are a number of sources for assembling the story of the Lethbridge Research Centre. Scientific and extension communications are one source for recapping the flavour of the Lethbridge Research Centre. At the other end of the spectrum, "Coffee Table News," an internal weekly newsletter, brings to life the daily activities and events. Indeed, we can glean information not only about seminars and publications, but also births, weddings, awards and obituaries; it is truly the people that have made the story.

The Lethbridge Research Centre is ready to enter a new century

Partnerships

The University of Lethbridge

A number of members of the Research Centre community contribute directly to the University in their roles as Adjunct Professors by conducting collaborative research, giving lectures and seminars, hosting COOP and independent study students, and helping with field trips.

Since Lethbridge is at the core of the highest percentage of Canada's irrigated land, partners from the southern Alberta research, education and health communities formed a not-for-profit initiative to study and promote sustainable water management. The Water Institute for Semi-arid Ecosystems (WISE), housed at the University of Lethbridge, is a key research and education institute dedicated to water resource management for semi-arid regions. Launched on November 20, 2001, it generates and shares knowledge, skills and ideas incorporating responsible land and water stewardship, sensitivity to public health concerns, and sustainable economic development.

The Canada/Alberta Livestock Research Trust Incorporated

The potential for industry to have a greater role in the research programmes of the Research Branch, coupled with restraints on public funding available for research, prompted the Alberta livestock industry to accept a larger partnership role in livestock research.

Formed in October 1990, the Canada/Alberta Livestock Research Trust Inc. (CALRT) is a unique partnership between the Lethbridge Research Centre and Alberta beef, sheep, and dairy producers. It is set-up as a non-profit, livestock industry-driven, research trust. All revenues from the sale of the livestock and their byproducts are reinvested in the Lethbridge research programmes. The objectives are to establish research priorities, provide funds, encourage transfer of technology, maintain herds and flocks, and foster post-graduate training.

The community

With a large pool of not only knowledgeable individuals, as well as people with many talents and organisational skills, it is predictable that the community not only freely draws on these talents, but that they are always freely given. Although we have not supplied the city with a Mayor (as the Research Centre at Beaverlodge did with Bob Elliott) there are many other ways to contribute and help, including presentations at schools, supporting, organizing, and judging at science fairs, and volunteering for numerous tasks and activities in the city of Lethbridge and surrounding area. For example, volunteering over the summer holidays at the Public Library with demonstrations and "things to see" shared with children aged 4 to 7 years is a great experience. Many staff are members of community bands, the Lethbridge Symphony and theatre production groups.

Research Scientists, Archana Chugh and Jim Miller, are taking their roles as judges at the Lethbridge Regional Science Fair very seriously

The breadth of research

Agriculture in southern Alberta faced many challenges, such as a short growing season, lack of moisture, high winds, different soils, and lack of adapted crop varieties, all of which had their toll on the first settlers. Early research dealt with the inoculation of alfalfa, irrigation technology, grains, livestock, insect pests, plant diseases, and techniques to control soil erosion. As challenges evolved over the years, research also evolved to create new opportunities to keep Canadian producers competitive in world markets. For example, over the last thirty years direct seeding techniques were pioneered, alfalfa yields were increased, and range management and cross-breeding systems were developed to increase beef production.

It is, of course, not possible to cover all the research carried out at the Lethbridge Research Centre. Nevertheless, the following cross-section is illustrative:

Finding the Genetic "Needle in the Haystack:"
Life in its myriad forms is the expression of just four different molecules that are repeated many times and combined in unique, complex patterns called genes. The complement of genes controls the traits of plants, animals, and other life forms, which are

passed from generation to generation. Wheat, for example, has thirty to forty thousand different genes. Each one has the potential to influence some aspect of plant development. Changing gene combinations by crossbreeding is a traditional method of improving crop varieties. New techniques, developed by molecular geneticists, can help plant breeders track the transfer of desired genes in breeding programmes. Application of these techniques expedited breeders' work and benefited producers by hastening the development of better-adapted cultivars.

Insects Recycle Dung in Pastures: Assuming no overlap of dung pats, the average area covered by dung is about 0.8 square metres per animal per day. For a grazing season of 150 days, a herd of 100 animals would cover about 1.2 hectares of pasture in dung. Dung left on the soil surface to dry may lose up to 80 percent of its nitrogen into the atmosphere as ammonia. Hence, un-degraded dung pats represent a loss of grazing area and a loss of soil nitrogen from the pasture. Fortunately, many insects live in cattle dung and accelerate the rate at which the dung pat is broken down and returned to the soil. More than 80 species of insects are found in cattle dung in western Canada. In southern Alberta, they are active from late March until early November and up to 80 percent of the mass of the pats can be broken down over this six-month period.

Dung beetle (*Canthon pilularius*)

Reduced Tillage Increases Earthworm Numbers: Movement of water and agricultural chemicals through the soil is an important agricultural parameter. The presence of earthworms enhances the chemical, biological and physical properties of soils and is often a good measure of the health or quality of the soil. Although the large pores or burrows created by earthworms improves water infiltration and soil quality, they also enhance downward movement of fertilisers and herbicides. Therefore, the potential for earthworm activities to affect groundwater quality has provided useful information.

Biological Control of Toadflax: Dalmation, *Linaria dalmatica* (L.) Mill, and yellow toadflax, *L. vulgaris* Hill, are noxious weeds of European origin that have been targeted for biological control. Dalmation toadflax is a serious weed of rangelands where it competes with forage species. Yellow toadflax is prevalent in the central prairies, where it limits the adoption of zero tillage in some areas. In its native Europe, natural enemies of toadflax keep these weeds in check. Conversely, in North America it has no native enemies. A number of insects that provide control of toadflax in Europe have been tested and approved for release in Canada.

Soft White Spring Wheat for Ethanol Production (the late Dr. "Sadash" Sadasivaiah): With fluctuating markets, there is value in examining potential alternative uses of our crops, for example, the use of wheat starch for the production of fuel-grade ethanol. In addition, ethanol has the added benefit of reducing harmful automotive emissions. Some of the high-yielding wheat lines developed at the Centre that did not meet quality characteristics for traditional pastry and cookie markets, have potential as a source of starch for ethanol production.

The late Dr. R.S. Sadasivaiah

Fenugreek for Forage: Fenugreek is an annual legume from the tropics with potential for use as a forage in western Canada. Research has demonstrated that fenugreek was highly digestible. In addition, fenugreek can also be grown as a cash seed crop because it contains diosgenin. Diosgenin provides about 50% of the raw material for the manufacture of cortisone, progesterone, and many

other steriod hormones. Current work is to examine whether the combined effects of high digestibility and diosgenin content will enhance the rate and efficiency of animal growth.

Fenugreek (*Trigonella foenum-graecum* L.)

Carbon Cycling in Agricultural Ecosystems: Understanding the contribution of agriculture to atmospheric carbon dioxide (CO_2) has taken on new urgency as elevated concentrations of this gas contribute to the global warming trends predicted for the next decades. In mature ecosystems, such as the grasslands of the Canadian prairies, the atmospheric CO_2 converted to plant matter is in balance with that being released by organisms. Cultivated agriculture, however, disrupts this ecological balance. To help make agriculture a potential solution, rather than a contributor, the Lethbridge Research Centre is working to identify practices that favour conversion of CO_2 to soil carbon.

Measuring Stress Objectively in Sheep: Although stress can be fairly easily measured in humans and manifests itself as increased heart rate and blood pressure, it is much more difficult to measure in farm animals. In the latter, stress derived from common procedures (tail docking, castration, weaning, isolation, transport and restraint) cause animal discomfort. It also led to financial losses resulting from reduced growth performance and meat quality. Certain hormones have different patterns in response to different types of stress. Assessing these hormones in animals with controlled imposed stress, is useful to quantify the stress response and ultimately, to develop best-management practices to optimise animal well-being and allay societal concerns regarding animal welfare.

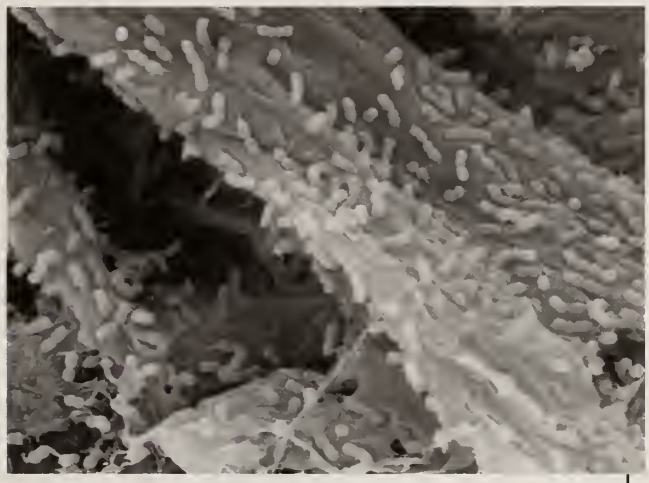
Bumblebees as Crop Pollinators: Bumblebees are the most efficient pollinators for many crops. They have long tongues and so are well adapted to pollinating flowers such as red clover, cicer milkvetch, or faba beans in which the nectar is in narrow corolla tubes. Southern Alberta has been a particularly good area for studying the biology and foraging behaviour of bumblebees; there have been 21 species identified here, in habitats ranging from alpine to dry-land prairie.

Monitoring Herbicides at the Part per Billion Level: Several herbicides that were developed by industry in the last decade are applied at rates of less than 20 grams per hectare. Once applied, the herbicides are diluted in the soil and degrade to concentrations in the parts per billion range within a year. Even in these small quantities, some of these herbicides can affect subsequent crop growth. (Forming a mental picture of one part per billion is difficult, but an example can be helpful. One part per billion is approximately equal to one teaspoon of salt uniformly mixed through 6,000 tonnes of potato chips. Normally, potato chips contain as much as one-sixth of a teaspoon of salt in a 55 gram package. Needless to say, the detection of part per billion or smaller quantities of herbicide is extremely difficult.) Bioassay techniques have been used to detect minute amounts of some herbicides in the soil following application. In bioassays, the growth of leaves or roots of a sensitive plant has been shown to be related to the herbicide concentrations. The results of such assays have then been used to develop recommendations for successful cropping following application of herbicides.

Weeds for Feed: Sometimes the research questions required to solve specific problems, such as weed control, will lead to a solution when they are turned around. Although producers consider weeds as undesirable contaminants of forage, weeds may well have feed value. To determine whether weedy seedling forage crops could be utilised as feed for livestock, a number of weeds that commonly infest seedling forage crops in Alberta were grown by Jim Moyer and Bob Hironaka, cured as silage, and digestibilities of crude protein and energy were determined using sheep. It was concluded that the use of seedling forages, established without a companion crop and without the use of herbicides, merited consideration as a high-quality feed for ruminants.

