Canadian DAIRYING

An Agricultural Tradition

One of the agricultural traditions brought by Europeans to Canada was the keeping of cattle for milk. This practice accompanied settlement in different regions and time periods, from Acadia and New France in the seventeenth century, to western Canada in the nineteenth century. The technology of dairy farming in Canada evolved over the past two centuries through three distinct though overlapping phases: domestic enterprise, farm mechanization, and technological integration. The processing of milk, butter, and cheese moved from farm to factory and the dairy farmer became a specialized fluid milk producer who formed part of an integrated, regulated industry producing a wide variety of milk-based food products for domestic and export markets.

Four technological and scientific innovations adapted from Europe and the United States were important in this transformation: the cream separator, the Babcock Test, the milking machine, and bulk handling of fluid milk. These innovations were introduced to Canadian farmers either by foreign manufacturers who quickly established distributorships in this country or by Canadian manufacturers adding the new technology to their product lines. Both sources advertised heavily in Canadian agricultural publications and made frequent use of agricultural fairs across Canada to ensure that the Canadian farmer was familiar with their products. The Canada Agriculture Museum's collection represents the significant technological and scientific innovations that affected each historical phase in the transformation of the Canadian dairy farm. It has a particular focus on Canadian-made examples of machines and equipment and ranges from handmade wooden butter bowls to a pipeline milking and bulk tank system representative of standard equipment on modern Canadian dairy farms.

Milking stool and pail rest from Quebec's Eastern Townships, built in the 1850s by a farmer for his wife, as it was she who milked the family's cow (010232); tin-plate milk pail (010248)

Domestic Enterprise

Dairying was at first a domestic enterprise. Cows were kept to supply the needs of a single family, with most milk produced during the summer. Although all family members got involved, women and girls were said to be best suited to milking duties because they were more gentle and patient. Equipment such as this homemade wooden milking stool and pail rest (010232, 010248*) was specially built to suit the user. Surplus milk, which soured quickly, was used as animal feed, or made into butter or cheese. This too was the work of farm women, using simple tools,

***Numbers in parentheses are the accession numbers of artifacts held by the Museum.**

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Above: ***Coopered wooden dash butter churn (660338)***

Top right: ***Wooden butter prints were often carved with decorative details such as the Scottish thistle (870037).***

such as an upright dash churn (660338), and butter print (870037). Cheese and butter not consumed at home were bartered or sold.

Beginning in the 1860s, as domestic technology was adapted to larger scale production, cheese factories began to replace cheese making on the farm. In cheese making, rennet was added to milk so that casein, one of the milk solids, formed a coagulated mass. The cheese was cut into small curds, the whey (the liquid remaining) drained away, and the curds allowed to mat together. After all whey was expelled, the curd was pressed into a solid cheese and stored until mature. A common feature of many rural Canadian communities, cheese factories gave farmers a good return for their milk, consequently widespread farm production of cheese soon disappeared in Canada.

Butter, however, remained a farm product much longer because of inadequate techniques for testing cream for butterfat content, and for separating cream from milk. Cows' milk on average contains 4% fat, 3% protein, 5% lactose, 1% minerals, and 87% water. To make butter the cream must first be separated from the rest of the milk. Traditionally milk was allowed to "set" for 24 to 48 hours in a shallow settling pan. The cream,

The 64-centimetre diameter of this pan provided a large surface for the separation of milk and cream. The milk was drained off from the spout on the pan's bottom edge (691106).

the lightest constituent, rose to the surface and was removed with a metal skimmer, though this "shallow" method left a third of the cream in the skim milk. A dash churn agitated the cream to force the fat globules together and the butter was worked with paddles in a bowl to eliminate all the buttermilk.

Butter paddles were often whittled at home from small pieces of locally available hardwood (010158).

Wooden butter bowls were carved by hand with a gouge, or turned on a lathe. The rise of small woodworking factories lead to mass production in a range of sizes (870035).

Time is Money

Technical improvements in the late nineteenth century replaced the torturous dash churns with hand or foot powered barrel churns, allowing farm women to work larger quantities of butter. Barrel churns

Although Beatty Brothers was best known as a supplier of barn fittings, they also sold domestic equipment such as washing machines, and this Beatty No. 2 churn. Women were often portrayed in advertisements using the foot pedal to churn butter while sitting in a chair (990056).

such as the Beatty Brothers "No. 2" (990056) manufactured in Fergus, Ontario, or a rocker churn like the "Buttercup" model (840246) made by F. Sandford of Fenelon Falls, Ontario, proved to be much more

The Buttercup churn rocked on its base like a baby cradle. Baffles inside the churn agitated the cream with a figure-eight motion (840246).

