# Lethbridge Research Centre

## Cutting Edge Agriculture

*AT THE EDGE OF THE southern Alberta city of Lethbridge, a sprawling complex of offices, laboratories, greenhouses, and croplands rises from the prairie heartland. This rural campus is the site of Canada's largest federal research facility, the Lethbridge Research Centre, known as LRC. The Centre, operating within the Research Branch of Agriculture and Agri-Food Canada, has a mandate to promote innovation, maintain the security of the food system, and protect the health of the environment.*

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**Top:** ***Experimental potato fields at Lethbridge Research Centre.***

**Above:** ***Researchers study how natural processes work within soils.***

Established in 1906 as a Dominion Experimental Station, the Lethbridge Research Centre today employs 400 staff, including approximately 80 scientists. "Over the years LRC has played a major role in changing the prairie landscape and farming practices across southern Alberta and beyond," says John Calpas, Information Coordinator for the Lethbridge Research Centre. "This region is home to Canada's largest irrigation belt of some 1.5 million acres where the cropping mosaic provides a virtual patchwork oasis in an otherwise semi-arid prairie. Indeed, the surrounding dryland belt of crops and rangelands also show the marks of modern technology in soil conservation practices and crop variety

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*Gene sequencing is part of the advanced research at LRC.*

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improvements as perfected by LRC's scientists and adopted by the area's progressive farmers and ranchers. LRC's complement of world-class livestock research facilities amplifies the region's genetic pool and intensive feedlot cattle finishing reputation."

"Many of our scientists have received recognition and awards for world-class science and research in several specialized areas, and indeed, several of our staff have managed long-term projects in countries such as China and India," notes Dr. Peter Burnett, Acting Director for LRC. "There is no doubt about the major influence and contributions that LRC and sister Research Centres across western Canada have made to help build a very viable agricultural industry along with sustainable farming techniques, in an otherwise harsh and generally semi-arid climate."

The Centre's activities involve three distinct research sections: Crop Sciences, Land Resource Sciences, and Livestock Sciences. Several core research priorities are defined within each section. These include the development of crop, soil, water and manure management strategies that maintain biodiversity, reduce greenhouse gas emissions, improve soil, water and air quality, and make efficient use of water. Lethbridge researchers are also engaged in advancing pest and disease management technologies that will effectively control crop and livestock pests while maintaining environmental quality. Major efforts are geared toward enhancing crop production sustainability and competitiveness by developing innovative technologies and cultivars, which are suitable for dry, irrigated land and are adapted to the Canadian prairies.

"*Cultivars* is another name for a varietal selection," Calpas explains. "Each of our major crops in the world have evolved through natural selection and evolution over centuries. Different plants in different regions adapted to different climates and seasons. For example, our thousands of hybrid corn cultivars, or varieties, evolved from much spindlier plants native to North America. Other examples would include alfalfa from Arabia and many of our forage grasses from Siberia. Man's ingenuity, knowledge of genetics and, in modern terms, DNA, has vastly speeded up the selection and breeding of cultivars for various individual or combinations of desired traits.

"Classic Canadian examples would be the development of our high protein, rust resistant wheats, without which we would not have developed our major grain exporting industry. Canola is the yellow-flowered crop that checkerboards the prairies in June and July. It's a much-improved version of our old rapeseed. It's a virtual new food oilseed selected from some genetic material in China, combined with desirable traits in our own, breeding out the undesirable characteristics of both by plant breeders in Saskatoon and Winnipeg to arrive with western Canada's Cinderella crop. Canola is second in importance in acreage and exports only to wheat."

*LRC also operates the Kamloops Range Research Unit, at Kamloops, British Columbia and substations at Onefour, Vauxhall, and Stavely, Alberta.*

Currently, LRC's cultivar research includes breeding of winter wheat for winter hardiness, breeding of soft white wheat for low protein and high yield under irrigation, and breeding selections of field beans for disease resistance. Field crops research also addresses the high-priority need to respond to market conditions in export, value-added, and niche markets for pulse crops and specialty oilseeds.

"Pulse crops include the whole family of legumes and nuts," says Calpas."Varieties include peas, beans, chickpeas, lentils, garbanzos, lima beans, soybeans, peanuts and so forth. These are all tremendously important foods in the Middle East and tropical countries. Places like India, Mexico and Central America use pulse crops as their main source of protein. Chicken and eggs become their next most affordable source in terms of animal protein.