Kochia, *Kochia scoparia,* (L.) Roth

Enhancing Feed Utilization through Enzyme Supplementation: Ruminants are well known for their ability to digest and derive energy from low quality feeds such as straw. This unique capacity arises primarily from the bacteria within the rumen that produce the enzymes required to digest low quality feeds. Feedlot cattle are typically fed high-grain diets and there is evidence that the rumen bacteria do not digest plant fibre as efficiently under these conditions. Supplementation of the diet with carefully selected enzymes was shown to enhance fibre digestion in these diets, and reduce the flow of nutrients into the environment. Insight was gained into the many mechanisms whereby enzyme supplementation enhances feed digestion. Undoubtedly, this information will prove invaluable in the selection of enzyme supplements that can even further improve feed utilization in both beef and dairy cattle.



Scanning electron microscope image of rumen bacteria digesting cellulose

New Insight into the Livestock Production – Human Health Interface: In the past, beef cattle research focused primarily on production related issues. However, consumer concerns over antibiotics, pathogens (e.g., *Giardia, Cryptosporidium, E. coli* O157:H7, *Campylobacter*) and potential contamination of the environment has led to research projects that address factors with potential implications on human health. A comprehensive study on antibiotic use in beef cattle production demonstrated that at present this practice does not promote the development of resistance in pathogens that cause disease in humans. A variety of control measures (e.g., plant extracts, bacterial viruses) have also been shown to kill potential human pathogens that may be passed from cattle such as *Giardia* and *E. coli* O157:H7. Many of the beef research projects in the last 10 years have immediate implications for trade and are critical in ensuring that consumer confidence in Canadian beef remains high.

Transmission electron microscope image of *E. coli* O157:H7 with bacteriophage attached (arrows)

A sampling of the titles of the Centre's many "Weekly Letter" news releases further portrays this breadth of research carried out over the past few years:

- Not all barleys are created equal
- Earthworms: Nature's plough
- Fingerprinting potatoes
- Canadian wheat in oriental noodles
- Radar, home on the range
- Cool bulls are more fertile
- Biocontrol: an old idea for modern agriculture
- The unknown prairie
- Soil - the lifeblood of Canada
- Nightshade alert
- Romanov rams deliver dollars

To support this breadth of research at the Centre, many disciplines are represented such as forage breeding, ruminant nutrition, insect cell physiology, molecular biology, livestock parasitology, reproductive physiology, various crop breeding programmes, weed control, remote sensing, range ecology, bio-economics, ecosystem modeling, soil physics/biochemistry/chemistry, water and air quality, carbon cycling, molecular cytogenetics, plant pathology, DNA fingerprinting, and agro-meteorology.

This then allows research on such topics as carcass and meat quality, female reproductive efficiency, stress indicators, hormone effects on energy and growth, estrus synchronisation, a variety of pests such as horn fly, tick, cattle grub, louse and stable fly, alfalfa as a sustainability tool, bloat-safe grazing of alfalfa, perennial cereal rye, reducing phosphorus pollution, rebuilding eroded soils, risk of water-quality contamination from ranching activities, herbicide sustainability, exploring beef-water-human health links, controlling atmospheric emissions from feedlots, herbicide leaching, odour control, nitrous oxide emissions, protecting riparian

areas, carbon cycling, Colorado potato beetle control, "gene stacking," improving the nutritional value of rumen-synthesised protein, bacteriocins as ionophore alternatives, targeting rumen protozoa, reducing phosphorus pollution, improving fibre digestion, alternate sources of fibre, embryo development, weeds such as leafy spurge, hound's tongue, dalmation toadflax, and composting as added value.

Although, in general, agricultural research is incremental, that is, building on the work of our predecessors, collectively, a tremendous amount of new information is continuously being released to support local, national, and even international agricultural production/activities.

Corporate booth at the Calgary Stampede

Personnel from the Lethbridge Research Centre have regularly staffed a booth in one of the tents at the Calgary Stampede, explaining and promoting the activities of Agriculture and Agri-Food Canada to the public. Over the years, the booth has included representation of many if not all branches of the Department. An item of special interest has been the giant jigsaw puzzle of Canada, always a great attraction for children. The seed display included varieties developed by the Department and acted as a "hook" to draw people into the tent to see the other displays. The flaxseed exhibit gave one old-timer a chance to tell his stories from the 1930s; he reminisced that people would hop onto the grain cars to travel and find work elsewhere in Canada, but they would avoid cars carrying flaxseed, as it was like quicksand. The display sequence of spelt, wheat, rye and triticale fostered conversations regarding the evolution of agriculture in Canada. For many, it is has been the first exposure to such a variety of seeds; further evidence of an increasingly urbanised population in southern Alberta and over the Canadian prairies.

The onslaught of communication

The evolution of the means of communicating our findings has not been gradual but rather supersonic. Several examples will illustrate this speed over the last 20 years.

In terms of writing letters we had first pen, paper, and beautiful long-hand writing. The ritual of "Sir, ... I beg to submit herewith ... I have the honour to be your Lordship's Most Obedient Humble Servant ..." with the envelope closed with an applied lacquer seal has gone the way of the passenger pigeon. It was replaced by typewriter machines for writing in characters similar to those produced by printer's type by means of keyboard-operated typefaces striking through an inked ribbon. Now we have word processors, with staff learning how to create words on glass or plasma screens and ultimately on paper and in digital files. Courses were offered to learn to operate new word-processing equipment. As well, we all learned to transmit communications via "electronic mail."

Telephoning has gone from dialing to touching and now to cell phones and BlackBerry® devices. The Centre went from shared telephones and a paging system to now having telephones in every nook and cranny of the Centre and voice-mail. The intercom was no longer needed.

Then came Year 2000 or Y2K. In the early days of computers, when memory was very costly, software writers would code dates with the fewest possible numbers: December 31, 1999 became 12/31/99. Few in the computer industry expected such programmes to last. But many did, leaving some 700 billion lines of old computer code to be fixed. If they were not, on January 1st, the year 2000 would register as 01/01/00 which a computer would read as 1900.

Our capable computer specialists, Tracy Lund and Bourke Reaney, undertook the massive effort of ensuring that all desktop computers were Y2K or "millennium bug" compliant. Because of, or perhaps despite these efforts, when January 1, 2000, arrived, there were few reports of Y2K failures world-wide and almost nothing at our Centre.

The face of publishing has changed as well from submitting a carefully typed manuscript through the mail, to submitting it electronically to the Editor who,

in turn, solicits and receives reviewers comments electronically. Furthermore, hard copies are being replaced by electronic journals and print information resources are being replaced with electronic alternatives.

Even presentations at scientific or public meetings have gone from a presentation *per se* to using overheads, slides and now PowerPoint®. However, excessive reliance on the many special features built into PowerPoint® unfortunately often seems to emphasize the medium at the expense of the message.

Acclaim and praise

Although a public institution is often subjected to criticisms, the Lethbridge Research Centre also has a loyal following, which is expressed via word-of-mouth, telephone calls, and most recently, electronic mail messages: For example, following the 90th Anniversary celebrations:

- "Great show! ... very talented people, enthusiastic staff, impressive history, great organisation, exceptional facilities, how can they be so enthusiastic about their work in this wind?";
- "I didn't realise you were doing so many interesting things out here, beautiful grounds, food displays were great idea, I hope you do this again soon, ... you should be proud, even the politician's speeches were great, congratulations";
- "A great example of the relevance of the present research activities to food safety and security, and protection of the soil, water and genetic resources."

When our Information Officer was absent, a visitor was helped by "two ladies who had been particularly helpful. You usually don't get that kind of personalized treatment. I was quite surprised! They were very helpful." "Praise to 'the two helpful ladies', whomever they were."

Congratulations have been in order over the years for the greenhouse and ground crews. The Research Centre has been awarded first place by the Lethbridge and District Horticultural Society for having "The Best Public, Industrial or Institutional Grounds" in our area over a number of years. In spite of continual reductions in budgets and people power, the various teams always stepped up, accepted the challenge and worked towards success.

Do you remember that

- in 1986, 18 runners participated in the 180 mile (288 km) Jasper-Banff road race? Each was asked to predict her/his own time for their average 10 miles (16 km) run, some running over passes in the middle of the night, others running when it was hot and at lower altitudes. When all those individual times were totaled, it came to about 26 hours and 25 seconds for the entire course. Although most of the runners' estimates were out by one or more minutes, the underestimates and overestimates balanced, and the team finished within one minute of the overall estimate. Realistically, isn't this what you would expect from a team of scientists, technicians and spouses?
- as workplace safety became increasingly emphasized, a Safety Adviser (Darryl Graham) was appointed? Are you aware of his excellent "Safety Zone" briefings in Coffee Table News?
- in 1992, Bernie Hill suggested that he "wouldn't be bobbing for apples in grandma's rain barrel?"
- as downsizing and consolidation of programmes occurred across the Department, many scientists and technicians arrived from elsewhere, some left Lethbridge to go elsewhere, and many took advantage of early-retirement incentives?
- the Study Management System assessment frame work was developed by the Industrial Research Institute in the United States of America? It was then applied by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Australia. Canada in turn adapted Australia's model. It is a computerised study data and management system for managing research studies. This permitted managers to make investment decisions in research at the project level. The assessment framework measured returns from the Research and Development carried out, the Research and Development capacity of the organisation, the relevance of the scientific and technical results from the work, and the ability to capture the benefits. The assessment was based on the premise that the highest priority research should be that which has potential to return the highest economic, environmental, social, and other benefits to Canada. The goals for dissemination and technology transfer were to be laid out clearly and had to be measurable based on tangible results. Individual scientists were to identify resource needs as part of their budgeting processes and these were

to be rolled up and priorities set through the Study Management System on a national level.

- the Alberta section of the Land Resource Unit, which was a part of the Centre for Land and Biological Research in Ottawa, amalgamated with the Land Resources section at Lethbridge in 1997?
- in 1997, a logo, specifically for this Centre, was designed to better identify and increase awareness of this research establishment? This new logo, was basically L R C with land, crops, and beef cattle ingrained in each of one of the three letters. It was adopted for incorporation onto all the releases coming from the Research Centre. However, to unify all persons working within Agriculture and Agri-Food Canada, this logo was subsequently replaced by a national corporate logo.