Although the Eureka Sanitary churn would have been easier to clean, it was also more expensive than a wooden one (790358).

effective than their technological predecessors. The ceramic barrel of the Eureka Sanitary churn (790358) manufactured by the Eureka Planter Company of Woodstock, Ontario, could be cleaned more quickly than a wooden one. The V-shaped lever table (691148) and the later roller worker, similar to the “Philadelphia” (800749) made by the De Laval

The roller’s movement forced milk out of the butter, and the liquid drained out the pointed end of the table into a waiting pail. Salt was worked through the soft butter with the same action (691148).

The roller in De Laval’s “Philadelphia” could be cranked back and forth over the mass of butter. De Laval was known as a supplier of everything “dairying” from farm to factory (800749).

Butter moulds were mass produced by small woodworking firms across Canada. Because they held exactly one pound, they helped to standardize the retail sale of butter (870387).

Company of Peterborough, Ontario, improved on the butter bowl and paddles so that more butter could be processed in the same amount of time. A one pound butter mould (870387) made for quick work turning out uniform blocks, and could be used to identify the producer.

The first commercial creameries were established in the 1870s and were soon using an improved “deep” setting method of raising cream in metal cans 50 centimetres high and 20 centimetres across. This faster and more efficient method raised the cream in 24 hours and separated a greater percentage of it. The Champion Cabinet Creamer (730341) working on the principle

The top of the Champion Cabinet creamer was filled with cold water to speed the separation of milk and cream. Once separated, the milk was drained off through the valve at the bottom of each of the three cans contained in the cabinet (730341).

of the Cooley system, patented in the United States in 1875, used tight fitting lids and totally submerged the cans. Most farm families would have used the relatively inexpensive alternative of a cream can (720141) such as those made by General Steelwares that had a tap at the bottom and a viewing window so that first the skim milk and then the cream could be drained off.

General Steelwares of Winnipeg continued to make cream cans well into the 1940s for those farm families who kept only one cow (720141).

When the Cooley can system started to be used on farms in the 1880s, it revealed that not all cows or breeds produced the same percentage of butterfat. This stimulated efforts to improve cattle breeds and eventually led to changing the basis of payment to farmers from weight of milk to amount of butterfat. The transformation of dairying was also affected by other developments in the last decades of the nineteenth century. Markets grew rapidly due to increasing Canadian urban populations and trade preferences in Great Britain. Improved railway transportation, government regulation, and agricultural education programs produced higher quality milk and dairy products.

Butterfat

As cheese factories and creameries were established it became urgent to establish a fair and accurate system of evaluating the quality of the milk as a basis for paying the farmers who supplied them. Various tests for butterfat had been devised in the late nineteenth century but all involved complicated procedures more suitable to a laboratory than a dairy farm.

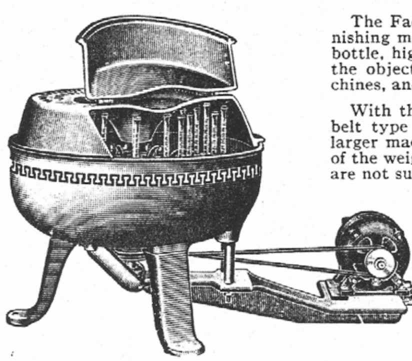
This Babcock tester, supplied by Ketchum Manufacturing of Ottawa, was used in the dairy technology laboratory at the Central Experimental Farm (790290).

The Babcock Test, developed in 1890 by Dr S. M. Babcock of the Wisconsin Agricultural Experiment Station, satisfied the requirements for a rapid, easily performed, inexpensive, and accurate test of butterfat content in milk. Small, equal amounts of milk and sulphuric acid were mixed, the acid dissolving all solids except butterfat. The fat was separated by centrifugal force and then hot water was added to raise the fat into the graduated neck of a bottle where it could be measured.

The Babcock Test proved to be a practical means of determining butterfat production from each cow. It ensured fair payment to farmers for their cream, and it could detect milk adulteration such as watering or skimming. Babcock equipment suitable for milk testing on farms was available in a range of sizes from four-bottle (790290) models to much larger units capable of testing twelve tubes at once, such as the electrically powered testers advertised in the 1930 Cherry Burrell catalogue.

The large electric Babcock testers advertised in Cherry Burrell's catalogue were used by dairies to monitor the butterfat content of incoming milk shipments (C5225 3021).

