THE INSTITUTE OF EDUCATION

Subject

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COURSE: Agricultural Science

ACADEMIC LEVEL: Leaving Certificate

ACADEMIC YEAR: 2020/21

TOPIC: Dairying

Dairying

Composition of Milk

Milk is made up of water, milk fat (butterfat) and solids not fat (SNF)

SNF includes proteins (casein, albumen and globulin), sugars (lactose and glucose) and minerals (calcium and phosphorous)

Water content usually 87.5% Lactose is around 4.7%, Protein varies from 3.3 – 4% Fat/Butterfat varies from 3.5-5%, Minerals usually makeup 0.8%

Factors Affecting Milk Composition

1. Breed
   Jersey cows produce a lower volume of milk than Holstein Friesians but the milk is higher in fat and protein
2. Age
   As cows get older (over 4th lactation) they produce lower fat and protein
3. Milking Interval
   Farmers usually milk their cows twice per day. The longer the interval the lower the butterfat, hence morning milk usually has a lower butterfat than evening milk. (if farmer milks at 7am and 5pm). Ideally the interval should be even but this is not practical
4. Disease
   Mastitis lowers fat and protein
5. Diet
   Fibre increases butterfat so low fibre (early spring leafy grass) produces lower butterfat. Starch and protein levels in the diet affect the protein content of the milk
6. Genetics
   Daughters of cows with high abilities to produce fat and protein will inherit these traits

Milk Quality

Dairy farmers put enormous efforts into producing high quality milk. Clean milk means milk without bacteria, antibiotics, dirt, cleaning chemicals and teat dip. It should have a low SCC and TBC content and should also be free of any zoonoses. Milk contains ideal food bacteria to grow and prosper. The souring of milk is caused by anaerobic lactic acid bacteria who convert the sugars to lactic acid and produces curds and whey.

Famers must be able to store 1-3 days supply of milk on their farms before it is collected by the creamery. It is stored in a stainless steel bulk tank which keeps it stirred and refrigerated to 2 degrees.

After collection milk is tested for quality also undergoes pasteurisation and homogenization.

Pasteurisation
Extends the shelf life of the milk and removes micro-organisms. Milk is pasteurised by heating the milk to 72 degrees C for 25 seconds and cooling down rapidly.

Ultra Heat Treated (UHT)
Ultra high heat treatment (UHT) milk lasts even longer however the taste is compromised. This involves heating the milk to 141 degrees C for 2 seconds to completely sterilise it.

Homogenisation
Homogenisation involves breaking up the fat globules in the milk so that they remain suspended evenly in the milk rather than separating out and floating to the top.

Milk Quality Tests in Creameries

1. Total Bacterial Count (TBC)
   This is a test for general numbers of bacteria in the milk. It will rise due to improper hygiene in the milking parlour. It must not exceed 100,000 bacteria per ml of milk
2. Somatic Cell Count (SCC)
   This is a test of numbers of white blood cells in the milk. A high number indicates sub clinical mastitis in the herd. SCC should not exceed 400,000 cells per ml of milk
3. Thermoduric Test
   This tests the numbers of heat resistant bacteria which can survive pasteurisation. This must not exceed 1,000 per ml of milk
4. Milk Temperature
   Milk will only be collected from refrigerated bulk tanks and must be less than 6 degrees upon collection
5. Antibiotic Test (Delvo Test)
   Milk must not contain any traces of antibiotics
6. Excess Water
   Milk should usually be around 87.5% water.
7. Sediment Test
   Milk should be free of any particles after milking and should be filtered.

Milk Pricing
Dairy farmers are paid for their milk through the ABC system.

Formula is (A * Protein % + B * Butterfat %) – C, plus any bonuses or penalties

A = Value for protein set by creamery
Protein % is tested for in the creamery
B = Value for butterfat set by creamery
Butterfat % is tested for in the creamery
C = processing charge based on the volume of milk and includes cost of processing and collection

This pricing system rewards farmers for producing milk with high levels of fat and protein rather than volume.

Steps involved in producing high quality milk

1. Herd Health
   All the cows are tested for TB and Brucellosis and any cases are culled. Mastitis cases are treated and cows constantly getting infections are also culled.