LETHBRIDGE RESEARCH CENTRE

- the classification system developed in 1967, aside from the issue of discrimination in the assessment of work performed by female and male dominated groups, was with time, seen as being inconsistent and overly complex? Pay equity affirmed the need for classification reform. The Universal Classification System therefore was designed to replace the current 72 classification standards with one and reduce the occupational groups from 72 to 28.
- the Lethbridge Research Centre was headed by the Centre Management Committee, comprised of management and section heads? The Centre Management Committee determined direction, with advice from Agriculture and Agri-Food Canada leadership and the Centre's own Advisory Committee. The latter consisted of volunteers from industry, universities, the Provincial Government and the local community, who assisted the Centre management in planning the research programmes. The Committee met twice a year to review ongoing programmes and overall research direction. Following the re-organisation of the Department, starting on January 1, 2003, both committees were replaced by a Centre Advisory Committee with representatives of the various Themes/Teams represented at the Research Centre.
- we received training for the new telephone system in 1999?

Times they are a-changing

Smoking policy

The Director advised (Coffee Table News - January 9, 1987) that certain zones of the building were to be "no smoking" areas. These included all washrooms, laboratories, elevators, public reception areas, and parts of the cafeteria. This action was taken upon the recommendations of Health and Welfare Canada and with the unanimous support of the two labour/management consultation committees.

The Non-Smokers' Health Act: Bill C-27 received royal assent on June 9, 1989, and came into force on December 30, 1989. The act now prohibits smoking in all work places under federal jurisdiction except in designated smoking rooms or areas. However, Treasury Board re-emphasised that under its total smoking ban even smoking in the designated smoking rooms or areas was no longer permitted.

Fragrance policy

The Lethbridge Research Centre is committed to providing a healthy environment for all employees. This is in line with a high priority in the Public Service of Canada to provide working conditions conducive to the safety and health of employees. A sensitive issue for many staff was the fact that there are individuals working within the Centre who have allergic reactions to certain fragrances.

Initially, it was suggested that everyone voluntarily refrain from chemical-based scented products. Using a more pro-active approach and seeing several staff on the second floor suffered from chemical sensitivities, in early 2000, the Director, Land Resource Sciences Section staff and other employees working on the second floor supported the effort of the Land Resource Sciences Section to create a fragrance-free floor. Staff from other floors doing business on the second floor readily comply with this scent-free policy.

Inclusiveness team

Canada is very different today than it was 30 years ago, particularly in relation to equity groups such as visible minorities, persons with disabilities, the

number of women in the work force and aboriginal people. The Research Centre is a good microcosm of this.

The Inclusiveness Committee recommends practices to make all staff members feel they are an essential part of the organisation. Their contributions are highly valued. The Department has emphasised making inclusiveness functional at the workplace. Inclusiveness is crucial to foster a sense of purpose/ belonging and ensure everyone is valued and treated respectfully. Lethbridge staff representing Visible Minorities, Persons with Disabilities, and Women in the Workplace, sit on national committees.

The local Committee is an informal and confidential means of resolving employee concerns at the Centre level. Its mandate is to be an impartial sounding board for recommendations to employees and managers to increase communications, morale and motivation by fostering values of respect, trust, equity and fairness. The Committee does not replace the roles of unions or Human Resources.

Quality assurance initiative

"A properly conducted experiment is a beautiful thing. It is an adventure, an expedition, a conquest. It commences with an act of faith, faith that the world is real, that our senses generally can be trusted, that effects have causes and that we can discover meaning through reason."
- Vincent Dethier, University of Massachusetts

Typical research laboratory

The ideals of the scientific method are "research that is reproducible and unbiased, with comprehensive records and documentation to support the research." Whereas in the past it may have been sufficient to conduct research and maintain records to our own high personal standards, the trend is now to document more formally all procedures that affect the quality of the results.

Although there are now generally no regulatory requirements for research at the Lethbridge Research Centre to meet strict Good Laboratory Practice standards, as promulgated by the American Environmental Protection Agency and the Food and Drug Administration, the future trends in agricultural research are clear. Research departments in private industries, universities and government are all moving towards formal Quality Assurance Programmes to ensure the integrity of research data.

The Lethbridge Research Centre has earned a reputation for high quality agricultural research. To maintain our reputation in the global economy of the 21st century, a formal quality control programme has been implemented. The Initiative requires that all research conducted at the Lethbridge Research Centre be seen to meet the same high standards expected in other research institutes.

Workplace Hazardous Material Information System (WHMIS)

The Workplace Hazardous Material Information System (WHMIS), Canada's hazard communication standard, became mandatory at the Lethbridge Research Centre in April 1989. The key elements of the system are cautionary labeling of containers of WHMIS "controlled products," the provision of Material Safety Data Sheets (MSDSs) and worker education programmes. The latter applies to all staff including the summer students working at the Lethbridge Research Centre.

Library collection of MSDS sheets

WHMIS was implemented through coordinated federal, provincial and territorial legislation. Supplier labelling and MSDS requirements were set out under the Hazardous Products Act and associated Controlled Products Regulations. The Hazardous Products Act and its regulations are administered by Health Canada.

The Controlled Products Regulations established a national standard for classifying hazardous workplace materials. In addition to setting out criteria for biohazards, chemical and acute hazards, the Regulations specified criteria for chronic health hazards including mutagenicity, carcinogenicity, embryo and reproductive toxicity, respiratory tract and skin sensitisation.

Public Service 2000 and other initiatives affecting staff and programmes

The "Public Service 2000" initiative, launched in December 1989, was aimed at a wide-ranging transformation of the public service culture and to "equip it for the 21st century." It involved removing central controls in order to increase managerial freedom, i.e. "let the managers manage," improve service to the public, and meet standards of efficiency and effectiveness associated with the private sector. Increasing managerial freedom and finding "innovative ways to encourage efficiency and improve programme delivery" emerged as key themes, both in the delivery of services to citizens and in internal reforms.

This initiative had strong support from Treasury Board and the Public Service Commission. In addition to its administrative reform agenda, Public Service 2000 sought cultural change in the public service, seeking to persuade public servants to focus on the quality of the services provided to citizens, rather than on rules and procedures. Although the process led to a number of worthwhile administrative reforms, by the mid-1990s the programme was effectively superseded by other federal priorities such as the effects of deficit-reduction and downsizing, including wage constraints, cutbacks, agency mergers and eliminations. By 1993, the profile of Public Service 2000 declined.

"A Mission for the 90s" was formulated to improve the long-term competitiveness of the Canadian agri-food sector through the development and transfer of innovative technologies. To achieve this mission, the Research Branch would, among others:

- Consolidate research programmes having a common focus at fewer Centres with integrated teams and better infrastructure.
- Focus research on projects with economic or environmental significance for the sector but with less potential for early monetary return and which, therefore, are unlikely to be done by the private sector.

A government-wide expenditure review was initiated which led to questions including:

- What functions or services can we do without?
- What research programmes/specific studies should we terminate?
- Where are we incurring substantial costs that could be eliminated or reduced?
- Are you interested in retiring if an early retirement package becomes available?

Since core funding for the Research Branch's programmes had been declining steadily since about 1985, difficult decisions had to be made.

"Town hall" meetings were held to allow open discussion of operational efficiency and cost-reduction suggestions submitted by staff. Staff at the Lethbridge Research Centre who attended these sessions were commended for their high level of participation and objective input.

Between 1993 and 1997, human resource issues in the public service were relegated to the back-burner, as senior managers focused on the immediate challenges of implementing the programme cuts, meeting spending reduction targets, and responding to the day-to-day operational challenges of "doing more with less."

Staff members, who were or would be 55 or older within the next couple of years and had 10 or more years of service, were asked if they were interested in voluntary retirement under the Work Force Adjustment Policy. To help with work force adjustments "Managing Change and Transition Workshops" were offered. These provided an understanding of the dynamics of change and transition, but also made one aware of how one reacts and then effectively manages change and transition. Another initiative was to facilitate the transition of the remaining employees who felt the impact of downsizing and organisational change, and through the Employee Assistance Programme, counselors were made available to assist with counseling or referral services for personal and work-related concerns that could affect one's physical or emotional well being.

Kamloops Range Research Ranch

Entrance of new headquarters at Kamloops

From April 1, 1993 to March 31, 2005, the Lethbridge Research Centre was responsible for managing of

the Kamloops Range Research Ranch, including a land base of 57 hectares, 470 hectares of forested rangeland, and several thousand hectares of provincial rangeland. As expected, this led to considerable traffic in both directions between establishments to integrate the 26 employees at Kamloops and their activities, with those of the Lethbridge Research Centre. Range Management, the mandate of the Kamloops Ranch, was to be reflected in the programme and organisational changes at the Lethbridge Research Centre to mesh the research activities at the two sites.

This also led first to the transfer of Priya and Zahir Mir and Brenda Pink to the Livestock Sciences Section at the Lethbridge Research Centre to consolidate ruminant nutrition/physiology research at Lethbridge. Others such as Ian Walker, Harriet Douwes and Bourke Reaney, soon followed. Other staff at Kamloops became members of the Land Resource Sciences Section. To better accommodate this integration, an exchange visit was arranged with members of the Section involved with the Range Management related programmes travelling to Kamloops in May, 1995, with a reciprocal trip by the Kamloops members coming to Lethbridge in September, 1995.

Livestock handling facility at Kamloops

Walter Majak, Acting Site Manager of the Kamloops Range Research Ranch, was largely responsible for the smooth transition and integration of the Ranch with both the Lethbridge Research Centre and the Land Resource Sciences Section. Subsequently, Douglas Veira accepted the position of Kamloops Site Manager full-time in October 1997. Administrative support was in the capable hands of Carol Fagan. Under the current restructuring, Kamloops is under the jurisdiction of Summerland as of April 1, 2005.

When the Kamloops Range Research Ranch was amalgamated with the Lethbridge Research Centre in 1993, the property of the old Prince George farm was included. As active research had ceased at this site several years prior to the amalgamation, a portion of the land later went to Transport Canada and some was sold to the University of Northern British Columbia. The remainder of the land may be part of a Native American land claim.

75 years of research 1927-2002 at the Research Substation, Onefour

John E. Lawson, former Head of the Animal Science Section, provided an historical overview of the origin of the establishment and the research conducted at the Research Substation, Onefour (originally called Range Experiment Station, Manyberries), between 1927 and 2002 (Lawson 2002).

In 1926, the Experimental Farms Service directed L.B. Thomson, a Field Husbandman, and S.E. Clarke, an Assistant Agrologist, to identify range problems in southeastern Alberta and south-western Saskatchewan. Mostly between 1910 and 1930, a great many squatters and homesteaders had attempted to farm small parcels of land on the short-grass prairie. A combination of small holdings, soil that produced relatively light crops, inadequate rainfall, high evaporation rates caused by heat and high winds, and sometimes grasshoppers, caused many of the homesteads to be uneconomical and to be abandoned. Originally it had been assumed that most of the area would come under cultivation for farmland, so range management did not have high priority. When it became apparent that the dryland areas were more suited to ranching than farming, the reclamation of over-grazed and weedy farmland became important. An estimated 4,050,000 hectares of grazing land were seriously depleted. Other areas that warranted research included the determination of grazing capacity or introduction of grass species for cattle and sheep, water sources for stock, and supplementary winter feeding.

