



# The life of: dairy cows

The dairy cows of today descend from wild ox, known as aurochs (*Bos primigenius*), that were found in most areas of Europe, Asia and North Africa. Cattle are thought to be one of the first animals to be domesticated, around 10,000 years ago<sup>1</sup>. Aurochs became extinct in the 17<sup>th</sup> century but today we have over one thousand breeds of cattle. During domestication, breeds have been developed to express certain desired characteristics such as high milk production, resulting in the dairy cows we see today in commercial farming. In the 1800s, each cow produced an average 1000 litres of milk annually; in many countries around the world today, the average annual milk yield is over 10,000 litres per cow<sup>2</sup>.

## 1. The modern dairy cow

A cow can **live for around 20 years** but in commercial systems she will be **culled at 6 years** old, on average<sup>3</sup>. She can give birth from 2-3 years old. Dairy cows have a hierarchical social structure and communicate by touch, smell, vocalisations and body language. It is thought that cows can identify 50-70 different cows<sup>4</sup>.

Cows kept on natural pastures with different types of vegetation will vary their feeding behaviour and browse on twigs from deciduous trees. Cattle are highly motivated to look for food and will **forage for 6 to 10 hours a day**<sup>5</sup>. They also have a strong drive to rest and will lie for long periods in the day which allows them time to ruminate.

The progress of intensification in dairy production was outlined by EFSA (2009)<sup>6</sup> to include:

- Breeding and genetic improvement to increase milk production per cow;
- Large-scale import of complementary feed ingredients from other continents for a comparatively low price;
- An almost full scale mechanization of farming, with advanced building designs and automated control, providing high productive output against low labour costs.

## 2. Calving

In order for cows to produce milk they need to give birth to a calf. In commercial units, pregnant cows will be separated from the milking herd about 2 months before they are due to give birth (classified as 'dry cows'). When a cow is ready to give

birth she will try to find a clean and dry area away from other cows. As long as the calf is in the correct position for birth, the labour should not need any human assistance. The cow will often eat the afterbirth as this would attract predators in the wild.

- The new-born **calf is licked clean** by the cow and she **encourages suckling by nuzzling the calf** in the direction of the udder.
- It is **important for the calf to receive the mother's first milk** (known as **colostrum**) which gives nutrition and contains immunoglobulins to give the calf protection its immune system is still maturing.
- The farmer **normally separates the calf from the cow** within the first few days, so that the cow can be milked for human consumption.



Cows typically give birth for the first time at about 2 – 3 years old. Calves are able to stand almost immediately after being born.



In some systems the calf will never suckle and instead the mother is milked for colostrum by the farmer and this is fed to the calf from a bottle, nipple feeder or bucket.



In the EU, calves may be kept in single pens for the first 8 weeks of life.

The cow has a strong maternal instinct and is normally distressed by the removal of her calf. Both the calf and mother will make loud calls trying to locate each other after they are separated.

### 3. Calf rearing

- Removed from its mother, the calf is **fed from either a bucket or nipple feeder with milk replacer**. This is a cheaper and easier alternative to whole cow's milk and better for preventing the spread of disease via milk.
- Calves are put into rearing pens, either singly or in pairs/small groups. This may be in a barn or outside.
- Around 60% of calves in the UK are reared in **individual pens**, for the first 8 weeks of life<sup>7</sup>. This means they have very **limited access to social companions**, only able to interact with neighbouring calves through the sides of the pen.
- When calves reach **8 weeks old**, it is **legally required in the EU** that they are put into groups.
- **Straw bedding** is a requirement by law in the EU but in other parts of the world many dairy calves are kept in a barren environment with slatted flooring.

#### 3.1 Replacement stock

Female calves may be bought from a market at a few weeks old to be reared on the farm as replacement stock (to replace older dairy cows as they are culled), or at around a year and a half just before they are old enough to become pregnant for the first time.

#### 3.2 Bobby calves

A bobby calf is one that is slaughtered at an early age (from immediately after birth up to about a month old) for consumption. Alternatively, in many systems the male and surplus female calves are reared for veal or beef. The age of slaughter for veal varies in different countries but it is normally around 5 to 7 months old, or slightly older in the UK. Calves may be transported to other countries for rearing and this is typically at a young age, normally around 2 weeks old.