2. Milking Routine
   All the cows udders and teats are washed before milking. Cows tails are kept short and neat. Milkers hands and arms must be clean (gloves). Check the cows for mastitis with teat cups

3. Parlour
   All walls and floors must be cleaned spotlessly after each milking. A clean water supply both hot and cold is required for milking. After milking all pipes, jars and the bulk tank are washed out with detergent and rinsed thoroughly with clean water. The milk is filtered to remove any dirt before it enters the tank.

4. Cooling
   Milk is cooled by firstly a plate cooler and then in the bulk tank.

Steps involved in improving milk quality and composition

1. Culling
   Generally cows last for around 5 lactations and should then be culled. Older cows increase the TBC, SCC and reduce protein and milk yields.

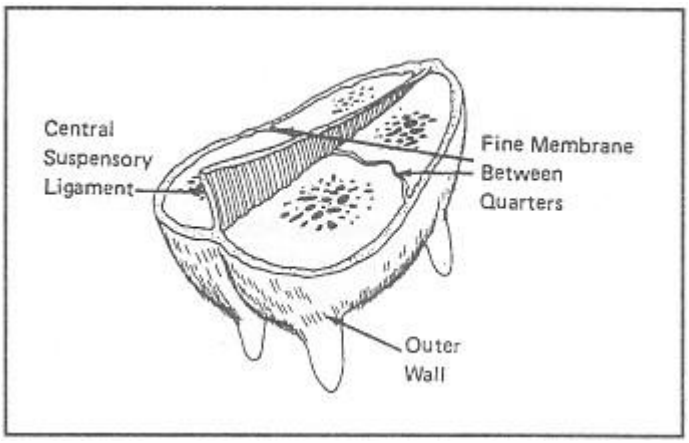
2. Breeding
   New replacements should be the daughters of cows with have a genetic potential for high milk yields, high fat protein levels and who were fertile. Many farmers now use A.I. and high EBI bulls

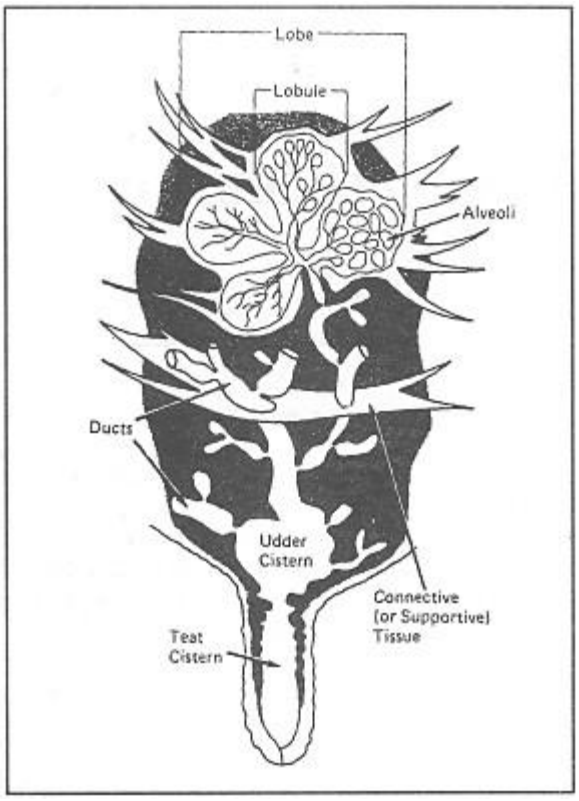
3. Milk Recording
   This allows the farmer to pick out the most suitable cows in his herd for breeding

4. Diet
   Farmers must ensure that a proper grazing system is in place to provide the cows with access to high quality leafy grass. Concentrates should be fed at appropriate times and fibre should be supplied in the diet in early spring. Emphasis should be placed on producing high quality 75% + DMD silage

The cows udder

The udder is attached to the cows abdomen by two suspensory ligaments. The lateral suspensory ligament stretches around the outside of the udder under the skin, the central suspensory ligament divides the udder lengthways in two halves. Each half is further divided into forequarters and hindquarters





Milk is made in the glandular tissue of the udder. Cells in the walls of the alveloli secrete milk into the milk ducts. When the udder is stimulated by a warm wet cloth or the calves mouth, nerves carry these stimuli to the brain. The pituitary gland in the brain releases the hormone oxytocin in the blood stream, this causes the muscles in the alveoli to contract and force the milk into the cisterns. This is known as milk let down. The hormone lasts 3-7 minutes until the cow is milked.