Thomson and Clarke had access to precipitation records from Medicine Hat that were started in 1885. The driest year on record was 1886 (195.5 millimetres), with three other years recording less than 51 millimetres during April, May, and June. Thomson noted that, ironically, two favourable years, 1915 (359 millimetres) and 1916 (455 millimetres), were closely linked to the settlement on the less productive portions of the short-grass prairie, whereas the dry spell of 1917 to 1926 was the same period during which most of those areas were abandoned.

In 1913, a post office was established at the Wetherelt farm, the buildings of which were located on SE3-27-1-4-W4. From its situation in Township 1, Range 4, the post office and district were called "Onefour". In 1927, the Range Experiment Station was established in the district but used as a post office address the town of Manyberries, approximately 53 kilometres to the north. The land location of the Station headquarters was the SW2-15-2-4-W4. In 1951, the Station acquired Mrs. Wetherelt's holdings (12 sections of land and the buildings). In 1964, the renamed Manyberries Range Experimental Farm became a Substation of the Lethbridge Research Station. Tom Anstey, then Director of the Lethbridge Research Station, soon realised that the Manyberries address was costing the Research Branch about $1,200 per year in postal delivery charges. He found that, if the old Onefour post office could be relocated at the Substation headquarters, Canada Post, rather than the Research Branch, would be responsible for postal delivery charges. This, in turn, meant that the name of the Substation had to be changed from the Manyberries Range Research Substation to the Onefour Range Research Substation. Later, the name changed to the Onefour Range and Livestock Research Substation.

Most of the research reported by John Lawson was based on the Experimental Farm/Research Branch mandate for work at the Manyberries/Onefour Substation in the broad areas of forage and range management, sheep, beef cattle, and soils research. Other research, conducted outside this mandate, included work on grasshoppers, soapweed (yucca), fauna (e.g., such as piping and mountain plover, burrowing owl, swift fox and sage grouse), satellite rangeland monitoring, and palaeontology.

During the summer in Alberta, Onefour often makes the supper hour news; this lonely research outpost in the southeastern corner of the province, is frequently the provincial hotspot!

Reorganisation of Agriculture and Agri-Food Canada

During the meeting of the senior and middle managers of the Department at Lethbridge in June 2000, Samy Watson, the new Deputy Minister of the Department, talked about the future of life sciences in agriculture. He mentioned that he had established a task force charged with looking 10 years into the future and defining the major trends that would likely occur and the potential opportunities for the agricultural industry, the response to these trends by the Department, and their implications for the staff in the Department. He asked this task force, in which Steve Morgan Jones represented the Research Branch, to find him a North Star - a Departmental Business Plan - to which all the Department could contribute. It would become a framework for setting priorities and developing policy.

From this exercise, a new economy emerged based on the life sciences which would create a new range of products and services from renewable natural resources. This emerging economy would create new opportunities to use commodities not only for food but also for ingredients in cleaner-burning fuel, for health and bio-medical products, for manufacturing materials and for many other non-food products. If developed in a sustainable manner it ought to create stability in income for the agriculture and agri-food industry and increase the importance of agriculture in the national economy. This strategic direction recommended by the team was based upon Canada's unique position of leading this emerging revolution. Research and development would have a key role in this new life-sciences economy.

Eight key result areas and surrounding strategies, action plans and performance indicators were identified. Agriculture and Agri-Food Canada was seen as a learning organisation that creates, acquires, interprets, shares and retains information, knowledge and experience. Within that, three major lines of business were identified in the Department: the security of the food system, environmental health, and innovation for growth. Concomitantly, a management philosophy was emerging centered

around the concepts of one department rather than a series of Branches and Agencies; horizontal integration of our activities, fostering innovation; and an inclusive team approach to work. The Department had adopted the challenge of making Canada a world leader in the life-sciences economy by 2010.

The Minister identified six priorities (Food safety/ quality, Farm income, Renewal and transition for the farm sector, Environment, Science and innovation, and International issues), to be addressed by 16 Teams. Within that framework, four national research programmes were identified - Environmental Health, Sustainable Production Systems, Bioproducts and Bioprocesses, and Food Safety and Quality. In other words, research was to be planned on the basis of national programmes rather than on the basis of an individual Centre; therefore, new studies would be planned on an inter-Centre basis. As well, the Research Branch Advisory Committee was disbanded in favour of a Departmental Science Advisory Committee; within the Lethbridge Research Centre, this meant disbanding the sections (Animal Science, Land Resource Sciences, and Crop Science), which, since 1988, were consolidations of the Animal Science, Animal Parasitology, Soil Science, Plant Breeding, Crop Science and Plant Pathology Sections.

On April 1, 2002, the regional structures were disbanded. The National Programme Leaders and the Centre Managers from now on were to report to the Assistant Deputy Minister, the Science Directors (Theme leaders) were to report to their respective National Programme leader, whereas Scientists, allocated into 16 Themes, were to report to the appropriate Theme Leaders. Finally in November 2003, the Public Service Commission announced that the Director General positions for the four National Programmes were filled by Steve Morgan Jones (Sustainable Production Systems), Gordon Neish (Bioproducts and Bioprocesses), Wayne Lindwall (Environmental Health), and David Bailey (Food Safety and Quality); it was noteworthy that all four had spent time at the Lethbridge Research Centre.

Long-term research

In spite of any planned organisational changes, one role that cannot be replaced by industry is the establishment and maintenance of long-term sites in the public domain. An insightful discussion by Janzen (1995) noted that ecologists have recognised long-term sites as invaluable tools in the study of ecosystem dynamics. Because of their complexity, ecosystems often show only gradual change, and long-term trends are often initially indistinguishable from short-term fluctuations. Agricultural ecosystems are unique in many ways; their long-term changes merit particular attention because they are usually managed more intensely than "natural" ecosystems.

Breaking the native prairie sod around the beginning of the twentieth century created a need for information regarding how to grow a variety of cultural crops on land that had sustained only native plants (predominantly grasses), for millennia. The federal government responded by setting up substations of the Central Experimental Farm in Ottawa. The oldest crop rotations in Alberta were established in 1910 at what is now the Agriculture and Agri-Food Canada Research Centre; it is remarkable that some of these plots are still maintained 96 years later. A substation of the Research Centre is nestled in the foothills west of Stavely, Alberta. It is the site of another long-term study, i.e., the sustainability of a native grassland ecosystem for grazing use by cattle. Several other long-term agroecological studies have also been initiated.

The first established crop rotation

Janzen (1995) succinctly pointed out that one trait to be learned from our predecessors is far-sightedness, anticipation of questions that have not been asked yet. Long-term studies, because of their well-documented history, provide unique sites for conducting process studies addressing a wide range of specific hypotheses. A good example of this is the role of soils in buffering greenhouse gases impacting climate change using data, originally gathered for other reasons, to understand the chemical transformations of plant-derived organic compounds in soil and the impact of soil and crop management practices on the global environment, thereby providing tools for investigation of strategies to minimise adverse effects. No doubt there are many other research questions to be asked and answered; this should be ample justification for the public-domain maintenance of these long-term sites regardless of reorganisation and changes in policies and priorities.

The skeleton of the Lethbridge Research Centre

Culture collection centre

Microorganisms fill important roles in nature and many are important to agriculture. When conducting research involving microorganisms, it is necessary to properly maintain and preserve cultures of them. To keep track of the many cultures used over the years, a culture collection centre was established. Initially, the collection consisted of two groups of bacteria that were of specific interest to scientists at the Research Centre, i.e., bacteria that fix nitrogen from the atmosphere and make it available to plants, and bacteria which exist in the digestive tract of ruminants. The latter are important for the digestion of feed, the detoxification of toxic components found in certain plants, and the normal functioning of the digestive system. Fungi that can harm plants have since been added to the collection as well. With the culture collection, researchers are now assured of a readily available source of reference cultures and specific strains required for their research without having the task of maintaining individual collections. A vote of thanks goes to the first supervisor, Roger Phillippe, Bacteriologist, for having taken the initiative of creating this culture collection centre.

Jay Yanke, presently entrusted with keeping the culture collection

Energy retrofit

In 1988, the Research Centre initiated a major energy retrofit. The inefficient, high-pressure steam plant was decommissioned in favour of a new, more efficient low-pressure steam plant that was brought on-stream. The Centre won the prestigious Canadian Electrical Association Regional Energy Efficiency Award for its programme to improve the efficiency of electricity use. It is estimated that as a result of these changes, the Centre saved approximately 25% of annual energy costs (about one-quarter million dollars). The savings have been used directly in support of the various research programmes.

Feed mill, controlled-environment livestock facility, and research feedlot

The new computerised feed mill, which began operations on July 19, 1986, contains equipment equivalent to that of a commercial mill and has several additional features designed to enable preparation of feed mixes with specific additives. Researchers can prepare special rations for animal feeding trials on a hand-batch basis or use computerized processing to ensure highly accurate ration formulation.

Feed mill

The controlled-environment livestock facility, officially opened July 19, 1986. It was designed for both research by the pesticide residue chemists and to enhance the Centre's ability to conduct specialised livestock research, such as projects on dung insects and physiology of parasitic organisms, and conducting experiments on interactions between cattle and other domestic ruminants and insect pests under rigidly controlled conditions of temperature and photoperiod. It has also been used for critical research defining the nature of immune responses to several species of blood-feeding insects, including lice and horn flies. For example, using the unique capabilities of this facility, it was possible to define the role of temperature in the induction of diapause in the blood-feeding horn fly. This key biological feature is crucial in the development of management strategies for an insect that costs the North American cattle industry approximately $700 million annually.

As well, this facility has been critical in the development of an understanding of the role of biting insects as stressors for cattle. The controlled-environment building has complete necropsy facilities (occasionally used as a surgery suite), laboratory space, and facilities for rearing insects.

With the presence of a new research feedlot facility, it is possible to concomitantly conduct research on manure handling and composting techniques. Fresh manure is normally hauled from feedlot pens directly to the field. Because of trucking costs, it is only carried short distances. Conversely, the composting facility is allowing the study of the transport requirements of compost versus fresh manure for land application.

Controlled-environment building

Research feedlot

Sheep facility

The facility, completed in 1991, houses up to 300 sheep and has laboratories for collection and processing data and samples. The facility supports research on the digestion of various feedstuffs, and on the economic and biological efficiency of ewes and lambs, as well as supporting studies on reproduction, physiology and rumen microbiology.

