

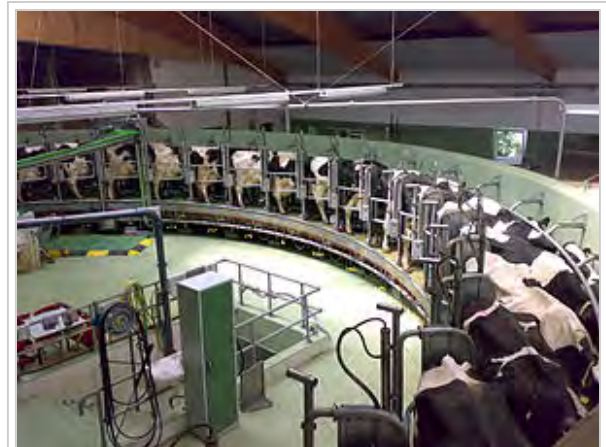
Dairy farming

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Dairy farming is a class of agriculture for long-term production of milk, which is processed (either on the farm or at a dairy plant, either of which may be called a dairy) for eventual sale of a dairy product.

Contents

- 1 Common species
- 2 History
 - 2.1 Hand milking
 - 2.2 Vacuum bucket milking
 - 2.3 Milking pipeline
 - 2.4 Milking parlors
 - 2.4.1 Herringbone and parallel parlors
 - 2.4.2 Rotary parlors
 - 2.5 Automatic milker take-off
 - 2.6 Fully automated robotic milking
- 3 History of milk preservation methods
 - 3.1 Refrigeration
- 4 Milking operation
- 5 Management of the herd
- 6 Concerns
 - 6.1 Animal waste from large cattle dairies
 - 6.2 Use of hormones
 - 6.3 Animal welfare
- 7 Market
 - 7.1 Worldwide
 - 7.2 Supply management
 - 7.3 European Union
 - 7.4 Israel
 - 7.5 United States
- 8 See also
- 9 References
- 10 External links



A rotary milking parlor at a modern dairy facility, located in Germany

Common species

Although any mammal can produce milk, commercial dairy farms are typically one-species enterprises. In developed countries, dairy farms typically consist of high producing dairy cows. Other species used in commercial dairy farming include goats, sheep, and camels. In Italy, donkey dairies are growing in popularity to produce an alternative milk source for human infants.^[1]

History

Dairy farming has been part of agriculture for thousands of years. Historically it has been one part of small, diverse farms. In the last century or so larger farms doing only dairy production have emerged. Large scale dairy farming is only viable where either a large amount of milk is required for production of more durable dairy products such as cheese, butter, etc. or there is a substantial market of people with cash to buy milk, but no cows of their own.

Hand milking

Centralized dairy farming as we understand it primarily developed around villages and cities, where residents were unable to have cows of their own due to a lack of grazing land. Near the town, farmers could make some extra money on the side by having additional animals and selling the milk in town. The dairy farmers would fill barrels with milk in the morning and bring it to market on a wagon. Until the late 19th century, the milking of the cow was done by hand. In the United States, several large dairy operations existed in some northeastern states and in the west, that involved as many as several hundred cows, but an individual milker could not be expected to milk more than a dozen cows a day. Smaller operations predominated.

For most herds, milking took place indoors twice a day,^[2] in a barn with the cattle tied by the neck with ropes or held in place by stanchions. Feeding could occur simultaneously with milking in the barn, although most dairy cattle were pastured during the day between milkings. Such examples of this method of dairy farming are difficult to locate, but some are preserved as a historic site for a glimpse into the days gone by. One such instance that is open for this is at Point Reyes National Seashore.^[3]

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Vacuum bucket milking



A dairy farm on the banks of the Columbia River in Clark County, Washington (May 1973).



Woman hand milking a cow.

The first milking machines were an extension of the traditional milking pail. The early milker device fit on top of a regular milk pail and sat on the floor under the cow. Following each cow being milked, the bucket would be dumped into a holding tank. These were introduced in the early 20th century.