The alveoli and milk cells work on demand once the cisterns are emptied, therefore the more often a cow is milked, the more milk it will produce. So cows milked three times a day would produce more than ones milked twice.

Specified Practical Activity (SPI)

To investigate the quality of a milk sample over time

Materials:

Samples of milk (raw unpasteurised milk, raw sour unpasteurised milk, fresh pasteurised milk and sour pasteurised milk), resazurin solution, water bath, test tubes, labels and pen.

Resazurin is a blue dye that changes colour depending on the amount of bacteria present. Blue is the best quality (low bacterial numbers), followed by mauve, then pink and white (very high numbers of bacteria or poor quality)

Method

1. Label 4 test tubes A, B,C, D
2. Add 10 cm^3 of raw unpasteurised milk to A, to B add 10 cm^3 of raw sour unpasteurised milk, to C add 10 cm^3 fresh pasteurised milk and finally add 10 cm^3 of sour pasteurised milk to D
3. Add 1 cm^3 of resazurin to each tube
4. Place in a water bath at 37 Degrees for 10-15 minutes
5. Record any colour change

Production systems

Milk production in Ireland is a low cost system based around grazed grass. Most farmers in Ireland are spring calving creamery suppliers. Some of this milk is used for drinking milk but the vast majority is processed into different products such as cheese, butter and milk powder. Milk solids and not volume is the biggest priority for this type of farmer and therefore cows that can produce milk efficiently from just grazed grass and small amounts of concentrates are ideal. Most of these cows are Holstein Friesian, Friesian or Friesian crosses. These farmers stop producing milk usually over the months of December and January.

If all dairy farmers operated this type of system there would be no milk in the shops over the winter period. Therefore a small amount of farmers calve their cows in the autumn and produce winter milk or liquid milk. Producing milk during this time of year involves higher costs because the farmer has to feed more concentrates and conserved feeds. Consequently this type of production earns a higher milk price. The primary aim of this type of farmer is to produce high volumes of milk and therefore this type of farmer puts a greater emphasis on the Holstein breed.

Characteristics of Ideal Dairy Cows

- Wedge shaped
- Narrow shoulders and wide hindquarters
- Long narrow head and neck
- Shoulder blades close together

- Not very well fleshed
- Large udder with teats pointing down
- Good temperament
- Good fertility

The Dairy Cow Cycle

Terms

Lactation = time the cow is producing milk, most dairy cows produce milk for approximately 300-305 days after they calve

Gestation = Pregnancy length approximately 283 days

Dry Period= After lactation the farmer gives the cow dry cow tubes which stop the cow milking and prevent it from getting mastitis. The cows then enter the dry period of 60-65 days. This is very important because:

- It allows milk cells to regenerate
- Allows the cow to recover condition before calving and next lactation
- Allows the cow to produce colostrums
- Allows the cow to divert all her energy to developing the calf which grows rapidly in the last two months
- Allows steaming up to occur

Oestrus Cycle

A cow comes into heat or oestrus every 21 days until she becomes pregnant, this is when the ovaries produce eggs that can be fertilised. The heat period lasts for around 24 hours and standing heat occurs for the first 18 hours. When a cow is in heat she stands still and allows herself to be mounted by a bull or other cows.

Calving Interval

This is the time between calvings, the objective is to keep this at 365 day. If the calving interval goes over a year the cow will produce less calves and less milk over her productive life, also the cow will not be able to utilise as much grazed grass in her diet. Consequently longer than optimal calving intervals result in reduced profit. A very common reason for sub-optimal calving intervals is because of missed heat periods.