New multi-purpose research facility

When Agriculture and Agri-Food Canada moved its weed biological control arthropod quarantine from Regina, Saskatchewan, to Lethbridge, Alberta, in 1992, it became clear that the Research Centre needed a state-of-the-art containment facility. In concert with the growing emphasis on bio-control research (to manage agricultural pests), this prompted construction of a new containment facility with sufficient capacity to accommodate research on bio-control of agricultural pests and the study of potential pests. Agricultural pests include arthropods, pathogens, and weeds. The main function of the facility was to provide a secure environment for researchers to study the biology, efficacy, and specificity of exotic arthropods and pathogens for use in bio-control.

Rosemarie De Clerck-Floate was the Chair of the Facility Planning Committee and User Representative during design and construction. She and Carey Jackson, Tom Kveder, and Peter Burnett invested much effort and time in this project. During the design phase of the Containment Facilities in particular, the focus was concentrated on gathering background information to ensure that the facility would meet both regulatory and user requirements. Since Canada did not have official guidelines for the design of containment facilities for bio-control of arthropods and pathogens, site visits were conducted at several facilities around the world. Each facility was unique in design and focus, based on the different challenges and constraints (climate, budget, politics, and public acceptability). In that regard, the new Lethbridge Research Centre facility was to focus on: a) meeting regulatory requirements for secure containment of organisms; b) be a design conducive to organisms and personnel; and c) be within budget.

This Insect-Microbial Containment Facility at the Lethbridge Research Centre has a number of novel design features and is widely regarded as a model in the design and construction of similar facilities in North America (De Clerck-Floate et al. 2000, 2005). Literature published on the Lethbridge Research Centre facility is referenced in newly drafted North American Plant Organization Standards for Containment (2004).

The containment facility, however, was but one component of a larger building expansion which provided additional and replacement laboratory and office space for the livestock, crop and soil sciences. For instance, the new facilities replaced those of the Biology Building and the Food Processing

Laboratory (both were demolished). Much of the previous greenhouse complex was replaced by modern greenhouses with better controls and more efficient layouts.

The total building project started in March 1999 (total cost of approximately $36 million). Lyle Vanclief (Minister of Agriculture and Agri-Food Canada) and Senator Joyce Fairbairn performed a sod turning to officially announce the building project on July 9, 1999. The facility opened in 2004.

July 9, 1999, Senator Joyce Fairbairn and Agriculture Minister, Lyle Vanclief at sod-turning ceremonies for Centre expansion

Millennium arboretum

Work was started on this project in the autumn of 1999. It is an Agriculture and Agri-Food Canada Millennium project and was completed in partnership with Alberta Agriculture, Food and Rural Development and the St. Mary River Irrigation District. Ninety-eight plants, including elm, oak, spruce, pine, larch, dogwood, linden, maple, junipers, and lilac, were moved to the site by Tom Kveder, Mike Booth, Bob Romanchuk and Perry Siegl.

Some field-grown trees (e.g., various choke cherries, mountain ash, weeping birch, and black and green ashes) were also purchased. In addition, three ponds were constructed for both practical and aesthetic purposes; the two ponds to the south provide drainage (including the contingency of a 100-year flood event), whereas, the deep northernmost pond is a settling pond for the St. Mary's River Irrigation District. On September 16, 2000, the Millennium Arboretum, encompassing two hectares, was officially opened by Senator Joyce Fairbairn (on behalf of the Agriculture and Agri-Food Canada Minister, Lyle Vanclief).

Senator Joyce Fairbairn, Dr. Steve Morgan Jones and a young helper unveil millennium arboretum plaque

The Chinese connection

The Lethbridge Research Centre was designated (February, 1990) as the Canadian Executing Agent for an agronomy research and technology transfer project in China's Hebei province. The cooperating Chinese institution was the Hebei Academy of Agriculture and Forestry Sciences (HAAFS) and its satellite stations. With limited surface water resources in the Hebei Lowland Plain and groundwater resources being depleted rapidly, the project was to improve water use efficiency for crops in that region. There was interest in any technology leading to increased water efficiency including water conveyance systems, water application methods, soil management (e.g., tillage, soil fertility and appropriate equipment), and drought-tolerant crop species and varieties. Some of the disciplines involved were soil physics, hydrology, soil fertility, engineering, computer science, cereal breeding and physiology, and soil chemistry. Most of the scientific and technical expertise was drawn from the Swift Current and Lethbridge Research Centres. The project operated through short-term visits by Canadians (3 to 6 weeks per visit) to China and reciprocal visits by more than 40 Chinese research fellows to our Research Centres (up to 6 months). Several Chinese fellows also attended Canadian

universities for more formalised training. The project was planned for 5 years and budgeted at $5 million.

Subsequently, the project was designated by China as a "key project" at provincial and state levels. This recognition resulted in additional Chinese funding for the project as well as support for the second phase. Hence, in 1996, the 5-year Project Implementation Plan for Phase II of the Canadian International Development Agency (CIDA) sponsored project to the Joint Project Steering Committee was initiated. The Committee consisted of representatives from the Chinese Ministries of Agriculture, Foreign Trade and Economic Cooperation, Science and Technology and representatives from CIDA and the Hebei Academy of Agriculture and Forestry Sciences. This Phase continued the prior focus on irrigation technology and development of conservation cropping systems and also considered environmental sustainability, alternate crops, integrated pest management, socio-economics and extension. It was extended to December 2002 with strong priority being given to extend the results of the project where applicable to other areas of China.

Field demonstration site in Jinxi County, Hebei Province, 2001

Lethbridge Research Centre staff, Chi Chang, John Keng, and Nader Foroud have been the coordinators of the project. Ultimately, scientists from several other Research Centres, e.g., Brandon, Lacombe, Saskatoon, and Summerland and specialists from the Province of Alberta, played an important role in delivering this project.

The project was a major success and has had an important impact on the agricultural practices in the Hebei Lowland Plain immediately south of Beijing. It has been a champion for minimum and zero tillage and introduced a zero-till system for corn following the winter wheat harvest which has now been adopted by most farmers in Hebei. The technology was reported to have been used on over 700,000 ha in the North China Plain in 2000. This has enabled farmers to not only conserve soil moisture and increase yield, but also improve soil quality and reduce greenhouse gas emissions by not burning wheat residue. Over 50,000 zero-till corn seeders developed by the project were manufactured and sold in Hebei in the past three years. New winter wheat varieties with strong drought resistance that were developed are now used for production on over 50,000 ha of land. As well, the project evaluated a range of other crops and helped develop superior wheat germplasm.

Cotton/sunflower intercrop for cotton boll weevil control near Shijiazhaung

Quo vadis?

Returning to the question raised in "Now the rest of the story ...", that is, who in the future would be the users of the information provided by the Lethbridge Research Centre, some crystal ball gazing is now in order. When a human community establishes itself, it upsets the existing balance of nature by replacing the natural vegetation with food plants. In its pioneering stages of development, a human society, predominantly agricultural, inevitably takes more fertility out of the soil than it can put back. This is a condition of survival. Soil exhaustion and erosion cannot be helped. It is not greed or ignorance; indeed every human society that has arisen in the last few centuries has exhausted its soil. Conversely, northwest Europe has been continuously increasing the fertility of its soil since industrialisation started. We here in Canada are only now reaching a stage of our social evolution at which we can produce enough wealth for other things than those needed for survival. The concentration of well-to-do food consumers, such as are found in our major cities, and the wealth they possess, provide the most powerful of all incentives for soil conservation. Generally, the most productive and most carefully tended soils are those around the city.

Modifying Maslow's Hierarchy of Needs, we first have soil. The next layer will be plants and animals, then food, clothing and shelter, and finally education and all other aspirations of people. That is, food is still essential, even though, as a result of a very efficient agricultural industry, it seems to have been delegated to the edge of the radar screen. More centrally located on the screen are questions like *Escheria coli* (*E. coli*) O157:H7, Bovine Spongiform Encephalopathy (BSE), bird flu, feedlot runoff, genetically-modified crops, biosafety, and animal care. Ultimately, the consumer demands low-priced, healthy food grown in a clean environment. This means, reducing the level of production risk for the producer. Organic farming as a lifestyle is gaining ground in the context of conserving natural resources and preventing degradation of soil, water, and air.

Agriculture is a human activity whose affects are both local and global. It now stands side by side with soil health, clean air, and uncontaminated water to form the framework for future research (Acton and Gregorich 1995; Coote and Gregorich 2000; Janzen et al. 1998). In 2006, the Agriculture and Agri-Food Canada Research Centre still is a pioneering institution as it was in 1906; however it is now poised to enter its second century serving not only the stomach, but also the well-being of the whole human.

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Appendix 1

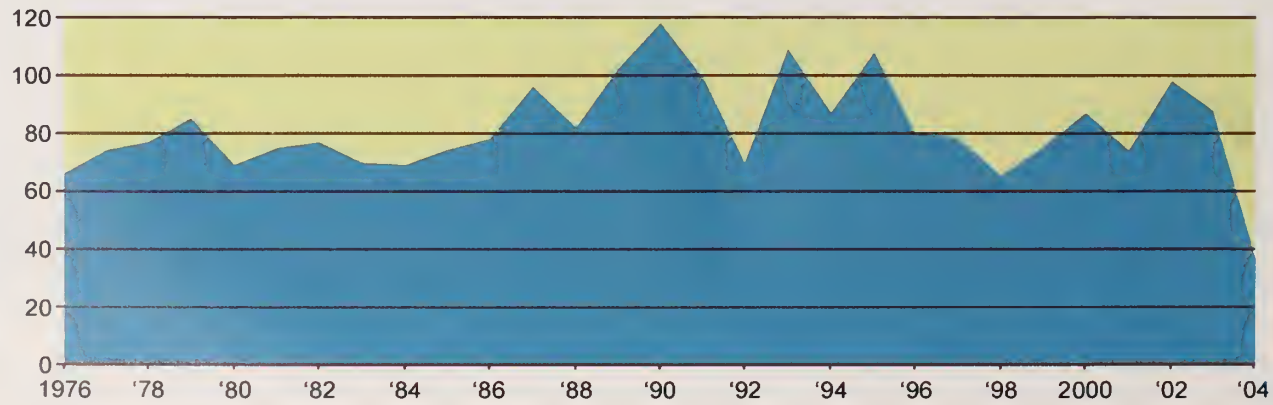
Facts and figures

- Originally established in 1906 as a Dominion Experimental Station, now the largest in the Research Branch of Agriculture and Agri-Food Canada outside Ottawa, ON.
- Located in the Agriculture Centre, a facility shared with the offices of Alberta Agriculture, Food and Rural Development including the Provincial Irrigation Branch offices, and Alberta Sustainable Resource Development - Public Lands and Forests Division.
- 25,000 m^2 laboratory/office complex; adjacent land, 500 ha.
- Staff comprises about 280 persons; indeterminate, casual, seasonal and externally funded, including 60 in the professional categories.
- Farms: Onefour Ranch - 17,000 ha shortgrass prairie range research site; Vauxhall - 190 ha site for potato, soft white wheat and rotation research; and Stavely - 400 ha in the foothills of the Rocky Mountains for rough fescue range research.