Burrell-Facile Electric Motor-Driven Babcock Testers

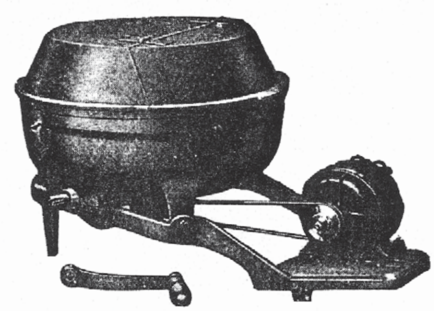


The Facile line is the result of many years' experience in furnishing motor-driven testers, from the 2-bottle Junior to the 40-bottle, high cover and large case tester. In developing this line the object has been to furnish reliable, well-built electric machines, and to this end only the best makes of motors are used.

With the exception of the 2 and 4-bottle open machines, the belt type is used. This has proven more satisfactory for the larger machines, because the motor does not have to carry any of the weight of the rotating parts, and the bearings of the motor are not subject to vibration and wear therefrom.

The belt drive is elastic; requires no starter or rheostat; the motor is less liable to damage from wet, and it is more accessible for oiling and cleaning.

Any of the Facile Testers can be furnished with either alternating or direct current motor and for different voltages. Stock motors, however, are for 110 volt, single phase, 60 cycle alternating current and for 110 volt direct current.



Combined Hand and Electric

24 to 40-Bottle Burrell-Facile High Cover Electric Driven Tester
For 9-inch Test Bottles

These testers are equipped with the same heavy cast iron frames as used in all other models. The spindle is carried down beneath the frame for convenient application of the belt drive. A well-built machine for high-grade accurate testing and severe service.

Regular machines take 6-inch bottles only. High cover machines take either 6-inch or 9-inch bottles.

Bottle carrier is made of heavy steel plate with pressed steel lugs securely riveted, the whole well tinned and is carried on a special ball bearing. Spindle runs in long phosphor bronze bushing.

Improved Combined Hand and Motor Drive Testers
For 6-inch Test Bottles Only

This is an improved type of a combined hand and electric Babcock Tester. It can be run either by hand or electric motor, each independent of the other.

A heavy and substantial machine. Body is of heavy cast iron construction with split hinged cover. Can be ordered either as straight electric drive machine or combined with the hand drive as shown in the illustration.

Bottle carriers of one-piece pressed steel, insuring perfect balance.

Prices include standard motor for 110 volt, 60 cycle, single phase, alternating current. Motors of other specifications may be furnished at slight additional charge.

Rheostat furnished for direct current motor extra..........$....

Electric heaters for Burrell-Facile Testers, consisting of a standard 500 watt, 110 volt space heater, secured to underside of cover, and special switch attached to outside of cover..............................$....

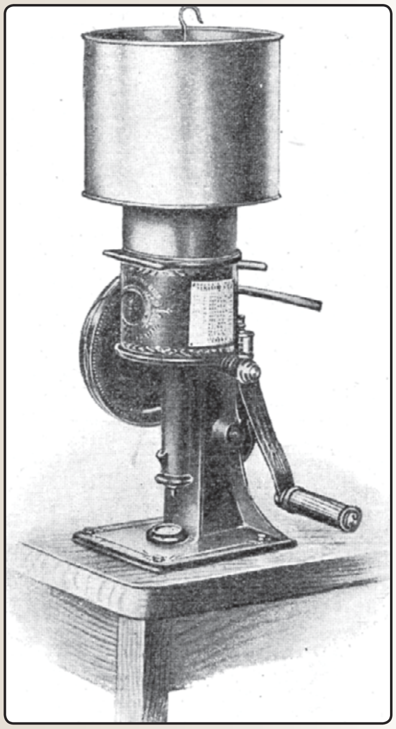
Temperature indicators...................................... ....

Keep test at proper temperature for accurate reading.

List of Sizes

24-Bottle for 6″ and 9″ Bottles, without glassware..............$....
36-Bottle for 6″ and 9″ Bottles, without glassware.............. ....
40-Bottle for 6″ and 9″ Bottles, without glassware.............. ....
8-Bottle Combined Hand and Motor, without glassware......... ....
12-Bottle Combined Hand and Motor, without glassware........ ....
24-Bottle Combined Hand and Motor, without glassware........ ....
8-Bottle Motor Drive only, without glassware.................. ....
12-Bottle Motor Drive only, without glassware................. ....
24-Bottle Motor Drive only, without glassware................. ....