Detecting Heat

The primary method of detecting heat is observing the cows being mounted by other cows. Farmers commonly use tail painting to detect heat, paint is put on the back just over the tail and any cow with which has the paint disturbed is inseminated. Heat detection can also be done automatically by attaching a sensor to the cows leg or neck which measures metabolism and activity levels (they increase dramatically when the cow is in heat) Most dairy farmers use a combination of A.I. and a stock bull to ensure mating is successful. The sperm has a life of 24 hours and the ovum about 4, therefore its best if sperm are available towards the end of the heat period. If cows are observed in

heat in the morning they are inseminated in the evening, ones observed in the evening are inseminated in the morning. (AM/PM rule)

Some farmers used a vasectomised bull (seminal fluid has no sperm) to show cows in heat. Heat synchronisation (using hormone progesterone to stimulate heat) can also be used usually on heifers and late calving cows.

Lactation Curve

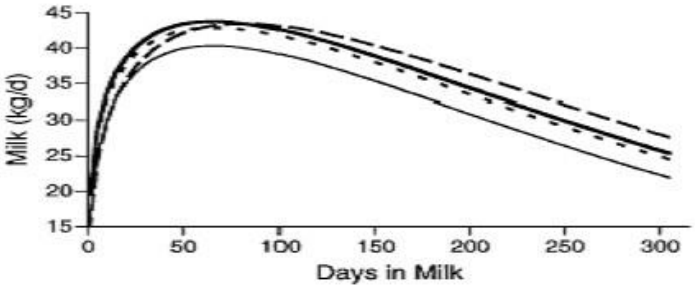


Figure 1. Predicted milk production by DIM for an average multiparous cow from the base herd (——), a herd using bST (■ ■ ■), a herd using three times daily milking (__), or a herd using long daily photoperiod (- - -).

The cow reaches her peak milk yield around day 75 of the lactation. Ensuring the cow reaches her maximum yield at the peak is very important because the yield at the peak determines the total lactation yield

Yield at peak X 200 = Estimated Total Lactation Yield

Feeding the Dairy Cow

Early Lactation (Days 1-150 of lactation)

As soon as possible after calving the cow is let out for some grazed grass. Most cows calve in February or March and farmers plan to have grass in their diet. Along with grazed grass the cows also get some fibre and 4-5 kg of concentrates in the milking parlour. The concentrates contain calcined magnesite (cal-mag) which prevents grass tetany. It is also important to watch out for bloat (build up of gas in the rumen when cows eat lush grass)

It is important to feed them well in early lactation for a few reasons

- Cows suffer an energy deficit after calving and compensate by "milking off their back" so it is important to minimise this weight loss. (This can also lead to a condition called Ketosis which is similar to twin lamb disease in sheep) The liver cannot break down the fat quick enough which results in a build up of ketones in the blood.
- To ensure the cow reaches her lactation peak
- To ensure the cow is a Condition score of 3.5 at mating in order to be in optimal fertility

If the cows cannot get out to graze or if no grass is available, they must be kept inside on ad-lib 70% DMD silage and 6-7 kg of concentrates.

Grass Budgeting

Many dairy farmers carry out grass budgeting on their farms to plan their grassland management. This involves walking the farm paddocks weekly and measuring the amount of grass in each one estimating grass growth rates. The grass is measured by cutting a area and weighing it or else by using a plate metre. The farmer can work out the herd demand, how much grass is on the farm and how fast the grass is growing. This highlights if there is enough grass or surpluses or deficits and he can plan accordingly. He can apply extra fertiliser, feed extra concentrates or increase the grazing area if there is a deficit or reduce fertiliser and decrease concentrates, fertiliser and cut baled silage if there is surplus grass.