This developed into the Surge hanging milker. Prior to milking a cow, a large wide leather strap called a surcingle was put around the cow, across the cow's lower back. The milker device and collection tank hung underneath the cow from the strap. This innovation allowed the cow to move around naturally during the milking process rather than having to stand perfectly still over a bucket on the floor.



Demonstration of a new Soviet milker device. East Germany, 1952

Milking pipeline

The next innovation in automatic milking was the milk pipeline, introduced in the late 20th century. This uses a permanent milk-return pipe and a second vacuum pipe that encircles the barn or milking parlor above the rows of cows, with quick-seal entry ports above each cow. By eliminating the need for the milk container, the milking device shrank in size and weight to the point where it could hang under the cow, held up only by the sucking force of the milker nipples on the cow's udder. The milk is pulled up into the milk-return pipe by the vacuum system, and then flows by gravity to the milkhouse vacuum-breaker that puts the milk in the storage tank. The pipeline system greatly reduced the physical labor of milking since the farmer no longer needed to carry around huge heavy buckets of milk from each cow.

The pipeline allowed barn length to keep increasing and expanding, but after a point farmers started to milk the cows in large groups, filling the barn with one-half to one-third of the herd, milking the animals, and then emptying and refilling the barn. As herd sizes continued to increase, this evolved into the more efficient milking parlor.

Milking parlors

Innovation in milking focused on mechanizing the milking parlor (known in Australia and New Zealand as a *milking shed*) to maximize the number of cows per operator which streamlined the milking process to permit cows to be milked as if on an assembly line, and to reduce physical stresses on the farmer by putting the cows on a platform slightly above the person milking the cows to eliminate having to constantly bend over. Many older and smaller farms still have tie-stall or stanchion barns, but worldwide a majority of commercial farms have parlors.

Herringbone and parallel parlors

In herringbone and parallel parlors, the milker generally milks one row at a time. The milker will move a row of cows from the holding yard into the milking parlor, and milk each cow in



Efficiency of four different milking parlors.

- 1=Bali-Style 50 cows/h.
- 2=Swingover 60 cows/h.
- 3=Herringbone 75 cows/h.
- 4=Rotary 250 cows/h.

that row. Once all of the milking machines have been removed from the milked row, the milker releases the cows to their feed. A new group of cows is then loaded into the now vacant side and the process repeats until all cows are milked. Depending on the size of the milking parlor, which normally is the bottleneck, these rows of cows can range from four to sixty at a time. The benefits of a herringbone parlour are easy maintenance, the durability, stability, and improved safety for animals and humans when compared to tie stall ^[4]

Rotary parlors

In rotary parlors, the cows are loaded one at a time onto the platform as it rotates. The milker stands near the entry to the parlor and puts the cups on the cows as they move past. By the time the platform has completed almost a full rotation, another milker or a machine removes the cups and the cow steps backwards off the platform and then walks to its feed. Rotary cowsheds, as they are called in New Zealand, started in the 1980s^{[5][6]} but are expensive compared to Herringbone cowshed - the older New Zealand norm.^[7]



Rotary milking parlor

Automatic milker take-off

It can be harmful to an animal for it to be over-milked past the point where the udder has stopped releasing milk. Consequently, the milking process involves not just applying the milker, but also monitoring the process to determine when the animal has been *milked out* and the milker should be removed. While parlor operations allowed a farmer to milk many more animals much more quickly, it also increased the number of animals to be monitored simultaneously by the farmer. The automatic take-off system was developed to remove the milker from the cow when the milk flow reaches a preset level, relieving the farmer of the duties of carefully watching over 20 or more animals being milked at the same time.

Fully automated robotic milking

In the 1980s and 1990s, robotic milking systems were developed and introduced (principally in the EU). Thousands of these systems are now in routine operation. In these systems the cow has a high degree of autonomy to choose her time of milking freely during the day (some alternatives may apply, depending on cow-traffic solution used at a farm level). These systems are generally limited to intensively managed systems although research continues to match them to the requirements of grazing cattle and to develop sensors to detect animal health and fertility automatically. Every time the cow enters the milking unit she is fed concentrates and her collar is scanned to record production data.