Research support facilities

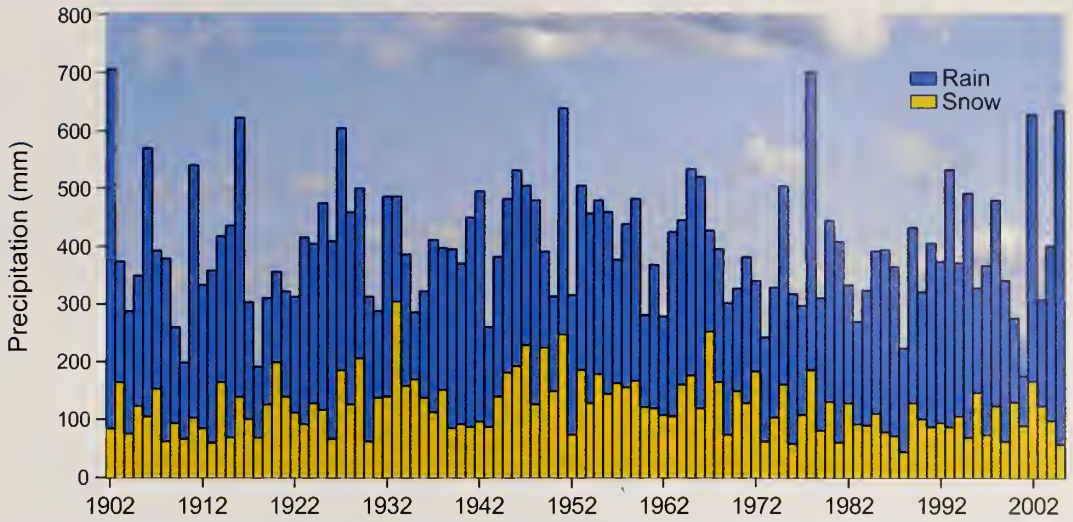
- Bacterial Artificial Chromosome (BAC) libraries for cereal and potatoes
- Controlled environment building
- Dairy and sheep barns
- Facility for composting manure
- Feed mill
- Gene sequencers
- Greenhouses
- Image analysers
- Individual feeding barn
- Insect quarantine facility
- Insect rearing rooms
- Livestock research feedlot
- Low level radio-active isotope handling facility
- Mass spectrometer
- Microbial culture centre
- Plant growth cabinets
- Scanning and transmission electron microscopes
- Weather station

Number of scientific articles published (1976-2004)



Appendix 2

Lethbridge weather - when did it happen?



Sunniest month, July 1933 (405 hr sunshine)
Sunniest year, 1988 (2,673 hr sunshine)
Cloudiest month, January 1971 (43 hr sunshine)
Cloudiest year, 1942 (2,120 hr sunshine)

Greatest monthly snow, April 1967 (137 mm)
Greatest annual snow, 1967 (307 mm)
Wettest June, 2005 (268 mm)
Wettest month, May 1902 (286 mm)
Wettest year, 1902 (709.1 mm)
Most rainfall, 1902 (621 mm)

Greatest rainfall in 24 hr, Sept 10 2005 (105.6 mm)
Greatest snowfall in 24 hr, Apr 29 1967 (52.1 mm)

Driest June 1985 (2 mm)
Driest year 2001 (176 mm)
Least rainfall 2001 (84 mm)

Averages (1902-2005):
-Number of days with precipitation - 94
-Year with most days (1951) - 136
-Year with least days (1918) - 54
-Number of days with > 1.0 mm - 61.4
-Number of days with > 5.0 mm - 24.1
-Number of days with > 10.0 mm - 10.1
-Number of days with > 20.0 mm - 2.89
-Number of days with > 50.0 mm - 0.24
-Number of days with rainfall - 53
-Year with most days (1992) - 85
-Year with least days (1967) - 30
-Number of days with snowfall - 41
-Year with most days (1951) - 71
-Year with least days (1918) - 20

Hottest day, July 23 1904 (max. 39.1°C)
Hottest month, July 1936 (mean 21.3°C)
Hottest year, 1987 (mean 8.3°C)
Hottest January, 1931 (mean 1.8°C)

Coldest day, January 7 1909 (min -43.0°C)
Coldest month, January 1950 (mean -25.9°C)
Coldest year, 1951 (mean 2.5°C)
Coldest July, 1993 (mean 14.4°C)

Highest evaporation month, June 1953 (443 mm)
Highest evaporation year, 2001 (1864 mm)

Windiest month, January 1947 (mean 38 km/hr)
Windiest year, 1946 (mean 25.6 km/hr)
Max. wind gust, November 19 1962 (171 km/hr)
Windiest month on average, December (mean 21.3 km/h)
Calmest month on average, August (mean 14.6 km/h)

Hottest day of year on average, July 22 (mean 19.0°C)
Coldest day of year on average, January 25 (mean -9.5°C)
Day of year with greatest temperature extremes, February 2 (60.0°C) (+20.0°C (1962), -40.0°C (1992))
Day of year with least temperature extremes, July 1 (28.5°C) (+ 31.1°C (1990), +2.8°C (1927))

Notable daily temperature ranges during Chinooks:
February 4, 1947 (+9.4°C and -35.0°C) - range 44.4°C
January 6, 1996 (+6.3°C and -34.3°C) - range 40.6°C
January 12, 1911 (+7.0°C and -33.3°C) - range 40.5°C
Between January 1, 1909 and December 31, 2005 there where 137 days where the daily temperature range was >= +30.0°C and 27 days where it was >= +35.0°C.

Frost

Earliest last frost (< 0.0°C) - April 26 (1998)
Mean last frost (< 0.0°C) - May 18
Latest last frost (< 0.0°C) - June 27 (1951)

Earliest first frost (< 0.0°C) - August 15 (1928)
Mean first frost (< 0.0°C) - September 19
Latest first frost (< 0.0°C) - October 15 (1940)

Shortest frost free period - 83 days (1910)
Mean frost free period - 123 days
Longest frost free period - 171 days (1940)

Growing season

Growing season temperature:
(Apr to Aug) mean (13.7°C)
Warmest 1988 (15.4°C), coldest 1954 (11.2°C)

Growing season precipitation:
(Apr to Aug) mean (244.3 mm); Wettest 1978 (468.7 mm), driest 1910 (70.2 mm)

Seasonal temperatures

Winter (DJF) (mean -6.7°C)
Warmest 1930/31 (1.7°C), coldest 1968/69 (-15.8°C)

Spring (MAM) (mean 5.0°C)
Warmest 1910 (9.3°C), coldest 2001 (0.4°C)

Summer (JJA) (mean 16.8°C)
Warmest 1961 (19.0°C), coldest 1993 (14.4°C)

Fall (SON) (mean 6.2°C)
Warmest 1905 (9.9°C), coldest 1986 (0.4°C)

Seasonal precipitation

Winter (DJF) (mean 52 mm)
Wettest 1978/79 (118 mm), driest 1992/3 (10 mm)

Spring (MAM) (mean 107 mm)
Wettest 1906 (265 mm), driest 1926 (28 mm)

Summer (JJA) (mean 156 mm)
Wettest 2005 (361 mm), driest 1910 (43 mm)

Fall (SON) (mean 80 mm)
Wettest 1948 (225 mm), driest 1998 (22 mm)

Appendix 3

Stop the Press!

In conjunction with Alberta's Centennial, the Lethbridge Herald, a southern Alberta newspaper, invited readers during 2005 to nominate and vote for the individual that they felt was the greatest southern Albertan of the past 100 years. More than 70 people were nominated and the reader's final decision was Asael Palmer (www.albertaag100.com, Article #38)!

"Asael E. Palmer was born in 1888 and died in 1984 and dedicated his lifetime to improving Prairie farming in Western Canada. Palmer graduated from Knight Academy in Raymond and returned to the United States to study at the Utah State Agricultural College where he earned a degree in soil science. After graduation, he accepted a position with the Canadian Pacific Railway as a soil chemist and irrigation investigator and made groundbreaking discoveries in soil science that helped prove the land east of Brooks was suitable for irrigation agriculture.

In 1922, Palmer began working at the Dominion Experimental Farm in Lethbridge and held the position of superintendent there from 1946 until his retirement in 1953. He helped to establish the sugar beet industry in southern Alberta and was one of the original directors of the Alberta Sugar Beet Growers Association. His research also helped pave the way for the commercial poultry industry in Western Canada. During his lifetime, he became an expert on soil drifting in Canada and the techniques he promoted were indispensable in saving the Palliser Triangle. During his lifetime, Asael Palmer created a lasting legacy that changed the landscape of agriculture in Alberta."

Asael C. Palmer (around 1945)

At his retirement dinner (1953), Asael Palmer is given some luggage by Bill Hay of the Cereal Section

Asael Palmer showing Chi Chang (1978) the lysimeter study initiated (1917) near Tilley, Alberta

Appendix 4

People in charge (1906-2003)

Superintendents, Lethbridge Experimental Farm

Mr. W.H. Fairfield
1906-1945

Dr. A.E. Palmer
1945-1953

Mr. H. Chester
1954-1959

Directors, Lethbridge Research Station

Dr. T.H. Anstey
1959-1969*

Dr. J.E. Andrews
1969-1981

Dr. D.G. Dorrell
1983-1988

Officers-in-Charge, Dominion Entomological Laboratory

Dr. E.H. Strickland
1913-1921

Dr. H.L. Seamans
1921-1944

Mr. G.F. Manson
1944-1948

Dr. C.W. Farstad
1948-1949
Field Crops
Insect Laboratory

Mr. R.H. Painter
1946-1951
Livestock Insect
Laboratory

Science Service Laboratory**

Dr. W.C. Broadfoot
1949-1959

Directors, Lethbridge Research Centre

Dr. B.H. Sonntag
1989-1993

Dr. S.D. Morgan Jones
1996-2003

*First Director of the Lethbridge Research Station (resulting from the amalgamation of the Science Service Laboratory and the Experimental Farms Service)

**Following the amalgamation of the Field Crops Insect Laboratory with a new Plant Pathology Laboratory, and including the Cereal Breeding Laboratory from the Experimental Farm; and in 1951 also adding the Livestock Insect Laboratory

Appendix 5

Cultivars developed or introduced at Lethbridge

This list includes Lethbridge Research Centre breeders, pathologists and affiliated staff only. Cooperators from other agencies and locations have been involved in the development of many of the cultivars listed below.