#### 3.3 Identification

In many countries, ear tags are required for identification, normally in both ears. These are fitted at around one week of age. In more traditional systems the calf's ears may be notched or tattooed.

#### 3.4 Mutilations

- **Disbudding:** To reduce injury during fighting or handling by stockmen, calves are disbudded (horn buds removed) so that they are unable to grow horns. This is either done by chemical cauterisation (caustic soda is applied to the horn bud and destroys the cells; this should only be done to calves under 8 days old) or using a hot iron. When disbudding by hot iron, local anaesthetic is required by law in the UK but pain relief is not. Sometimes farmers will give some short-term pain relief (circa 6hrs).
- **Teat removal:** Female calves are occasionally born with an extra teat, known as a 'supernumerary teat'. The farmer will normally remove it with scissors or a blade. In the UK, an

anaesthetic must be used if the calf is 3 months old or over, however pain relief is not usually given.

- **Tail docking:** Some farmers dock the tails of calves at about 10 days old based on the disproven belief that it is more hygienic for the cow, and for the farmer during milking. This is done either by hot iron, crushing or tying a rubber band around the tail which stops the blood flow so it eventually falls off.



Docking of tails in the EU is illegal but is still practised in some member states and in other countries around the world.

- **Castration:** Male calves may be castrated at any age, depending on the farmer's preference. UK regulations state that only calves under 8 days old may be castrated by a ring (applied to cut off the blood supply), and this does not require pain relief to be given. Other methods for older calves include surgically or using burdizzos (an instrument that crushes the spermatic cord). An anaesthetic must be used if the calf is aged 2 months or over.

### 3.5 Weaning

- Calves are given hay or barley straw to chew on as early as one or two weeks old, which helps their stomachs develop. They should always have access to clean drinking water.

- At around **2 weeks old they will also be offered dried food.**

- Calves are usually **weaned** (when they are no longer fed milk and solid food is fed instead) at around **8 weeks old**, but some producers will choose to do this earlier to save costs.

- Following weaning, calves can be **vaccinated against certain bacterial or viral diseases** and be given treatment for parasites. Vaccination usually requires a course of injections.



In the EU, calves must be group housed after 8 weeks old because social contact is important for their welfare.

## 4. Heifers

Female cattle that are over 6 months old but have not yet given birth to a calf are called 'heifers'. At about 8 to 9 months old heifers may be **branded** for ease of identification, using an iron that has either been heated (hot iron branding) or cooled to below 100°F (freeze branding); these **procedures are painful.**

The time it takes for a heifer to reach puberty depends on her weight and breed, but will be between 8 and 16 months old. Farmers usually aim for their heifers to become **pregnant at around 15 months of age** so that they give birth when they are around two years old. Some farmers may aim for a lower puberty age so calving is before 2 years old, as they believe this gives greater production rates. This is achieved by altering their feeding regime to increase their weight, inducing puberty earlier.

## 5. Reproduction

### 5.1 Oestrous cycles

To achieve synchronised calving (see 7.), cows' oestrus cycles (which occur over an 18 to 24 day period) may be synchronised by the farmer. This can be achieved using hormonal implants either in the ear or intra-vaginally, or by giving an injection. These hormone implants differ from the EU banned hormone 'Bovine Somatotrophin' (BST), which is still widely used in the USA and other countries around the world. BST is given to a cow to increase her milk yield but is shown to increase the risk of mastitis and lameness<sup>8</sup>.

## 5.2 Heat

When a cow is 'in heat' (**receptive to mating**), she will typically become more active and spend more time licking, sniffing another cow's vulva and attempting to mount other cows. A cow on heat will mount others regardless of whether they are themselves in heat, but if they stand to be mounted it is likely that they are also in heat.



Mounting behaviour is typical of a cow in heat.

## 5.3 Mating and pregnancy

Cows are impregnated either **naturally by a bull** in the herd, or via **artificial insemination (AI)** carried out by the farmer. The **use of AI is widespread in the dairy industry** and this may be because of ease, lack of suitable bull stock, the ability to choose different sires for different cows, or to choose the sex of the calf. For AI to be most successful, farmers sometimes use devices to help alert them to a cow coming into heat. For example, **tail paint** (if the paint get rubbed off, it suggests the cow has been mounted), **pedometers** (to detect an increase in activity), Kamar pads (detectors that turn bright red when a cow has been mounted) or a **teaser bull** (a castrated bull that will mount cows on heat) may be used.