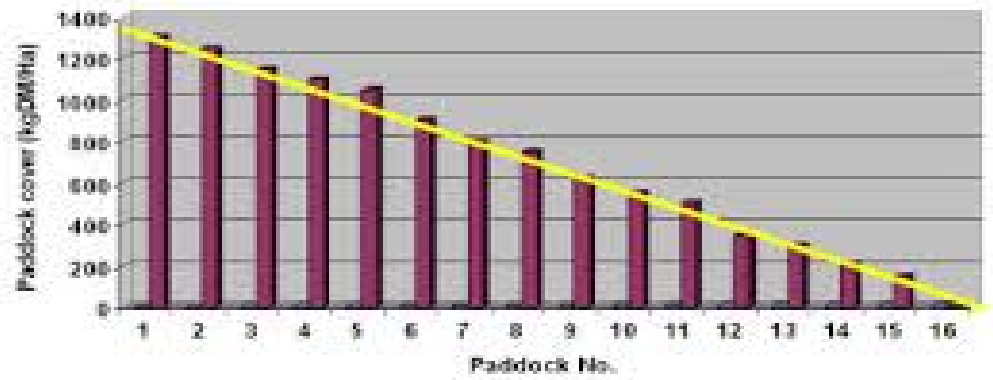
Spring Rotation Planner

The spring rotation planner is a tool that divides the area of your farm into weekly portions and takes the guesswork out of planning the first grazing rotation. The only data you need to use is the date you want to turn out your animals and the date when you think you are growing enough grass to supply all the grass you need (i.e. supply = demand; Magic Day). The spring rotation planner will not tell you if you are feeding the cattle enough grass — you will have to gauge that by walking through your paddocks or fields and assessing either visually or by measuring if you have enough grass. The spring rotation planner is a simple and effective tool to ensure that: Sufficient grass is grazed early enough to allow time for re-growth for the second rotation. Ensure that grass does not run out before the start of the second rotation. A wedge-shaped supply of grass is created, ensuring a continuous supply during the second rotation.

Pasture wedge

During mid-season the farm must be walked at least once a week and the grass yield on each paddock or field determined. This information can then be used to make critical decisions about the quantity of feed available to the herd. Plotting (on a graph) the yield on each field, where the fields are ranked from the highest (on the left) to the lowest (on the right) will give a picture of grass supply – and the chart will look like the steps of a stairs. This picture of sorted grass yields is called the ‘pasture wedge’ or ‘feed wedge’.

The pasture wedge visually illustrates the breakdown of the pre-grazing yield distribution on the farm. A line is superimposed onto the graph calculated from the intended herd demand, rotation length and grazing residual. If the yield in a paddock is below the line, it indicates that the yield of grass in the paddock is lower than planned. If it is above the line it indicates the yield is ahead of expectations, and if it is on the line, it is on target. If too many paddocks are under the line, forecast a grass shortage in the near future. Too many paddocks above the line forecasts a surplus (especially in a period of growth that exceeds herd demand).



Adequate Grass Supply

Mid Lactation (Day 150-225)

At this stage the milk yield is dropping, the cow is pregnant but the calf grows very slowly in the womb for the first few months. Overall nutritional demands are lower, and grazed grass alone is enough

Late Lactation (Day 225-300)

Milk yield drops even further and the cow should continue to be grazed on grass as long as it is available. In November cows may have to be housed and fed on silage and concentrates as ground conditions deteriorate to prevent poaching

Dry Period

Usually cows are dried off abruptly, the farmer stops milking them and uses a dry cow tube to seal the teats and prevent mastitis. The dry period corresponds to the final two months of pregnancy when the calf grows rapidly. Cows are indoors and fed according to their condition, those at optimal condition (3-3.5) are fed ad lib silage (70% DMD) for the first 2-3 weeks and for the final 6 weeks *steaming up* occurs. Steaming up is feeding the cow very well in the final stages of pregnancy to ensure adequate calf development and full milk production in the next lactation. Feed ad lib 70% DMD silage plus 5 kg of concentrates / day

Management during Calving

Most cows calve on their own without difficulty but sometimes veterinary assistance is needed.

Reducing Problems and Mortality

- Choose an easy calving bull especially on heifers
- Use proper records to supervision can be planned
- Ensure proper steaming up, overfeeding fat cows results in problems
- Isolate the cow in a calving box 1-2 days pre calving
- Have an experienced person around and call a vet if difficulties arise
- Ensure proper hygiene

- Ensure the cow has sufficient calcium to prevent milk fever

The new born calf may need a little attention. Remove membranes from nose and mouth, make sure airways are clean. Rub it down with a towel or straw and spray the navel with iodine. Although they will be separated its best to allow the calf to suckle the cow to get colostrums (beestings). If the cow does not suckle it must be stomach tubed.