An automatic milking system unit as an exhibit at a museum

History of milk preservation methods

Cool temperature has been the main method by which milk freshness has been extended. When windmills and well pumps were invented, one of their first uses on the farm, besides providing water for animals themselves, was for cooling milk, to extend its storage life, until it would be transported to the town market.

The naturally cold underground water would be continuously pumped into a cooling tub or vat. Tall, ten-gallon metal containers filled with freshly obtained milk, which is naturally warm, were placed in this cooling bath. This method of milk cooling was popular before the arrival of electricity and refrigeration.

Refrigeration

When refrigeration first arrived (the 19th century) the equipment was initially used to cool cans of milk, which were filled by hand milking. These cans were placed into a cooled water bath to remove heat and keep them cool until they were able to be transported to a collection facility. As more automated methods were developed for harvesting milk, hand milking was replaced and, as a result, the milk can was replaced by a bulk milk cooler. 'Ice banks' were the first type of bulk milk cooler. This was a double wall vessel with evaporator coils and water located between the walls at the bottom and sides of the tank. A small refrigeration compressor was used to remove heat from the evaporator coils. Ice eventually builds up around the coils, until it reaches a thickness of about three inches surrounding each pipe, and the cooling system shuts off. When the milking operation starts, only the milk agitator and the water circulation pump, which flows water across the ice and the steel walls of the tank, are needed to reduce the incoming milk to a temperature below 5 degrees.

This cooling method worked well for smaller dairies, however was fairly inefficient and was unable to meet the increasingly higher cooling demand of larger milking parlors. In the mid-1950s direct expansion refrigeration was first applied directly to the bulk milk cooler. This type of cooling utilizes an evaporator built directly into the inner wall of the storage tank to remove heat from the milk. Direct expansion is able to cool milk at a much faster rate than early ice bank type coolers and is still the primary method for bulk tank cooling today on small to medium-sized operations.

Another device which has contributed significantly to milk quality is the plate heat exchanger (PHE). This device utilizes a number of specially designed stainless steel plates with small spaces between them. Milk is passed between every other set of plates with water being passed between the balance of the plates to remove heat from the milk. This method of cooling can remove large amounts of heat from the milk in a very short time, thus drastically slowing bacteria growth and thereby improving milk quality. Ground water is the most common source of cooling medium for this device. Dairy cows consume approximately 3 gallons of water for every gallon of milk production and prefer to drink slightly warm water as opposed to cold ground water. For this reason, PHE's can result in drastically improved milk quality, reduced operating costs for the dairymen by reducing the refrigeration load on his bulk milk cooler, and increased milk production by supplying the cows with a source of fresh warm water.

Plate heat exchangers have also evolved as a result of the increase of dairy farm herd sizes in the United States. As a dairyman increases the size of his herd, he must also increase the capacity of his milking parlor in order to harvest the additional milk. This increase in parlor sizes has resulted in tremendous increases in milk throughput and cooling demand. Today's larger farms produce milk at a rate which direct expansion refrigeration systems on bulk milk coolers cannot cool in a timely manner. PHE's are typically utilized in this instance to rapidly cool the milk to the desired temperature (or close to it) before it reaches the bulk milk tank. Typically, ground water is still utilized to provide some initial cooling to bring the milk to between 55 and 70 °F (21 °C). A second (and sometimes third) section of the PHE is added to remove the remaining heat with a mixture of chilled pure water and propylene glycol. These chiller systems can be made to incorporate large evaporator surface areas and high chilled water flow rates to cool high flow rates of milk.

Milking operation

Milking machines are held in place automatically by a vacuum system that draws the ambient air pressure down from 15 to 21 pounds per square inch (100 to 140 kPa) of vacuum. The vacuum is also used to lift milk vertically through small diameter hoses, into the receiving can. A milk lift pump draws the milk from the receiving can through large diameter stainless steel piping, through the plate cooler, then into a refrigerated bulk tank.