Successful mating is very dependent on good **body condition** for the cow/heifer at mating. Being underweight can cause unsuccessful mating and an increased **risk of calving difficulties**, but being overweight can also cause problems. The breed of the sire (father of the calf) affects the ease of calving, as cows that are cross bred with larger breed males may have calves too large to pass through the cow's pelvis; this is particularly problematic for the heifer during her first calving and may result in a caesarean section.

During pregnancy a heifer is kept in her rearing group. The **gestation period** for a cow is around **283 days**. Her diet needs to be monitored carefully to ensure that she continues to grow while pregnant, as she is not fully grown until about 3 years old.

## 6. Lactation

The cow produces milk immediately after, or even just before, giving birth. The farmer may start milking the cow straight away (but feeds the first milk (colostrum) to the calf), or the calf may be left with the mother to suckle for the first few days post calving. The cow will then be **milked either once, twice or three times a day**, depending on the dairy system. The farmer will often try to get the cow **back in calf within 2 months** of her giving birth, so that she produces one calf per year. However many farmers do not achieve this and cows often give birth every 400 days or more.

### 6.1 Milking

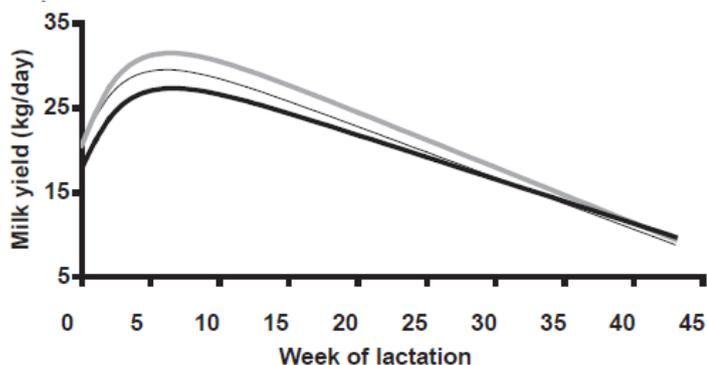
Milking cows by hand was the traditional method up until the mid-20<sup>th</sup> century, when milking machines became more commonplace. Milking machines allowed for herd sizes to increase as farmers were then able to milk more cows in a short space of time.

There are many **different milking parlour designs** including traditional herringbone and parallel parlours, and modern rotary parlours which are used to milk large herds, sometimes with automatic milking machines.

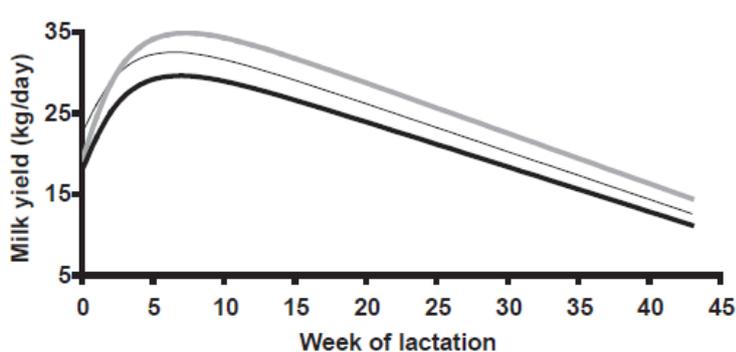


A rotary milking parlour is commonly used in larger herds.

(a)



(b)



These graphs show the milk yield of 3 types of dairy cows, all Holstein Friesian (HF) but with differing desirable traits (— High Production North American HF — High Durability North American HF and — New Zealand HF)<sup>9</sup>. (a) Milk yield over the lactation period for 3 different types of cows when fed on a pasture based diet; (b) Additional milk yield attained over the lactation in comparison to (a) by using a high concentration diet.