"Pulse crops are emerging as the specialty crops on the Canadian prairies. The combined acreage of peas, field beans, lentils, and chickpeas are increasing yearly and are now exceeded only by wheat, barley, canola and forage crops, in that order. Because of our abundant sources of meat proteins in North America, our per-capita consumption of pulses is very low, not exceeding much over five pounds per person annually. Hence, 90-95 percent of our pulse crops are exported. Two major processing plants in southern Alberta export their supplies to 60-70 different countries globally each year.

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*LRC's Biological Control Program develops strategies for management of weeds, pests, and plant pathogens.*

Designated as the Federal Centre of Excellence for beef cattle research, LRC has a Livestock Sciences Section that includes pest management, genetics and physiology, ruminant nutrition, feed microbiology, biotechnology and bioeconomics.

LRC conducts on-going research that seeks to develop new and improved technologies that will increase the efficiency and environmental sustainability of beef production. These research efforts provide methodologies and strategies to improve production efficiency, product quality and safety for the Canadian cattle industry and consumers. Resources for the beef cattle genetics research team include herds of purebred Angus and Charolais cows at the Onefour Research Substation near Manyberries, Alberta, and post-weaning facilities at the Centre in Lethbridge. Collaborative projects are conducted with Canadian purebred beef associations, the Lacombe Research Centre, the University of Alberta in Edmonton, the University of Guelph, and other government, industry and academic institutions in North America.

The Canada / Alberta Livestock Research Trust Inc. (CARLT), in support of the Lethbridge Research Centre, owns all livestock that the Centre uses in its research programs, CALRT, through its industry Board of Directors, provides direct financial support and advice for livestock research.

The beef unit facilities have capacity for 1,635 head. Included is a 285-head barn which allows specialized feeding of individual animals, a dairy and beef metabolism barn, a 1,000-head capacity feedlot with 48 small pens and four large pens, as well as several beef barns. Dairy facilities include 275-head capacity with a main barn, calf barn, loose housing and dry barn. Sheep facilities include a research barn, pens and isolation building for using sheep in ruminant model studies. A state-of-the-art feedmill provides a backdrop to nutrition studies.

When it comes to feedlot management, flies are often viewed as little more than an annoyance. But they contribute a significant hidden cost, because their constant irritation lowers cattle productivity. LRC conducts important work in this area.

"House and barn-fly control in livestock barns and feedlots is a major problem," says Calpas. "Dr. Kevin Foate's research work involves a small, aphid-sized wasp which is parasitic on fly maggots. Use of insecticides to control flies is costly, labour intensive, and environmentally less desirable. Also, flies quickly build resistance to insecticides, leading to more frequent spraying or higher doses. The rearing of wasps for these applications is now commercialized in the US, but our work is on more cold-resistant species and with a unique bacteria which can render total populations of wasps

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to be all female and reproduce for generations without male wasp interaction."

In western Canada, technology, mechanization and crop protection advances have resulted in rapid agricultural change over the past several decades. Productivity has improved dramatically, but several environmental concerns have emerged. "The rapid intensification of livestock production on the prairies has been accompanied by a growing need to address the issue of animal manure," says Calpas. "Manure is beneficial to crops when applied at appropriate rates, but can create soil, water and air quality problems when over-applied. Scientists are pursuing ways to not only manage that resource, but to take advantage of its nutrient value.

"Composting systems perfected at LRC are now being widely adopted by our commercial feedlots, thereby reducing risk of stream and groundwater contamination, and hence, *E.coli* risks as well. Dr. Frank Larney has been the team leader and their research on compost applications now extends to oilfield, pipeline and industrial site reclamation. Dr. Jim Miller is involved with soil and water quality monitoring as impacted by the region's intensive livestock industries.

After a four-year study, the Centre released findings showing that composted manure is a valuable tool for healing land disturbed by oil and gas wells. The oil and gas industry currently uses topsoil amendments to restore wellsites, but research indicates that composted manure may be used as a cost-effective alternative, while providing a value-added outlet for livestock manure, and reducing the need for using imported soil and chemical fertilizers.

At LRC, the Land Resource Sciences Section has a prairie-wide mandate for sustainable production and water quality. Related research activities include soil quality, range management and waste management. "Land use planning and management have always had a major influence on agriculture, but science has shown the implications extend far beyond the farm base," notes Calpas. "Researchers are working to unlock further secrets of how natural processes work within soils. Armed with that knowledge, they can look at land use issues ranging from building better production systems to improving the environment. The goal is to produce land management systems that ensure the sustainability of agricultural and non-agricultural ecosystems."