Cereals

Barley

Name	Released	Centre scientist(s)
Betzes	1960	S.A. Wells
Palliser	1960	S.A. Wells
Galt	1966	S.A. Wells
Hector	1973	S.A. Wells
Fairfield	1976	S.A. Wells
Bridge	1990	K.W. May
AC Harper	1997	K.W. May

Wheat

Canada Prairie Spring Red Wheat

AC Taber	1991	R.J. Morrison
AC Foremost	1995	J.B. Thomas

Canada Western Red Spring Wheat

Chinook	1952	A.W. Platt, M.N. Grant
Cypress	1962	H. McKenzie, M.N. Grant
Chester	1976	H. McKenzie
AC Cadillac	1996	J.B. Thomas

Canada Western Soft White Spring Wheat

Lemhi 53	1956	A. Wall, M.N. Grant
Lemhi 62	1962	M.N. Grant
Springfield	1972	M.N. Grant
Fielder	1976	M.N. Grant
Owens	1984	J.B. Thomas
SWS-52	1989	R.S. Sadasivaiah, J.B. Thomas
AC Reed	1991	R.S. Sadasivaiah, J.B. Thomas
AC Phil	1996	R.S. Sadasivaiah
AC Nanda	1998	R.S. Sadasivaiah
AC Andrew	2001	R.S. Sadasivaiah
AC Meena	2001	R.S. Sadasivaiah
Bhishaj	2003	R.S. Sadasivaiah

Canada Western Red Winter Wheat

Westmont	1959	J.E. Andrews
Winalta	1961	J.E. Andrews, M.N. Grant
Gaines	1965	M.N. Grant
Nugaines	1969	M.N. Grant
Sundance	1971	M.N. Grant
Norstar	1977	M.N. Grant
AC Readymade	1991	J.B. Thomas
AC Tempest	1999	J.B. Thomas
AC Bellatrix	1999	J.B. Thomas
Radiant	2004	J.B. Thomas, R.J. Graf

Appendix 5, continued ...

Cultivars developed or introduced at Lethbridge

Field crops

Dry bean

Name	Released	Centre scientist(s)
Limelight	1968	G.A. Kemp
Green Limelight	1977	G.A. Kemp
AC Skipper (navy)	1995	G. Saindon, H.C. Huang, H.-H. Mündel, G.C. Kozub
AC Earlired (small red)	1998	G. Saindon, H.-H. Mündel, H.C. Huang
AC Alberta Pink	1998	G. Saindon, H.-H. Mündel, H.C. Huang
AC Redbond (small red)	1999	H.-H. Mündel, G. Saindon, H.C. Huang
AC Polaris (great northern)	2000	H.-H. Mündel, G. Saindon, H.C. Huang
AC Black Diamond	2000	H.-H. Mündel, G. Saindon, H.C. Huang
AC Scarlet (small red)	2000	H.-H. Mündel, G. Saindon, H.C. Huang
AC Argonaut (navy)	2000	H.-H. Mündel, G. Saindon, H.C. Huang
AC Alert (great northern)	2002	H.-H. Mündel, G. Saindon, H.C. Huang
Arikara Yellow (mantequillai heritage)	2002	H.-H. Mündel, D. Gehl
AC Early Rose (pink)	2003	H.-H. Mündel, G. Saindon, H.C. Huang
AC Morden003 (navy)	2003	H.-H. Mündel, G. Saindon, H.C. Huang
AC Black Violet	2003	H.-H. Mündel, G. Saindon, H.C. Huang
AC Resolute (great northern)	2004	H.-H. Mündel, G. Saindon, H.C. Huang
AC Agrinto (pinto)	2006	H.-H. Mündel, H.C. Huang

Potato

Chinook	1964	W.E. Torfason
Sangre	1984	D.R. Lynch
Niska	1990	D.R. Lynch, G.A. Nelson
AC Ptarmigan	1992	D.R. Lynch, L.M. Kawchuk
Ranger Russet (Amisk)	1993	D.R. Lynch, L.M. Kawchuk
AC Stampede Russet	1998	D.R. Lynch, L.M. Kawchuk, D.K. Fujimoto, M.S. Goettel
AC Peregrine Red	2000	D.R. Lynch, L.M. Kawchuk, D.K. Fujimoto, M.S. Goettel
AC Glacier Chip	2000	D.R. Lynch, L.M. Kawchuk, D.K. Fujimoto, M.S. Goettel
AC Maple Gold	2000	D.R. Lynch, L.M. Kawchuk, D.K. Fujimoto, M.S. Goettel
Alta Russet	2003	D.R. Lynch, L.M. Kawchuk, Q. Chen, D.K. Fujimoto
Pacific Russet	2003	D.R. Lynch, L.M. Kawchuk, Q. Chen, D.K. Fujimoto

Forage crops

Alfalfa

Beaver	1961	R.W. Peake, R.K. Downey, J.L. Bolton, M.W. Cormack
Kane	1970	M.R. Hanna
Trek	1974	M.R. Hanna, E.J. Hawn
Barrier	1986	M.R. Hanna, H.C. Huang
AC Blue J	1994	S.N. Acharya, H.C. Huang
AC Longview	1999	S.N. Acharya, H.C. Huang

Appendix 5, continued ...

Cultivars developed or introduced at Lethbridge

Name	Released	Centre scientist(s)
Forage crops, continued ...		
Grasses		
Chinook (Orchardgrass)	1959	R.W. Peake
Greenleaf (Pubescent Wheatgrass)	1966	R.W. Peake
Banff (Bluegrass)	1974	J.B. Lebeau, M.R. Hanna
Cabree (Russian Wildrye)	1978	S. Smoliak
Elbee (Northern Wheatgrass)	1980	S. Smoliak, A. Johnston
Walsh (Western Wheatgrass)	1982	S. Smoliak, A. Johnston
Kayak (Orchardgrass)	2005	S.N. Acharya
Milkvetch		
Oxley	1970	A. Johnston, S. Smoliak, R. Hironaka, M.R. Hanna
AC Oxley II	2000	S.N. Acharya
Sainfoin		
Melrose	1969	M.R. Hanna, D.A. Cooke, B.P. Goplen
Nova	1980	M.R. Hanna
Perennial Cereal Rye		
ACE-1	2002	S.N. Acharya, Z. Mir, J.R. Moyer
Fenugreek		
Tristar	2004	S.N. Acharya, Z. Mir, J.R. Moyer
Horticultural crops		
Apple		
4 cultivars	1950s	J. Coyle, I. Nonnecke
Chrysanthemum		
11 cultivars	1960	I. Nonnecke, G.A. Kemp
9 cultivars	1963	I. Nonnecke, G.A. Kemp
6 cultivars	1968	I. Nonnecke, G.A. Kemp
Corn		
White Alberta	1920	W.H. Fairfield
Sugar Prince	1946	C. Walkof
Gladiolus		
Puck	1952	M.W. Cormack, H.H. Downs
Baby Butterfly	1953	M.W. Cormack, H.H. Downs
Muskmelon		
Early Gold	1964	G.A. Kemp

Appendix 5, continued ...

Cultivars developed or introduced at Lethbridge

Name	Released	Centre scientist(s)
Horticultural crops, continued ...		
Tomato		
Earlinorth	1952	G.A. Kemp
Early Lethbridge	1953	G.A. Kemp
Earlicrop	1963	G.A. Kemp
Special crops		
Safflower		
Saffire	1985	H.-H. Mündel, H.C. Huang
AC Stirling	1991	H.-H. Mündel, H.C. Huang, R.J. Morrison
AC Sunset	1995	H.-H. Mündel, H.C. Huang, J.P. Braun

Appendix 6

The language of science

Alex Johnston (left) and Sylver Smoliak (right) examining Oxley milkvetch

As Head of the Plant Sciences Section (1982-1987), Sylver Smoliak was in an excellent position to observe our "language." This led to a compilation of Research Trivia plus "translation" based on the presentations made during one of the annual research reviews:

Basophil hypersensitivity	a type of skin hypersensitivity characterised by a specific delayed onset skin reaction, which induces specific activation of lymphocytes in resistant animals and also characterized by basophil skin infiltration (Animal Parasitology)
Browny brome	downy brome (Soil Science)
Carpogenic germination	germination of a fungal sclerotium by production of a sexual fruiting body (Plant Pathology)
Chinook episodes	occurrence of Chinook winds (Soil Science)
Contagious distribution	clumpy distribution of a plant species within a sampling unit (Plant Science)
Gravid flies	pregnant flies (Animal Parasitology)
Grubicides	chemicals that kill grubs (Animal Parasitology)
Hybridoma technology	the use of hybridomas (fused tumor and mouse spleen cells) to produce very specific antibodies in a tissue culture system (Animal Parasitology)
Immunoaffinity isolation	a method of isolating antigens using a column packed with separation medium to which a specific antibody has been attached; the antigen passing through the calcium binds to the antibody and can then be isolated from this mixture in a pure form (Animal Parasitology)
Incompetent nude mice	nude mice do not have an intact cellular immune response because they lack "mature" T cells (thymus-derived lymphocytes) (Animal Parasitology)
Inputed	inputs into a computer programme (Soil Science)
Insensitive sisters	daylength-insensitive sister lines of wheat (Plant Science)
Lousy cattle	cattle harbouring cattle lice (Animal Parasitology)
Melanisation of the rind	development of dark brown or black pigments in the outer layer of a biological structure, such as a sclerotium (Plant Pathology)
Montane ticks	ticks from mountain areas (Animal Parasitology)
Naive lambs	lambs which have not had any exposure to a sensitising agent, for example, exposure to sheep keds (Animal Parasitology)
Sensitive lines	daylength-sensitive lines of wheat (Plant Science)
Serendipitous	knack of stumbling upon interesting discoveries in a casual manner (Soil Science)
Sophistricy	sophistication (Soil Science)
Spermosphere	the region around the germinating seed (Soil Science)
Suppressive soils	soils that suppress a biological activity, such as growth or survival of a fungus (Plant Pathology)
Thiocarbohydrazide metallised	chemical coating of tissue sample for scanning electron microscopy to prevent charging (Animal Science)
Virgin bulls	young bulls that have not been used for breeding (Animal Science)

Appendix 7

Social activities

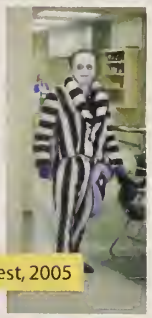

Jasper-Banff Relay, 1986


Anstey Cup, 1996


Cormack Bonspiel, 2003


Agros Soccer Team, 1995


Halloween costume contest, 2005




Lobster dinner, 2005


Christmas "Stand-up Social," 2004


Food lab farewell, 2003

"LRC Dragon Flyz" at the Lethbridge Rotary Dragon Boat Festival, 2004


Festive doors, 2005

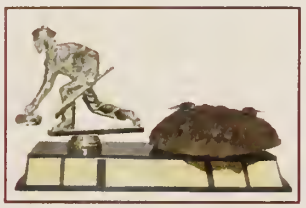

Crop Science Section bowling party, 2001


Ethnic lunch, 2004


Dr. Bill Cormack Bonspiel (started in 1969)