Colostrum advantages

- Contains antibodies
- Acts as a laxative and cleans out the digestive system
- Warms the calf
- Very high in nutrients

Nutrient	Whole Milk	Colostrum
Water	87.5%	78%
Fat	3.8%	4.0%
Protein	3.2%	15.2%
Lactose	4.6%	1.4%
Minerals and Vitamins	0.8%	1.2%

After calving the cow should pass the placenta but if the cow doesn't it leads to problems. Retained placentas lead to uterine infections, infertility, and ketosis. Retained placentas are often caused by improper feeding and calving difficulties.

Breeding

Cows need to be replaced in a dairy herd usually at a rate of 20% per year. The farmer has a choice of buying in replacement heifers or breeding his own replacements. The heifers to be used as replacements should have the potential characteristics of a good dairy cow as mentioned previously. The vast majority of dairy cows (95%) in Ireland are Holstein Friesians, these are most suited for dairy production but have a very low value for beef.

Consider an example of a farmer with 100 dairy cows and a replacement rate of 20%. This herd will be made up of approximately 80 mature cows and 20 younger replacement heifers. Each year he will need an additional 20 cows to replace the ones he is culling. Therefore he mates 50% of the best cows in the herd with a dairy bull through A.I. This should provide him with approximately 25 male and female dairy calves. He mates 50% of the cows with a dairy bull because, half the calves will be male and he must make allowances for infertility, calf and cow mortality and some calves may not end up being suitable.

Next he mates the 20 replacement heifers with an Aberdeen Angus bull because it is easy calving and the calves are going to be used for beef. The remainder of the cows are mated with a beef bull eg. Limousin to maximise their value for beef production.

So this farmer ends up with approximately 50 Holstein Friesian calves, 25 Holstein Friesian X Angus calves and 25 Holstein Friesian X Limousin calves

Crossbreeding

Many dairy farmers are now crossing dairy breeds such as Jersey, Norwegian reds or Swedish Reds or Mountbelliarde with their Holstein-Friesian cows to get the benefit of hybrid vigour. These crosses have better fertility, last longer in the herd, produce higher milk solids and are smaller cows more suited to grass- based systems

Calf Management

Dairy cows are separated from their calves almost immediately after calving because the cow's milk is sold. These calves are then artificially reared by the farmer.

Cost of Feeds
The following feeds are ranked in order of cost, starting with most expensive

1. Milk
2. Milk replacer
3. Concentrates
4. Grass

Therefore to feed the calf profitably the objective of the farmer is to get the calf successfully grazing grass as quickly as possible without upsetting the calves delicate digestive system. In practice this process takes approximately 6-8 weeks.

Calf Housing

- Calf housing should be well ventilated, draught free to prevent pneumonia. Many farmers successfully rear calves outside using calf huts. The roof of a calf house should be high and fresh air should circulate around the shed
- Clean dry bedding is needed with lots of fresh straw to prevent joint-ill and bacterial scour
- The shed should have easy access for feeding milk, hay, concentrates and water. Sheds should not be overcrowded

Feeding a dairy calf from birth to weaning (FEB-APRIL)

- The newborn calf weighs approximately 40Kg
- Colostrum is fed for the first 3-4 days. It is vital that the calf gets its first feed of colostrum within 12 hours after birth. Feed 10% of body weight in two feeds or two 2 litre feeds of colostrum
- Gradually switch the calf onto normal milk and then slowly onto milk replacer by mixing the milk with the powder. The calf will drink 4-5 litres of milk replacer for the next 6-8 weeks
- The calf should also be provided with fresh hay to develop the rumen (only stomach working in a new born calf is the abomasum)
- Fresh water should always be available

- Concentrates should be provided after 1 week, start with a handful per day and build up gradually to 1-2kg/day. They should be very sweet and palatable to encourage consumption
- After 6-8 weeks when the calf is eating hay and 1-2kg of concentrates it can be successfully weaned off milk and let out on grass.
- The calf should have doubled its weight at weaning now 80kg.
- Target LWG = 1kg/day