*U. S. Patent No. 1,713,579—5-21-29



De Laval's Hummingbird cream separator was classified as a table model; not as large as floor models, its capacity was accordingly smaller (D2780 30020).

Centrifugal Separation

Another technological innovation that transformed the dairy farm was the continuous centrifugal cream separator, developed in Europe and introduced to Canada in the 1880s. Early machines had to be stopped to remove the separated cream and skim milk. But in 1878 De Laval of Sweden developed a continuous flow cream separator featuring an airtight "bowl" containing the milk and rotated at high speed, such as De Laval's circa 1900 "Hummingbird". Centrifugal force moved the lighter cream to the centre of the container and the skim milk to the outside for removal while the machine was in operation.

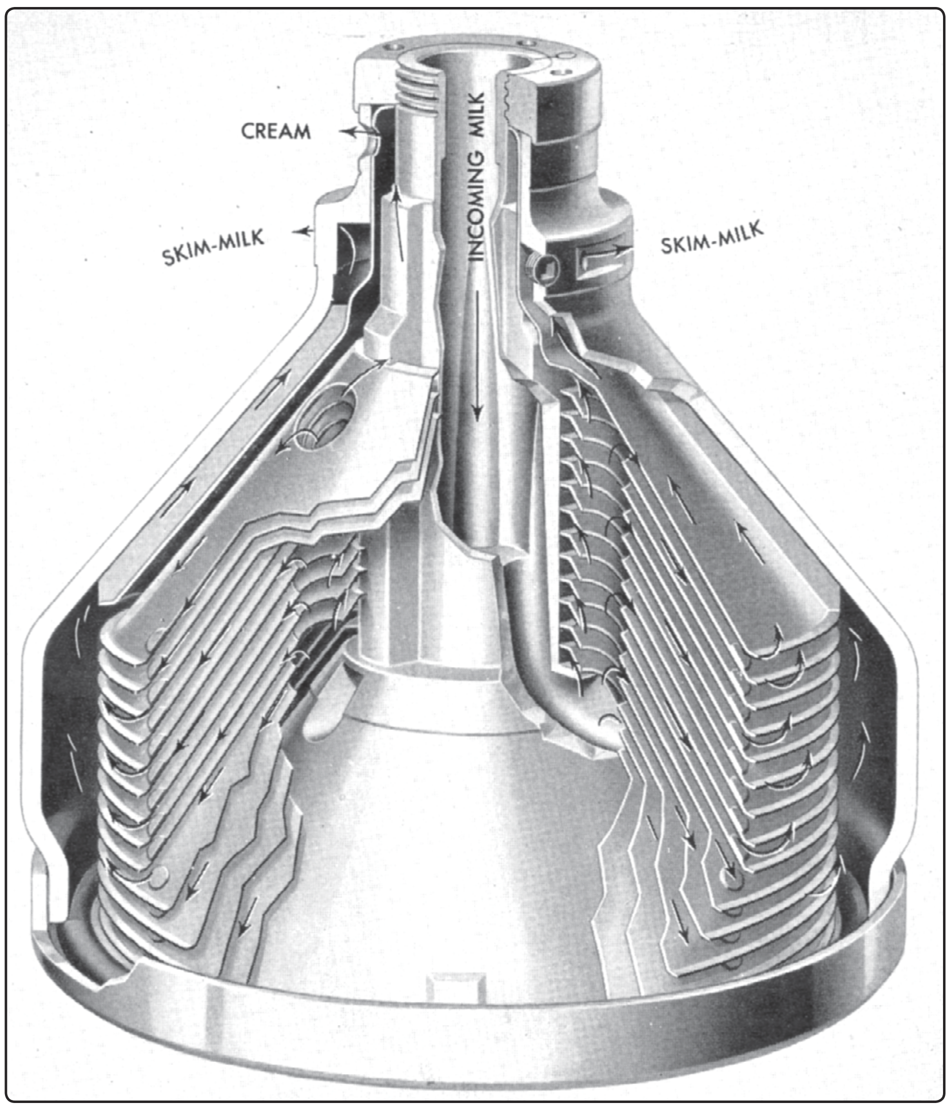
Although the centrifugal separator was more efficient than the "setting" method, it still left 0.16% butterfat in the skim milk.

The addition of baffles to the original hollow bowl diverted and elongated the paths of the skim milk and cream through the bowl, resulting in better separation. This improvement is a feature of the "Oxford" (790495) manufactured by the Durham Manufacturing Company of Durham, Ontario.