The cows are brought into a holding yard before entering the milking parlour. Cows **often enter the milking parlour in the same order**, which reflects their position in the social group. Electrical fencing may be used to drive the cows forward into the parlour. Some farmers choose to feed concentrate to the cows while milking which motivates the cows to enter the parlour. Some farms have **voluntary milking systems (VMS)** which allow cows to decide when they are milked (though the farmer will decide how many times per day each cow can gain access to the machine). Farms with VMS typically have one milking machine for every 60 cows, and cows can be **milked by the milking machine** at any time of the day or night, **without any assistance from the farmer**.

## 7. Calving patterns

The 'calving pattern' refers to the timing of calving for the whole herd. This may be:

- **Seasonal calving:** All cows in the herd give birth at a particular time of year and this is usually timed to match food supply. **Spring calving** utilises the grass growing period of temperate climates, therefore ensuring plentiful food supply at pasture. **Autumn calving** means that cows can be fed a total mixed ration in the winter when their yield is highest and then be out at grass during the summer months while they are dried off. **Good herd fertility is particularly important** for this to work as cows must become pregnant at similar times.

- **Batch calving:** like seasonal calving, but calving may occur at more than once in the year, i.e. cows may be divided into a spring calving group and an autumn calving group. This again may be to **ensure food availability or to utilise the milk prices**, choosing peak lactation (just after the calf is born) at high price times.

- **All year round calving:** each cow in the herd calves at a different time throughout the year. This offers **more even monthly milk production** and does not rely on synchronised calving, but needs a feeding system that can sustain the herd consistently throughout the year. Farmers may also choose seasonal and batch calving to reduce labour costs by hiring extra staff only at peak labour times. Both these calving patterns have finite periods for calving and, consequently, conception. All year round calving means that if a cow does not become pregnant from the first attempt, there is more flexibility for farmers to try again one or more times (a cow that does not become pregnant will be of no use in the dairy industry so will be culled or sold).

## 8. Housing

Around the world, dairy cows are kept in very different housing systems and herd sizes range from just a few, to thousands. In temperate climates, indoor housing is common during the wetter and colder months when there is a lack of grass at pasture. This is often the case for most of the year - around 5 to 7 months<sup>10</sup>.

### Tie-stall:

- Usually used for small herds with <100 cows and may be used as winter housing or all year round.
- Each cow is tied in place by either a chain, stanchion or rope tied around her neck; this is **very restrictive to her behaviour**. With a rope or chain the cow may be able to turn and lick herself but if it is too short or she is in a stanchion this is not possible.
- The bedding varies: straw, peat, or mattress (the thickness of mattress is important for cow comfort), or the floor may be bare.
- Water and food is provided, and grass may be brought to the cows.
- In some systems the farmer will allow cows outdoor access once a day. In small traditional herds this will involve walking them or giving them access to a loafing area. **Many tethered animals are not given any daily exercise**.
- Tie-stalls can be separated into individual partitions, partitions between every 2<sup>nd</sup> cow or there may be no separation at all. Cows are **only able to stand up and lie down** in a tie-stall system.
- In the USA and the EU, farmers may use an **electrified cow trainer**, where a metal wire is suspended above the withers (shoulder) of the cow. When her withers raise as she goes to defecate or urinate she will **receive a shock** if she doesn't step back, so she **learns to step back** which ensures dunging in the passage way.

### Cubicles/free stalls:

- This system is used frequently for large herds.
- Cows are able to **move freely around the barn** and **lie in individual cubicles** or stalls. The separation bars vary in design and their width is important for comfort.
- There is a walkway for the cattle to access the cubicles. They sit with their rear to the passage which ensures dunging is done into the passage. Bedding varies but materials like sand, straw or peat are often used, which may cover a mat or mattress inside the cubicle.
- Forage feed is delivered at a feed barrier, which should be long enough that all cows can feed at the same time. Dairy cows need to drink a lot of water and this is normally provided in troughs.
- This system is used for zero-grazing herds, as well as winter accommodation for those that go out in the warmer months. Herds may also be given an



In tie-stalls cows are tethered in one place by a chain (top), rope or stanchion (bottom). Food and water is brought to them. Cows are only able to stand or lie down; in stanchion systems they cannot even scratch their backs.



Cubicle design varies and bedding materials include: sand, straw, peat and mattresses. Sand is preferred by the cow. Waterbeds can also be used.

additional hard-standing (i.e. concrete) 'loafing area' that gives them access to outside.