BLUNT "C" Event Winner (1995), Anstey Cup

Research Station Hockey Team


"Shit-out-of-luck" Award, last-place trophy, Dr. Bill Cormack Bonspiel (started in 2003)


Summer Fest (Baseball - 1997)

Appendix 8

Honourary doctor's degrees received by Lethbridge Research Centre personnel from the University of Lethbridge

1970	Dr. Asael E. Palmer	LL.D.	Agricultural Specialist
1975	Dr. Neil D. Holmes	LL.D.	Scientist/Public Servant
1975	Dr. H. Karl Rasmussen	LL.D.	Scientist/Public Servant (former scientist at LRC)
1976	Dr. Alex Johnston	LL.D.	Range Specialist/Author
1977	Dr. Ruby Larson	D.Sc.	Scientist
1991	Dr. Johan Frederik Dormaar	D.Sc.	Soil Scientist
2002	Dr. Robert Hironaka	LL.D.	Chancellor Emeritus, University of Lethbridge; (former Animal Scientist at LRC)
2005	Dr. William Fruet	D.F.A.	Film Maker (former photographer at LRC)

Dr. Ruby Larson

Dr. Robert Hironaka, Chancellor Emeritus (1995-1999)

Dr. Johan Dormaar

University of Lethbridge

Appendix 9

Memorial and commemorative plaques

1. LRC millennium arboretum, 2000
2. Dr. D.G. Dorrell (Director 1983-1988); "Toba" Hawthorn
3. Signing of Joint Federal/Provincial Agreement on sustainable beef alliance, 1996; "Black" Walnut
4. Carol Braat memorial bench, 1996
5. Canada Department of Agriculture, Experimental Farm Service, 1956
6. Dave McFarlane Ball Diamond, 1995
7. Expansion and retrofit of LRC, 1999; "Crimson King" Maple
8. The "Fairfield" Poplar (Plains cottonwood, *Populus deltoides;* see page 6 for inscription)
9. Joanna Pinto memorial, 2001; "Amur" Maple
10. 29th National Alfalfa Improvement Conference (1984)

Appendix 10

Other research characters

Scanning electron microscope images

1. Cabbage pod weevil
2. Bacteriophage (transmission electron microscope image)
3. Parasitic mites on the eye of a black fly
4. Stripe rust spores, wheat
5. Soil mite
6. *Escheria coli* (*E. coli*) O157:H7
7. Deer throat bot (head and shoulders)

Appendix 11

Current Lethbridge Research Centre Staff (this listing reflects indeterminate staff as of April, 2006)

It is possible that in spite of consulting the latest available personnel and telephone lists, some names may have been omitted; we sincerely regret any such omissions.

Acharya, Dr. Surya
Amundsen, Eric
Anderson, Cheryl
Anderson, Merlin
Andrews, Craig
Andrews, Karen
Archibald, Willis
Baah, Dr. John
Baines, Dr. Danica
Baker, Brant
Balint, Mike
Barbieri, Jose
Barbieri, Ruth
Barkley, Cindy
Barrett, Rita
Barron, Brian
Beasley, Bruce
Beasley, Debbie
Beauchemin, Dr. Karen
Beck, Ryan
Benkel, Kaarina
Beres, Brian
Berezan, Jean
Bilodeau-Goeseels, Dr. Sylvie
Bizimungu, Dr. Benoit
Blackshaw, Dr. Bob
Bolyea, Don
Booth, Michael
Boswall, Lyle
Bourchier, Dr. Robert
Brandt, Randall
Braun, John
Brown, Fiona
Bruinsma, Yvonne
Byers, Dr. Bob
Cadieu, Erin
Caffyn, Pamela
Cárcamo, Dr. Hector
Carefoot, Joan
Casson, Donavan
Casson, Terry
Cessna, Dr. Allan
Chang, Dr. Chi
Chen, Dr. Qin
Chenger, Eric
Chomicki, Laura
Chomicki, Laura Lee
Clapperton, Dr. Jill
Coates, Trevor
Coe, Michele
Coe, Paul
Coghlin, Paul
Coles, Ken
Colwell, Dr. Doug
Cook, Millie
Cook, Shaun
Coulter, Dr. Glenn
Cramer, Leslie
Crews, Dr. Denny
Crews, Ronda
Curtis, Tony
Cushman, Nick
Dalton, Jim
Dancoisne, Dave
Daniels, Cathy
Daniels, Hank
Danyk, Troy
David, Michael
De Clerck-Floate, Dr. Rose
Demaere, Paul
Despins, Therese
Di Rocco, Sharon
Dickie, Pattie
Doram, Ray
Dormaar, Dr. John
Douwes, Harriet
Duke, Grant
Dyck, Erich
Dyck, Harvey
Dyck, Nathan
Dyck, Ryan
Egland, Brian
Ellert, Dr. Ben
Elliott, Sheila
Entz, Toby
Erb, Stephanie
Erickson, Scott
Ethier, Dan
Eudes, Dr. François
Eun, Dr. Jong Su
Farr, Bev
Fast, Martin
Floate, Dr. Kevin
Forster, Dr. Bob
Fox, Jack
Franz, Ray
Frick, Michele
Friebel, Doug
Furtado, Alastair
Gaudet, Dr. Denis
Genswein, Bernie
Gergely, Bob
Gibb, Dr. Darryl
Gilbert, Scott
Gilbertson, Clarence
Gillies, Grant
Goettel, Dr. Mark
Gomez, Niki
Graf, Dr. Robert
Graham, Darryl
Grams, Kendra
Gray, Dawn
Gregus, Ron
Gresiuk, Dave
Gusse, Jenny
Hachey, John
Halladay, Barb
Hao, Dr. Xiying
Harris, Dr. Peter
Heerschap, Chris
Herle, Carolyn
Hill, Brett
Hill, Dr. Bernie
Himsl-Rayner, Christine
House, Kathleen
Huang, Dr. Henry
Inaba, Dan
Inglis, Dr. Doug
Jakober, Katherine
Janzen, Dr. Henry
Jensen, Linda
Johnson, Cathy
Johnson, Cindy
Jones, Gail
Kalischuk-Tymensen, Lisa
Kaminski, Ted
Kanashiro, Derrick
Kastelic, Dr. John
Kawchuk, Dr. Larry
Kendrick, Sheree
Kereliuk, Gerald
Klassen, Vicki
Kneeshaw, Lorie
Koenig, Dr. Karen
Kremenik, Linda
Kulcsar, Frank
Kveder, Tom

Lancaster, Richard
Larney, Dr. Frank
Laroche, Dr. André
Larson, Gary
Larson, Tracy
Leadbeater, Lee
Lee, Byron
Leggett, Dr. Fran
Lepage, Lance
Lisowski, Kari
Little, Shannan
Lu, Dr. John
Lynn, James
Lyon, Evelyn
Lysyk, Dr. Tim
Martens, Eric
Matic, Zdenka
McAllister, Dr. Tim
McGinn, Dr. Sean
McIntyre, John
McKean, Wayne
McLean, Hugh
Melenchenko, Alvin
Messenger, Doug
Meyer, Murray
Middleton, Alberta
Miller, Dr. Jim
Mir, Dr. Priya
Mir, Dr. Zahir
Molnar, Louis
Morgan Jones, Dr. Steve
Morris, Brent
Moyer, Dr. Jim
Mueller, Carol
Mündel, Dr. Hans-Henning
Mullin, Doug
Murillo, Esther
Nagasawa, Mike
Nakonechny, Darryl
Nakonechny, Elaine
Newlands, Dr. Nathaniel
Nilsson, Denise
Nishiyama, Brian
Olson, Andrew
Panich, Paul
Paterson, Lyn
Pavlik, Eva
Pearson, Dave
Pearson, Drusilla
Penniket, Carolyn
Pennington, Brenda
Perkovic, Steve
Petry, Kate
Pierson, Crystal
Pink, Brenda
Pittman, Andy
Pittman, Dave
Postman, Brendan
Prus, James
Prysiazny, Bob
Puchalski, Byron
Puurveen, Gloria-Rose
Quinn, Dave
Romanchuk, Bob
Ronning Mains, Cheryl
Ross, Allan
Ross, Charmaine
Samuel, Karen
Schmaltz, David
Schmaltz, Tammy
Schuh, Cory
Schutten, Dan
Schwartzenberger, Lori
Schwartzkopf-Genswein, Dr. Karen
Selinger, Lorna
Shaffer, Todd
Shah, Dr. Mohammad
Shannon, Gale
Shannon, Norm
Sharma, Dr. Ranjana
Sheedy, Dr. Claudia
Shigemi, Ken
Siegl, Perry
Silasi, Reka
Smart, Wendi
Smienk, Susan
Smith, Dr. Anne
Smith, Dr. Elwin
Smith, Ken
Smith, Russel
Staples, Jayna
Steacy, Graham
Stewart, Dr. Jeff
Stratton, Amy
Sukeroff, Jim
Tarnava, Marg
Tarnava, Kara
Tattersall, Ann
Teather, Dr. Ron
Theriault, Gerald
Thompson, Jenny
Thomson, Monte
Toohey, Karen
Torgunrud, Sheila
Tousaw, Gary
Tovell, Bonnie
Travis, Greg
Tremel, Colette
Troute, Aaron
Upadhyay, Dr. Mani
Uwambajemariya, Agnes
Vachon, Catherine
Van Herk, Annie
Van Herk, Fred
Vedres, Darrell
Virginillo, Mark
Volk, Rodney
Vucurevich, Tara
Walker, Ian
Wang, Dr. Yuxi
Wardman, Jo-Ann
Wardman, Tom
Weisser, Blaine
Wilde, Randy
Williams, Bob
Willms, Dr. Walter
Wilson, Ray
Wolodchenko, Ron
Woolf, Gayle
Woolf, Terry
Wuerfel, Rena
Xu, Zhong
Yagos, Dan
Yanish, Jennifer
Yang, Dr. Wen
Yanke, Jay

Post-doctorate fellows:

Badea, Dr. Ana
Bergen, Dr. Reynold
Chaves, Dr. Alex
Chugh, Dr. Archana
Nandy, Dr. Sanjib
Ohene-Adjei, Dr. Samuel
Reuter, Dr. Tim
Sun, Dr. Jinyue
Zhou, Dr. Wenchun
Zvomuya, Dr. Francis

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