In the 1890s De Laval introduced a lasting refinement by using conical metal disks which so increased efficiency that only 0.05% of the fat remained in the skim milk. A variety of imported and Canadian

In the heyday of cream separators there were many small manufacturers, such as Durham Manufacturing, who advertised in farm papers to introduce their product to farmers in their area (790495).

The cream separator's bowl, spouts and disks all had to be washed in hot water after each use to remove rancid milk that might contaminate the next batch (D2780 3012C).



Although the Renfrew Machinery Company's factory was in Ontario, like many of its competitors it established branch offices across Canada so it could quickly service the needs of its clients (R4119 3001).

separators incorporated conical disks, among them the "Standard" sold across Canada by the Renfrew Machinery Company of Renfrew, Ontario, and the "Vega F2" (790394) made in Sweden and distributed in western Canada.

Although most cream separators used in Canada were manufactured in North America, some were imported from Europe, like the Vega from Sweden (790394).

Hand-operated cream separators began appearing on Canadian dairy farms in the 1890s and their operation became part of the daily routine of farm women for many decades. Manufacturers such as De Laval supplied their agents with signs with which to promote sales of the company's products (660705). Farm separation of cream ensured that farmers got full value for the butterfat production of their dairy herds, while the separator's higher butterfat yields stimulated the growth of cream gathering creameries. Electrically powered

Manufacturers provided retailers and farmers with signs designed to promote product sales (660705).

separators, such as the McCormick-Deering 3-S (770578), gradually replaced hand-powered machines in the twentieth century. By the 1940s, the Swedish Separator Company of Montreal, Quebec, was advertising a complete line of electric cream separators (890371). Eventually creameries developed

With rural electrification many tasks previously done by hand, such as the operation of cream separators and washing machines, were assumed by electric motors (770578).

the equipment to separate vast amounts of milk efficiently, but dairy farms with a small herd or a preference for older methods continued to use farm separators.

Home Delivery

Although some farmers had begun distributing milk to urban customers in the nineteenth century, improved rail and road transportation lead to independent shippers starting to purchase milk from the farm and delivering it to urban centres. Modern milk distribution began in 1900 with the organization of dairies in Ottawa, Toronto, and Montreal. New products such as condensed milk, powdered milk, and ice cream increased the demand for milk. Industry and urban consumers created a demand for a continual supply of milk and cream,

Viking cream separators and milkers were manufactured by the Swedish Separator Company which, despite its name, was located in Chicago and Montreal (890371).

and dairy farming became a year-round operation.

A constant challenge in dairying was sanitation. Farm-delivered milk had once reached the householder in pails, cans, or any available container. The glass milk bottle, patented in the United States in 1884, soon became required packaging for home milk delivery, one of many sanitary improvements adopted in the twentieth century. Once the relationship of bacteria, milk quality, and human health was understood, public awareness and government regulation combined to ensure better milk quality through pasteurization, sterilization, and farm and factory cooling and refrigeration systems. Often dairies supplied farmers with bulk shipping cans in order to ensure that their product was being delivered in sanitary containers. Since many dairies used steam as a source of power, they were also able to sterilize the empty cans before returning them to the farm. The four-gallon shipping can (751033) at the far left was used by the Pleasant View Dairy of Pembroke, Ontario. Parson's Dairy's milk bottle (750819) advertised that they sold "certified milk." In the 1920s the Canadian Tuberculosis Association mounted a public education campaign with a poster (930183) promoting the benefits of drinking milk.