"Forage research is focused on biological control of weeds on rangelands and the production of forage products of high nutritional quality," says Calpas. "Both areas of research are key to components of LRC's beef production systems national mandate. In the Kootenays and rangelands around Kamloops (BC), rangeland weeds such as hounds tongue, which is poisonous to cattle, and Dalmatian toad flax, and spotted knapweed have encroached and expanded in cattle country. Under the direction of Dr. Rose DeClerk-Foate, two species of root weevils selective to hounds tongue and Dalmation toad flax have been nurtured and introduced into these areas and have been effectively established there as a natural control to work on reducing these weeds which would otherwise basically ruin rangeland productivity."

At LRC, the Biological Control program develops strategies for management of weeds, pests, and plant pathogens. "A good example is the research using insects to control Leafy spurge, a bad weed that grows in pas-

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***Research developed at LRC uses wasps to control flies in barns and feedlots.***

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tures," says Calpas. "Based on research by Drs. Qin Chen, Mark Goettel and Larry Kawchuk , we're looking at some possible breakthroughs in selecting, through molecular genetics, and identifying germ plasm from wild potato species, which have natural resistance to the Colorado potato beetles. This trait and resistance to late blight disease if ultimately introduced into our table and processing varieties grown in Canada, or anywhere in the world, would mean huge savings to the industry in pesticide costs, as well as be more environmentally-friendly."

Grasshoppers are the primary targets in the biocontrol of rangeland insects. Controlling grasshoppers presents a huge challenge because they consist of many different species and affect vast tracks of rangeland, as well as many crops. Biocontrol offers advantages in cases where chemicals cannot be used, such as those regions close to bodies of water.

"The Centre has performed the first field tests in Canada, of microbial control agents against grasshoppers, and results will lead to more targeted strategies," says Calpas. "Scientists are also examining the use of parasitic flies and microbial derivatives to attack the grasshopper problem. Biocontrol research also shows benefits for the Prairie's booming field crops acreage. One target is white mould, the most important disease threat of dry bean, dry pea, canola, and safflower crops. Researchers have identified different types of fungi that either suppress this disease or attack it directly. One fungus shows great potential because it destroys white mould in the soil."

One of the oldest public research institutions in western Canada, the LRC is currently undergoing a $26 million expansion. The present facility was first commissioned back in 1977 and is now having its first major retrofit and expansion in 25 years. Presently, the Centre consists of a 25,000 square metre laboratory and office complex, with 1,230 acres of adjacent land.

"The new expansion will add about one third to our present laboratory and office space and add a new state-of-the-art greenhouse — essentially environmentally-controlled lab space," says Calpas. "This will allow us to significantly scale back the much more energy costly phytotrons or 'growth chambers.' Other projects include a modern and expanded insect-rearing facility and a Level 3 bio-containment facility, allowing for expanded research on national programs in the introduction of beneficial but foreign species for the proactive search for bio-control insects and organisms for pest and disease control in crops. Level 3 implies the second highest standard of security status for such facilities in North America. New facilities will be also used to conduct advanced research in areas such as molecular selection of potato clones.

"Already a world leader in biocontrol research, the Lethbridge Research Centre will soon boast one of the most comprehensive state-of-the art facilities for biocontrol studies in the world, complemented by scientists in several core disciplines with support from an international network of research and industry partners. Those resources have built a vast base of research over several decades, making biocontrol a more viable management option for weeds, insects and diseases. Today these advances are resulting in unprecedented success in the field, with benefits that apply to all types of agricultural land, including cropland, rangeland and feedlot production. With reference to biocontrol facilities, insect rearing, insect quarantine and the microbial culture centre–these are all being relocated, expanded and upgraded to Level 3 status within the new complex. The new wing will also house a modern food-processing lab for beans and potatoes, which are two major expanding crops in southern Alberta and western Canada. In fact, two major commercial potato processing plants have recently located in the vicinity with a view to expansion."

The Centre's in-house Business Development Office manages business partnerships, transfers commercial technology, and protects intellectual property rights. The office is designed to leverage the Centre's position as a producer of technology and leading-edge agricultural research to benefit industry and the public. "The Research Centre takes a balanced approach to bio-technology, environmental health, sustainable production systems and meeting the demands of consumers," says Calpas. "Canadian food quality, safety and brand identity are important in both domestic and international markets. With our small population, vast agricultural resources, modern and efficient production and processing facilities, Canada must export some 80 percent of our production. In this regard, the USA is our biggest customer, while Japan, the Pacific Rim, and the Middle East are growing markets. Canadian farmers are among the most efficient and least subsidized in the world. Our Research and Extension agencies have largely concentrated on production agriculture in the past to help bring this about. However, the future focus on life sciences will bring about more emphasis on environmental quality and valued-added, nutritional and medical linkages, as well as societal and consumer interests."

## FOR INFORMATION

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