Milk is extracted from the cow's udder by flexible rubber sheaths known as liners or inflations that are surrounded by a rigid air chamber. A pulsating flow of ambient air and vacuum is applied to the inflation's air chamber during the milking process. When ambient air is allowed to enter the chamber, the vacuum inside the inflation causes the inflation to collapse around the cow's teat, squeezing the milk out of teat in a similar fashion as a baby calf's mouth massaging the teat. When the vacuum is reapplied in the chamber the flexible rubber inflation relaxes and opens up, preparing for the next squeezing cycle.

It takes the average cow three to five minutes to give her milk. Some cows are faster or slower. Slow-milking cows may take up to fifteen minutes to let down all their milk. Though milking speed is not related to the quality of milk produced by the cow, it does impact the management of the milking process. Because most milkers milk cattle in groups, the milker can only process a group of cows at the speed of the slowest-milking cow. For this reason, many farmers will group slow-milking cows so as not to stress the faster milking cows.

The extracted milk passes through a strainer and plate heat exchangers before entering the tank, where it can be stored safely for a few days at approximately 40 °F (4 °C). At pre-arranged times, a milk truck arrives and pumps the milk from the tank for transport to a dairy factory where it will be pasteurized and processed into many products. The frequency of pick up depends on the production and storage capacity of the dairy; large dairies will have milk pick-ups once per day.

Management of the herd

Modern dairy farmers use milking machines and sophisticated plumbing systems to harvest and store the milk from the cows, which are usually milked two or three times daily. In New Zealand, some farmers seeking a better life style, are milking only once per day, trading a slight reduction in production of milk for increased leisure time.^[8] During the summer months, cows may be turned out to graze in pastures, both day and night, and are brought into the barn to be milked.

Barns may also incorporate tunnel ventilation into the architecture of the barn structure.^[9] This ventilation system is highly efficient and involves opening both ends of the structure allowing cool air to blow through the building. Farmers with this type of structure keep cows inside during the summer months to prevent heat stress, sunburn and damage to udders. During the winter months the cows may be kept in the barn, which is warmed by their collective body heat. Even in winter, the heat produced by the cattle requires the barns to be ventilated for cooling purposes. Many large, modern facilities, and particularly those in tropical areas, keep all animals inside at all times to facilitate herd management.

Farmers typically grow their own food for their cattle. Crops grown may include corn, alfalfa, timothy, wheat, oats, sorghum and clover. These plants are often processed after harvest to preserve or improve nutrient value and prevent spoiling. Corn, alfalfa, wheat, oats, and sorghum crops are often anaerobically fermented to create silage. Many crops such as alfalfa, timothy, oats, and clover are allowed to dry in the field after cutting before being baled into hay.

In the southern hemisphere such as in Australia and New Zealand, cows spend most of their lives outside on pasture, although they may receive supplementation during periods of low pasture availability.^[10] Typical supplementary feeds in Australasia are hay, silage or ground maize. The trend in New Zealand is towards feeding cows on a concrete pad to prevent loss of feed by trampling. In New Zealand slower growing winter pasture is rationed. It is carefully controlled by light weight portable electric break feeding fences run on mains power that can be easily repositioned.

Concerns

Animal waste from large cattle dairies

As measured in phosphorus, the waste output of 5,000 cows roughly equals a municipality of 70,000 people.^[11] In the U.S., dairy operations with more than 1,000 cows meet the EPA definition of a CAFO (Concentrated Animal Feeding Operation), and are subject to EPA regulations.^[12] For example, in the San Joaquin Valley of California a number of dairies have been established on a very large scale. Each dairy consists of several modern milking parlor set-ups operated as a single enterprise. Each milking parlor is surrounded by a set of 3 or 4 loafing barns housing 1,500 or 2,000 cattle. Some of the larger dairies have planned 10 or more series of loafing barns and milking parlors in this arrangement, so that the total operation may include as many as 15,000 or 20,000 cows. The milking process for these dairies is similar to a smaller dairy with a single milking parlor but repeated several times. The size and concentration of cattle creates major environmental issues associated with manure handling and disposal, which requires substantial areas of cropland (a ratio of 5 or 6 cows to the acre, or several thousand acres for dairies of this size) for manure spreading and dispersion, or several-acre methane digesters. Air pollution from methane gas associated with manure management also is a major concern. As a result, proposals to develop dairies of this size can be controversial and provoke substantial opposition from environmentalists including the Sierra Club and local activists.^{[13][14]}