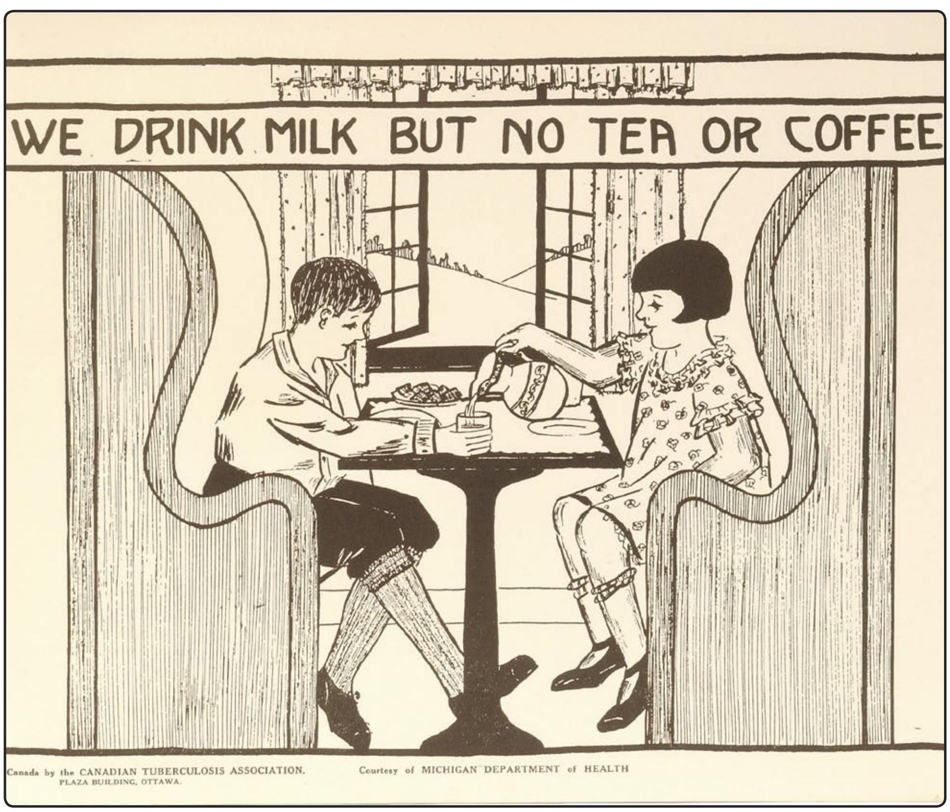
The shoulders of milk shipping cans were inscribed with the name of the dairy that supplied them. Farmers often painted their name or an identification number on the can to ensure its return (751033).

When it was discovered that tuberculosis could be passed from cow to human, dairies went out of their way to inform consumers that their suppliers' herds had been tested by a veterinarian (750819).

The Canadian Tuberculosis Association reassured Canadians that drinking milk was still highly beneficial to children (930183).

A Mechanical Dairymaid

The technological innovation that eventually enabled dairy farmers to meet the demand for increased and better quality milk was the milking machine. On average it takes ten minutes to milk a cow by hand and each must be milked at least twice daily, so as herd size increased so too did time and labour commitments. Attempts to invent a milking machine began in Europe and the United States in the 1870s, but a practical model was not developed until a proper



Above: ***The operator sat on the Wm. M. Mehring milker and "rowed" with his feet to create suction to milk the cow (780484).***

Top left: ***Although the belt kept the milker off the stable floor, an unco-operative cow must have complicated the placement of belt and milker. Surge continues to be a major supplier of dairy equipment (720127).***

understanding was achieved of how a cow produces and lets down milk, and until steady power sources and suitable manufacturing materials were available.

Experiments with milking machines tried three different methods: insertion of tubes into the cow's teats, external pressure on the teats, and continuous suction. The first two could injure the teats while the third could cause congestion in the teat, stopping the flow of milk. The principle of intermittent suction and release, first tried in 1895 and most closely imitating the natural action of a calf suckling, eventually became the method universally adopted.

The basic parts of a milking machine consisted of a power source, a pump to provide vacuum, pipes or hoses to the cow, a device for providing pulsations on the cow's teats, and a pail for collecting the milk. In the rubber-lined teat cups, a pulsator alternately compressed and relaxed the flexible liner causing the suction to become intermittent, an action which best released a cow's milk. An early variation of this method used intermittent action without compression, as in the 1899 Wm. M. Mehring milker (780484), but the suction and release method became the standard. It was used with milker pails that hung from a strap over the cow, such as the Surge "Omega" (720127), or in a floor model,

Cockshutt did not manufacture dairy equipment, but the importance of dairying meant that as a full-line company it had to be included in its product line (790658).

such as the Cockshutt Plow Company Conde milker (790658). Portable milkers are self-contained units that move from cow to cow; the Museum's 1923 McCartney (730345) is an example of one wheeled on a cart. Although the milking machine's major impact was as a labour-saving device, allowing farmers to milk more cows within the same period of time, Canadian dairy farmers were slow to adopt it. The milking machine was complicated and expensive and there were complaints about contamination, although most were attributed to careless operators rather than to the machines. Milking

It was no longer necessary to hand milk into a pail, but once full, the can on the McCartney still had to be emptied into a larger milk shipping can (730345).