### Loose housing/straw yard:

- Indoor housing on concrete/wooden flooring (or in some countries, earth), **bedded with straw**.
- Cows are kept in groups of varying size, depending on the accommodation and herd size.
- This system may be in place alongside other housing; it is commonly used for dry or sick cows.
- As in cubicle housing, forage feed is delivered at a feed barrier and water is available in troughs.
- Straw yards may be used as winter housing or may be used all year around on zero-grazing farms.
- To reduce infection risk, straw should be re-bedded daily.
- Straw bedding is **good for lame cows** as it provides a soft surface which is **more comfortable to stand on**.
- In large enough sheds it allows the cows freedom to lie more naturally, in groups and be comfortably spaced.

### Outdoor housing

- Outdoor housing is not necessarily pasture-based farming; **cows can be kept outdoors on concrete, sand or soil** with food brought to them. In some countries dairy cows have access to woodland.
- Some farms give pasture access during the summer months, but house cows inside during the winter when the weather is poor and there is not enough grass.
- **New Zealand** style farming is entirely **pasture-based** and the cows are outside for the entire year, often with no shelter.
- A loafing area might be the only outside access cows have and this is an area attached to the indoor housing.
- In hot climates such as **Saudi Arabia** the cows have a **barren outdoor area** which they will only use at night when temperatures drop.

## 9. Feeding

- An **entirely grass-based diet** can be sufficient for the cow to thrive whilst producing 4,000 litres of milk per year.
- Dairy cows can now produce higher yields of milk which require significant energy. A diet of grass



Loose housing - straw bedding area in a barn (can be just bare earth). Cows about to give birth are also housed in straw yards (top). Bulls on dairy farms are also often housed in loose housing when they are not running with the herd (bottom).



Outdoor access does not necessarily mean cows are kept on grass: A Californian farm with cubicles outside under shelter and acres of barren land (top); In New Zealand cows live on pasture all year around, normally without any shelter from bad weather or the sun

alone will not provide enough energy to produce high milk yields and keep the cow in good health.

- Concentrates, which are used to supplement grass, contain energy and protein-dense foods such as grains and oilseed meals.

- **Grass and concentrates** may only provide enough energy for **5,000 litres** of milk production/year, but a medium-high yielding cow will produce between 8,000 litres and 14,000 litres (more likely 11,000) a year.

- **Total mixed ration (TMR)** is a diet that includes hay, fermented grass (silage), maize silage and high energy grains like brewers grains, soy bean, cotton seed and citrus pulp.

- TMR ensures that cows get a complete diet which is necessary to enable them to **produce high quantities of milk without weight loss**. Cows producing very high yields (e.g. over 12,500 litres per year) can be very hungry and they will choose TMR over grass.



*Top:* cows eating TMR, which is a balanced diet to help provide the energy needed for medium to high yielding cows. *Bottom:* cows at pasture; a diet of grass can only provide enough energy to produce around 4,000 litres of milk a year.

- **Cows may be fed TMR throughout the year;** it may make up the whole diet (more often early in the lactation when the yield and energy demand is high) or be given in addition to grass at pasture. As the **cow requires more TMR to produce high yields of milk**, there is a trend in the industry for cows staying indoors for longer

periods of the summer months to ensure they get an adequate diet while at peak lactation.

## 10. Zero-grazing

This term refers to instances where cows are housed indoors with no access to pasture. In some cases cows have zero-grazing through most or all of their lactation and may only be **allowed out to pasture** (if at all) for about **two months**, at the end of their lactation but before the birth of their next calf. This time is so minimal that we would classify such a system as zero-grazed. An animal **may be zero-grazed but still be on a diet of grass**; in more traditional systems cows are often tethered all year round without access to pasture but grass is brought to them – this is more often the case for lower yielding, traditional breeds. For high yielding cows, their diet during lactation may be made up exclusively of TMR to ensure they get the energy they need. In countries such as Britain there is a move towards higher yielding cows and so **cows are being kept inside for longer periods** to receive the TMR they need in the summer months.