The potential impact of large dairies was demonstrated when a massive manure spill occurred on a 5,000-cow dairy in Upstate New York, contaminating a 20-mile (32 km) stretch of the Black River, and killing 375,000 fish. On 10 August 2005, a manure storage lagoon collapsed releasing 3,000,000 US gallons (11,000,000 l; 2,500,000 imp gal) of manure into the Black River. Subsequently the New York Department of Environmental Conservation mandated a settlement package of \$2.2 million against the dairy.^[11]

When properly managed, dairy and other livestock waste, due to its nutrient content (N, P, K), makes an excellent fertilizer promoting crop growth, increasing soil organic matter, and improving overall soil fertility and tilth characteristics. Most dairy farms in the United States are required to develop nutrient management plans for their farms, to help balance the flow of nutrients and reduce the risks of

environmental pollution. These plans encourage producers to monitor all nutrients coming onto the farm as feed, forage, animals, fertilizer, etc. and all nutrients exiting the farm as product, crop, animals, manure, etc.^[15] For example, a precision approach to animal feeding results in less overfeeding of nutrients and a subsequent decrease in environmental excretion of nutrients, such as phosphorus. In recent years, nutritionists have realized that requirements for phosphorus are much lower than previously thought.^[16] These changes have allowed dairy producers to reduce the amount of phosphorus being fed to their cows with a reduction in environmental pollution.^[17]

Use of hormones

It is possible to maintain higher milk production by supplementing cows with growth hormones known as recombinant BST or rBST, but this is controversial due to its effects on animal and possibly human health. The European Union, Japan, Australia, New Zealand and Canada have banned its use due to these concerns.

In the US however, no such prohibition exists, and approximately 17.2% of dairy cows are treated in this way.^[18] The U.S. Food and Drug Administration states that no "significant difference" has been found between milk from treated and non-treated cows^[19] but based on consumer concerns several milk purchasers and resellers have elected not to purchase milk produced with rBST.^{[20][21] [21] [22] [23]}

Animal welfare

The practice of dairy production in a factory farm environment has been criticized by animal welfare activists.^{[24][25]} Some of the ethical complaints regarding dairy production cited include how often the dairy cattle must remain pregnant, the separation of calves from their mothers, how dairy cattle are housed and environmental concerns regarding dairy production.

The production of milk requires that the cow be in lactation, which is a result of the cow having given birth to a calf. The cycle of insemination, pregnancy, parturition, and lactation, followed by a "dry" period of about two months of forty-five to fifty days, before calving which allows udder tissue to regenerate. A dry period that falls outside this time frame can result in decreased milk production in subsequent lactation.^[26]

An important part of the dairy industry is the removal of the calves off the mother's milk after the three days of needed colostrum,^[27] allowing for the collection of the milk produced. On some dairies, in order for this to take place, the calves are fed milk replacer, a substitute for the whole milk produced by the cow.^[27] Milk replacer is generally a powder, which comes in large bags, and is added to precise amounts of water, and then fed to the calf via bucket or bottle. However, not all dairies use milk replacer - some continue to feed calves milk from the cows in the milking herd. Some dairies even pasteurize extra milk from the main herd to feed calves.

Milk replacers are classified by three categories: protein source, protein/fat (energy) levels, and medication or additives (e.g. vitamins and minerals).^[28] Proteins for the milk replacer come from different sources; the more favorable and more expensive^[29] all milk protein (e.g. whey protein- a by-product of the cheese industry) and alternative proteins including soy, animal plasma and wheat gluten.^[28] The ideal levels for fat and protein in milk replacer are 10-28% and 18-30%, respectively.^[28] The higher the energy levels (fat and protein), the less starter feed (feed which is given to young animals) the animal will consume. Weaning can

take place when a calf is consuming at least two pounds of starter feed a day and has been on starter for at least three weeks.^[29] Milk replacer has climbed in cost US\$15–20 a bag in recent years, so early weaning is economically crucial to effective calf management.^[30]