Managing Dairy Calves out on Grass during their First Summer (APRIL – NOV)

- Gradually reduce concentrates for the first 2 weeks on grass to allow the calves rumen to adjust to a grass only diet
- The calves should be grazed using the leader-follower system and they should have fresh leafy, parasite free grazing
- Parasites are controlled by leader follower and dosing. The main ones are stomach worms, lung worms and liverfluke
- During the last 2 weeks pre-housing the concentrates are re-introduced
- The calf is housed in November at 200kg
- Target Liveweight gain (LWG) is 0.5kg /day

Replacement Heifers

Cows need to be replaced in the dairy herd at a rate of about 20% per year. There are several reasons for replacing cows some of which are

(a) Milk production declines with age
(b) Infertility problems
(c) Disease
(d) Injuries to udders, feet, etc.
(e) "Grading up"

Grading up refers to the practice of replacing lower EBI cows in the herd with higher EBI heifers with the objective of increasing the overall herd EBI over time.

Target weights and Dates

Born -1st Feb	40kg
Weaned off milk start of 1st summer	80Kg
1st November 1st winter housing	200 Kg
1st March 2nd Summer on grass	280kg
1st May – Mating/Service	300Kg (min)
1st November 2nd Winter Housing	450Kg
15th Feb – Calving	525Kg

Replacement heifers should be reared in the same way as other dairy calves but there are target weights and body condition scores that must be achieved.

Heifers reach puberty and come into heat at 8-12 months old but they should not be got in calf until they are *at least 15 months old and 300 kg in weight and have a BCS of 3-3.5*. Otherwise they will be very small at calving. As a result they may have calving difficulties and will never achieve their full size and milking potential.

If heifers are got in calf around May 1st of their second year, they will calve in mid-February at just 2 years old, this is the objective of most farmers.

At calving time the heifers should be 2 years old, at least 525Kg and BCS 3-3.5. After calving they join the rest of the milking herd but heifers in their 1st Lactation are not fully grown and they should be fed for growth, maintenance and milk production. Otherwise they will fail to achieve their full size, weight and milking potential.

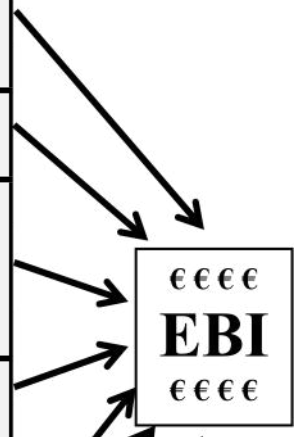
Understanding the Economic Breeding Index (EBI).

What is EBI?

EBI is a single figure profit index aimed at helping farmers identify the most profitable bulls and cows for breeding dairy herd replacements. It comprises of information on seven sub-indexes related to profitable milk production. These are; **(1)** Milk production, **(2)** Fertility, **(3)** Calving performance, **(4)** Beef Carcass **(5)** Cow Maintenance **(6)** Cow Management and **(7)** Health. A summary of the sub-indexes, including traits and relative weightings for traits in the EBI are given in **Table 1**. The economic values in the index are based on data collected from Irish Dairy Farms and the Dairy Industry. These values were last updated in December 2012.

Table 1. *Economic values and % emphasis of the various traits in the EBI formula.*

2014 Economic values and % emphasis for traits in the EBI				
Sub-Index	**Trait**	**Economic Weight**	**Trait Emphasis**	**Overall Emphasis**
Production	Milk	-€0.09	10.6%	33%
	Fat	€1.04	3.4%	
	Protein	€6.64	18.9%	
Fertility	Calving Interval	-€12.43	24.0%	35%
	Survival	€12.01	10.9%	
Calving	Direct Calving Difficulty	-€3.52	2.8%	9%
	Maternal Calving Difficulty	-€1.73	1.3%	
	Gestation Length	-€7.49	4.1%	
	Calf Mortality	-€2.58	1.0%	
Beef	Cull Cow Weight	€0.15	0.7%	9%
	Carcass Weight	€1.38	5.1%	
	Carcass Conformation	€10.32	1.7%	
	Carcase Fat	-€11.71	1.1%	
Maintenance	Cull Cow Weight	-€1.65	7.2%	7%
Management	Milking Time	-€0.25	2.1%	4%
	Milking Temperament	€33.69	1.9%	
Health	Lameness	-€54.26	0.6%	3%
	SCC	-€43.49	1.8%	
	Mastitis	-€77.10	0.8%	