## 11. Mega Dairies

The **intensification of the dairy industry** has led to fewer but larger farms, and mega dairies have recently been appearing in the EU. These systems are usually **zero-grazing** but if they do provide pasture, the more cows within a herd, the further they have to walk to pasture to obtain sufficient nutrition as well as space to defecate. A high volume of faeces in one area not only prevents cows from being able to find sufficient clean grass but also causes **water pollution**. Mega dairies therefore do not have sufficient space for this to be possible and herds cannot obtain sufficient nutrition on the pasture provided (if provided at all). For high-yielding cows this is likely to be true for any herd of 1000 or more, though the geography of some farms will limit the number to much less than this. For lower yielding cows, which only need to be milked once a day (such as New Zealand style systems), larger numbers can be kept since they don't need to walk to the milking parlour so often, they can get all their nutrition from grass and their faeces are spread over a large area of pasture.

## 12. Slaughter

Cows can live for over 20 years but on commercial farms the age at slaughter varies considerably. Farms with poor management, high-yielding cattle or high disease rates will **slaughter their animals at a much younger age**, normally after four lactations (around 5-6 years old), but sometimes after 2 or 3. Lameness, mastitis and poor fertility are common reasons for early culling.

The slaughtering of cattle is normally performed at an abattoir but if a cow is injured on the farm and unable to travel, it may be shot on farm. Cows can be killed using several different methods:

- **Non-penetrating captive bolt gun**: A gun-like device is used for stunning and strikes the skull to induce unconsciousness; the throat is then cut. This is just **used for calves** as it is not effective enough for adult cattle.

- **Penetrating captive bolt gun**: As above but it can also kill the animal as the rod penetrates the

skull and destroys the brain. The throat is then cut to bleed the animal. This is commonly **used for adult cattle**.

- **Electrical stunning**: electrodes are placed across the animal's brain and a current is applied for a few seconds; once unconscious the throat is cut and the animal dies from blood loss. This is **rarely used** in cattle.

- Current EU legislation stipulates that animals must be stunned before slaughter however there is an **exception for religious communities**, to slaughter without pre stunning. The **majority of animals killed in the UK for halal slaughter are stunned first**, since many Muslims believe this is an acceptable part of the slaughter process. However some religious slaughter is done without pre-stunning; animals killed for Halal or Kosher meat will have their **throats cut while conscious** and die from blood loss. In some countries animals may be killed by this method **regardless of religion**.

---

## References

<sup>1</sup> Orlando, L (2015). The first aurochs genome reveals the breeding history of British and European cattle. *Genome Biol.* 2015; 16: 225.

<sup>2</sup> Ekesbo, I. (2011) Farm Animal Behaviour: Characteristics for Assessment of Health and Welfare, Cattle, pg 53, *CAB International 2011*

<sup>3</sup> Mohd Nor, N., Steeneveld, W., & Hogeveen, H. (2013). The average culling rate of Dutch dairy herds over the years 2007 to 2010 and its association with herd reproduction performance and health. *Journal of Dairy Research*, 1-8.

<sup>4</sup> Fraser, A. F., Broom, D. M., (1990) Farm animal behaviour and welfare, 3rd edition, Bailliere, Tindall, London, 437pp.

<sup>5</sup> Tucker, C.B (2009) The Origins of Cattle in *The Ethology of Domestic Animals*. 2<sup>nd</sup> Edition. London: CABI International

<sup>6</sup> EFSA 2009 3.2.2

<sup>7</sup> Marcé, Guatteo, Bareille, & Fourichon (2010). Dairy calf housing systems across Europe and risk for calf infectious diseases. *Animal*. 2010 Sep;4(9):1588-96. doi: 10.1017/S1751731110000650.

<sup>8</sup> SCAHAW (Scientific Committee on Animal Health and Animal Welfare), 1999. Report on -Animal Welfare Aspects of the Use of Bovine Somatotrophin.. Directorate General Health and Consumer Protection. Report of the Scientific Committee on Animal Health and Animal Welfare (SCAHAW). Adopted on 10 March 1999, 91 pp. [http://ec.europa.eu/food/fs/sc/scah/out21\\_en.pdf](http://ec.europa.eu/food/fs/sc/scah/out21_en.pdf)

<sup>9</sup> Horan, B. et al (2005) The effect of strain of Holstein-Friesian, feeding system and parity on lactation curves characteristics of spring-calving dairy cows, *Livestock Production Science*, Vol 95, 231- 241

<sup>10</sup> Annex to the EFSA Journal (2009) 1143, 28-284