Because of the danger of infection to humans, it is important to maintain the health of milk-producing cattle. Common ailments affecting dairy cows include infectious disease (e.g. mastitis, endometritis and digital dermatitis), metabolic disease (e.g. milk fever and ketosis) and injuries caused by their environment (e.g. hoof and hock lesions).^[31]

Lameness is commonly considered one of the most significant animal welfare issues for dairy cattle,^{[31][32][33][34]} and is best defined as any abnormality that causes an animal to change its gait.^[35] It can be caused by a number of sources, including infections of the hoof tissue (e.g. fungal infections that cause dermatitis) and physical damage causing bruising or lesions (e.g. ulcers or hemorrhage of the hoof).^[34] Housing and management features common in modern dairy farms (such as concrete barn floors, limited access to pasture and suboptimal bed-stall design) have been identified as contributing risk factors to infections and injuries.^[36] New dairy farms being built now include non-slip flooring and other features designed to minimize risk to cows when moving between pens and to the milking parlor.

Market

Worldwide

There is a great deal of variation in the pattern of dairy production worldwide. Many countries which are large producers consume most of this internally, while others (in particular New Zealand), export a large percentage of their production. Internal consumption is often in the form of liquid milk, while the bulk of international trade is in processed dairy products such as milk powder.

The milking of cows was traditionally a labor-intensive operation and still is in less developed countries. Small farms need several people to milk and care for only a few dozen cows, though for many farms these employees have traditionally been the children of the farm family, giving rise to the term "family farm".

Advances in technology have mostly led to the radical redefinition of "family farms" in industrialized countries such as Australia, New Zealand, and the United States. With farms of hundreds of cows producing large volumes of milk, the larger and more efficient dairy farms are more able to weather severe changes in milk price and operate profitably, while "traditional" family farms generally do not have the equity or income other larger scale farms do. The common public perception of large corporate farms supplanting smaller ones is generally a misconception, as many small family farms expand to take advantage of economies of scale, and incorporate the business to limit the legal liabilities of the owners and simplify such things as tax management.



Holstein cows on a dairy farm, Comboyne, New South Wales



Dairy farm in Võru Parish, Estonia

Before large scale mechanization arrived in the 1950s, keeping a dozen milk cows for the sale of milk was profitable. Now most dairies must have more than one hundred cows being milked at a time in order to be profitable, with other cows and heifers waiting to be "freshened" to join the milking herd . In New Zealand the average herd size, for the 2009/2010 season, is 376 cows.

Worldwide, the largest milk producer is India^[37] (more than 55% buffalo milk), the largest cow milk exporter is New Zealand,^{[38][39]} and the largest importer is China.^[40] The European Union with its present 28 member countries produced 158,800,000 metric tons (156,300,000 long tons; 175,000,000 short tons) in 2013^[41](96.8% cow milk), the most by any politico-economic union.

Supply management

In Canada the dairy industry a system was put in by the Canadian Dairy Commission that is responsible for maintaining a stable market and line of employment for farmers by using a Supply Management System. This system was put into play in the early 1970s for a consistent pricing of milk for farmers, ensuring no fluctuation in the market^[42] The prices are based on the demand for milk throughout the country and how much is being produced. The Canadian Milk Supply Management Committee is in charge of monitoring the production rates of milk.^[43] In order to start a new farm or increase production more share into the SMS needs to be bought into known as "Quota". Quota is a fixed amount that an individual or group are bound to produce or receive.^[44] in this case farmers must remain up to or below the amount of "quota" they have bought share of. Each province in Canada has their own cap on quota based on the demand in the market^[45] There is a cap on the countries quota known as total quota per month. In the month of 2016 the total kgs of butter fat produced per month was 28,395,848^[46]

World total milk production in 2009

FAO statistics ^[47]

(including cow/buffalo/goat/sheep/camel milk)