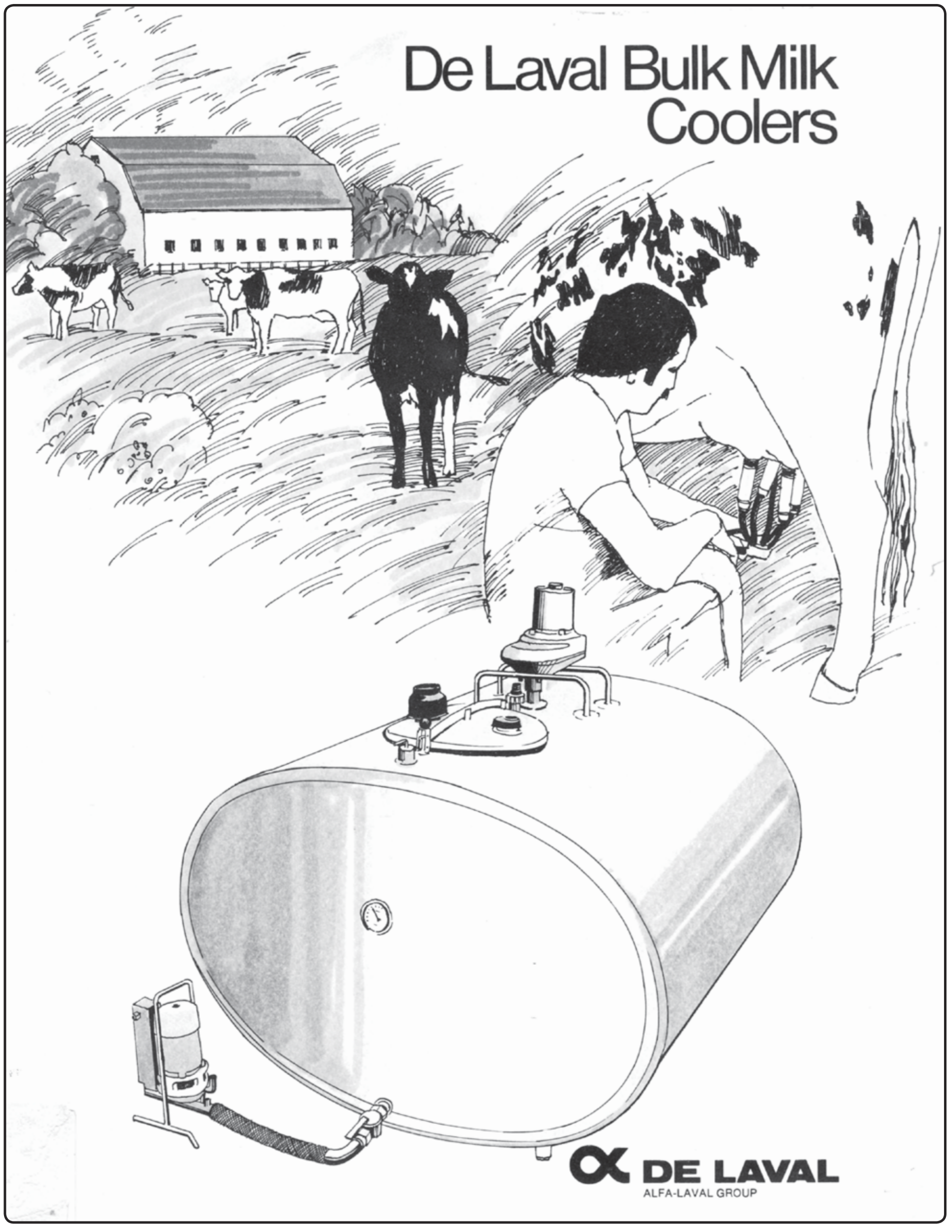
machines were not in common use on Canadian dairy farms until after the 1950s.

Pipelines and Bulk Trucks

The last period in the transformation of dairy farm technology began in the 1950s and was largely completed within twenty years with the adoption of the bulk milk tank system. By this time milking machines had divided into two types: portable and pipeline. Pipeline systems included either a pipeline for the air supply from the vacuum pump to the milker or a pipeline from the cow to the milk house for transporting the milk, together with a separate air line.
The vacuum pump produced a continuous suction that was transmitted by pipeline to individual milkers.

As long as milk continued to be poured by hand into cans for pick-up or delivery, labour costs and contamination remained

This re-created circa 1950s milk room at the Canada Agriculture Museum interprets early bulk tank/pipeline milking.



Stainless steel has become the standard material in the construction of bulk tanks such as the one in this advertisement from Alfa Laval (D2780 3022).

problems. Bulk handling of milk from cow to processing plant was the response to these challenges. The Museum's working De Laval pipeline milking system includes a bulk milk tank and an automated cleaning system for hoses and pipes.