Rank	Country	Production (10 ⁶ kg/y)
	World	696,554
1	 India	110,040
2	 United States	85,859
3	 China	40,553
4	 Pakistan	34,362
5	 Russia	32,562
6	 Germany	28,691
7	 Brazil	27,716
8	 France	24,218
9	 New Zealand	15,217
10	 United Kingdom	13,237
11	 Italy	12,836
12	 Turkey	12,542
13	 Poland	12,467
14	 Ukraine	11,610
15	 Netherlands	11,469
16	 Mexico	10,931
17	 Argentina	10,500
18	 Australia	9,388
19	 Canada	8,213
20	 Japan	7,909

European Union

The European Union with its present 27 member countries is the largest milk producer in the world. The largest producers within the EU are Germany and France.

Dairy production in the EU is heavily distorted due to the Common Agricultural Policy – being subsidized in some areas, and subject to production quotas in other.














Production building at a dairy farm in Norway.

European total milk production in 2009

FAO statistics ^[47]

(including cow/goat/sheep/buffalo milk)

Rank	Country	Production (10 ⁶ kg/y)
	 European Union (all 27 countries)	153,033
1	 Germany	28,691
2	 France	24,218
3	 United Kingdom	13,237
4	 Italy	12,836
5	 Poland	12,467
6	 Netherlands	11,469
7	 Spain	7,252
8	 Romania	5,809
9	 Ireland	5,373
10	 Denmark	4,814

Israel

The dairy farm on Sa'ad was the Israeli leader in 2011 for productivity with an average of 13,785 litres (3,032 imp gal; 3,642 US gal) per head that year. A dairy cow named Kharta, was the world record holder giving 18,208 litres (4,005 imp gal; 4,810 US gal) liters of milk.^[48] The 954 Israeli dairy farms achieved a world leading average production of 11,775 litres (2,590 imp gal; 3,111 US gal) a year per head, while the national average per head was 10,336 litres (2,274 imp gal; 2,730 US gal). Israeli consumption is lower than other western countries with an average of 180 litres (40 imp gal; 48 US gal) per person.^[49]

United States

In the United States, the top five dairy states are, in order by total milk production; California,^[50] Wisconsin, New York, Idaho, and Pennsylvania.^[51] Dairy farming is also an important industry in Florida, Minnesota, Ohio and Vermont.^[52] There are 65,000 dairy farms in the United States.^[53]

Pennsylvania has 8,500 farms with 555,000 dairy cows. Milk produced in Pennsylvania yields an annual revenue of about US\$1.5 billion.^[54]

Milk prices collapsed in 2009. Senator Bernie Sanders accused Dean Foods of controlling 40% of the country's milk market. He has requested the United States Department of Justice to pursue an anti-trust investigation.^[55] Dean Foods says it buys 15% of the country's raw milk.^[56] In 2011, a federal judge approved a settlement of \$30 million to 9,000 farmers in the Northeast.^[57]

Herd size in the US varies between 1,200 on the West Coast and Southwest, where large farms are commonplace, to roughly 50 in the Midwest and Northeast, where land-base is a significant limiting factor to herd size. The average herd size in the U.S. is about one hundred cows per farm but the median size is 900 cows with 49% of all cows residing on farms of 1000 or more cows.^[58]

See also

- Alfa Laval
- Animal husbandry
- Camel milk
- Dairy cattle
- Dairy products
- Factory farming
- Family farm
- List of dairy products
- Managed intensive grazing
- Ubre Blanca, a record milk-producing cow
- Veal

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External links

- Global milk production and consumption (<http://chartsbin.com/view/1492>) (ChartsBin visualizations)
- World milk production 1980–2003



(<http://www.fao.org/ag/againfo/themes/en/dairy/documents/docs/world-milk-production.pdf>) (FAO diagram)

- Respiratory hazards in dairy and beef farming (http://www.iom-world.org/pubs/IOM_TM9506.pdf) by D Sewell and others. Institute of Occupational Medicine Research Report TM/95/06
- Climate Change, Heat Stress, and U.S. Dairy Production (<http://purl.fdlp.gov/GPO/gpo52439>) United States Department of Agriculture, Economic Research Service

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