Bulk tank trucks for movement of milk from farm to dairy, inspired by railway tank cars, had first been tried in the United States as early as 1912 with a glass-lined tank mounted on a truck. An oval tank designed in 1929 made handling easier and by the 1930s glass-lined, cork-insulated tanks were equipped with inlet and outlet valves and pumps for loading and unloading. After experiments with glass, nickel, tinned-lined steel, and aluminum, stainless steel became the standard material for bulk milk tanks.

Bulk transportation of milk required a refrigerated tank, such as the one created by Alfa De Laval (D2780 3022), to be located at the farm to hold the milk until it could be pumped into a tank truck for transport to the dairy. Improvements to the milk house, water supply, wiring, and farm lane were also usually necessary. Bulk handling of milk began in Canada in 1953 by a small dairy in Ontario. Some farmers installed pipelines to connect the milking machine directly to the holding tank; others continued to pour milk manually from the milker pail into the tank. Those who converted to bulk handling saw two advantages: less heavy labour with the elimination of the need for milk cans, and better quality milk. In the early 1960s many farmers converted from cans to bulk tanks because processors were willing to pay a premium for the higher grade of milk that bulk handling guaranteed, and were unwilling to pay the increasing replacement costs of milk cans. By the 1980s almost all Canadian dairy farmers had switched to bulk tanks and a majority used pipeline milking systems.

A modern pipeline system features a vacuum line connection between each of the stalls, to which the herdsperson attaches the hoses from the milker.

The Canada Agriculture Museum's stainless steel bulk tank

The Future: Robots Take Over the Milking?

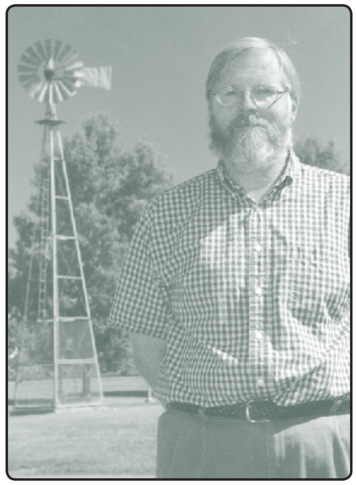
The personal computer, a common feature in many Canadian homes, also found its way into the dairy barn, to be used in the control of feed rationing and herd management. Computers are also an essential financial record-keeping tool, with special software being designed for use by dairy operations. But even with these and the many other technological aids now available, a dairy farmer remains closely tied to the herd. Each dairy cow must be milked at least twice daily year-round so, unlike a field crop operation, there is no off-season. Despite this reality, the majority of Canadian dairy farms remain family operations.

The arm of the Lely Astronaut robotic milker automatically swings out, locates and cleans the teats, and attaches the milking apparatus to them (ca 2002).

Since the late 1980s, the number of dairy farmers and dairy cows in Canada has steadily declined, yet milk production levels have increased slightly. This is due in large part to higher per-cow production levels. Although the average Canadian dairy herd consists of sixty cows, some farmers have adopted a “larger is better” philosophy, often keeping three hundred cows of which two hundred are being milked at any one time. This has renewed interest in further mechanizing the highly labour-intensive milking operation. A solution adopted by some dairy farmers is a robotic milker.

The first, an AMS Liberty manufactured by the Prolion Corporation, was installed on a Dutch dairy farm in 1992 and the technology brought to an Ontario farm seven years later. Now Canadian farmers can choose from units from each of the four large dairy equipment firms active in this country. All work on the principle that when a cow’s udder is full and uncomfortable she will voluntarily come in to get milked. When she enters the unit, a laser senses the location of her teats, cleaning them and the udder, then attaching the cups individually to her teats. As she is milked, a feed ration is offered and once completed the cow is mechanically ushered out of the milking enclosure. An electronic collar on the cow’s neck tracks her production and sends it to a computer elsewhere on the farm. As the system also records how often she comes in to be milked, the farmer can supplement her rations to stimulate increased production, in some instances leading to a third daily milking.

Despite the introduction of alternatives such as soy beverages there remains a strong market for real dairy milk and associated products. Most recently, issues of food purity and controversy about the use of hormones to stimulate milk production have lead some consumers to seek organic milk, giving rise to certified organic dairy operations across Canada. The dairy industry has an impressive record in responding to technological challenges. The main challenge facing the future of dairy farming in Canada will be to ensure that farmers are paid enough to cover their costs and allow for profitability, and to retain its viability as a livelihood.



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