Genetic Evaluations

Knowing the genetic merit of your herd is a key component to successfully improving traits of importance on your farm. The observed performance (e.g. 305 day milk yield) of an individual cow depends on two things:

a) the genetic merit of the cows
b) the environment in which she is performing

Genetic evaluations attempt to disentangle the effects of genes and the environment in order to select animals that have high genetic merit, and not those that perform well simply because they are well managed and fed. For example, if Cow X has a much higher genetic merit for milk yield than Cow Y, Cow Y will need much more feed to milk the same as cow X. Alternatively, if Cow X and Y are fed the same, Cow X will outperform Cow Y for milk yield. Genetic evaluations allow us to directly compare animals that are performing in many environments, by removing the part of the observed performance that is due to the environment and management of the cows.
We cannot directly alter the genetic merit of an individual cow, however improvements can be made for specific traits in the offspring of the cow provided she is bred to a sire that is better than she is for those traits. Therefore it is important to know both the genetic merit of the cow and the sire in order to make genetic improvements in traits of economic importance.

How do I interpret the Predicted figures for Milk kg, Fat kg, etc. on my EBI Report?
We call these Predicted Transmitting Ability figures (PTAs). An animal's PTA indicates the amount of a particular trait an animal is expected to pass on to its progeny relative to the base population (See **Table 2**). The PTA is equal to half of its own Breeding Value since a cow only passes on half her genes to her offspring. All values on the EBI report are expressed as PTA's. Information on bulls (in catalogues, bull search, etc.) is also presented in terms of PTA.

	Milk kg	Fat kg	Prot kg	Fat%	Prot%	CI days	Surv%
Base Cow Performance	5192	196	171	3.79	3.30	404	80

Table 2. ***Base Population Performance – 1995 born cows, calved and milk recorded in 2000***

The daughters of a bull with a PTA of 150kg for milk yield would be expected to produce, on average, 100kg more milk per lactation than the daughters of a bull with a PTA of 50kg if their dams have equal genetic merit. The actual difference will not be exact for comparing individual daughters because no two daughters would get exactly the same combination of genes or be exposed to exactly the same environment. Thus, daughters of the same sire may have varying performance.

Example:
Cow 972 (**Fig 1.** below) has a Milk kg PTA of **+167kg** which means that she would be expected to produce 334 kg more milk than the base cow (167kg x 2 = 334kg). If she is mated to a bull with a Milk kg of **+233kg** the resultant offspring will have a potential for milk (i.e. Breeding Value) of **+400kg**.

FB Cow ID Name Breed	Sire ID Dam FB MG Sire ID	Sire EBI Dam EBI MGS EBI	C. Date Age Lact.	Milk Kg Fat Kg % Prot Kg %	Milk	Fertility	Calving Health	Beef Mainten	EBI € Herd Rank
972 IE151013760972	RUU	138	25/01/2009	167	€ 25	€ 32	€ 26	€ 5	€ 84
P TRUDY 8	383	39	3y 2m	9.0 0.05			€ 3	€ -9	
HO 93.8%	ASI	34	1	5.0 -0.01					64

Fig 1. ***Example of an animal's PTA in the EBI Report***

Does this mean the offspring, assuming a heifer, will actually milk 400Kg more than the "base cow" (i.e. 5190kg + 400kg = 5590kg)? The answer always depends on the level of management – the heifer will be genetically capable of milking 400kg more than the base cow but how much she physically outperforms the base cow will be dependent on the management of the animal. In a higher input environment she could perform much more than this or in a lower input environment it may be less than this.

Key Point: Although the potential of the offspring heifer is **+400kg**, she will only pass on half of this to her own offspring, therefore her PTA for milk kg is **+200kg** (½ her Breeding Value) and this is what is displayed on the EBI report.

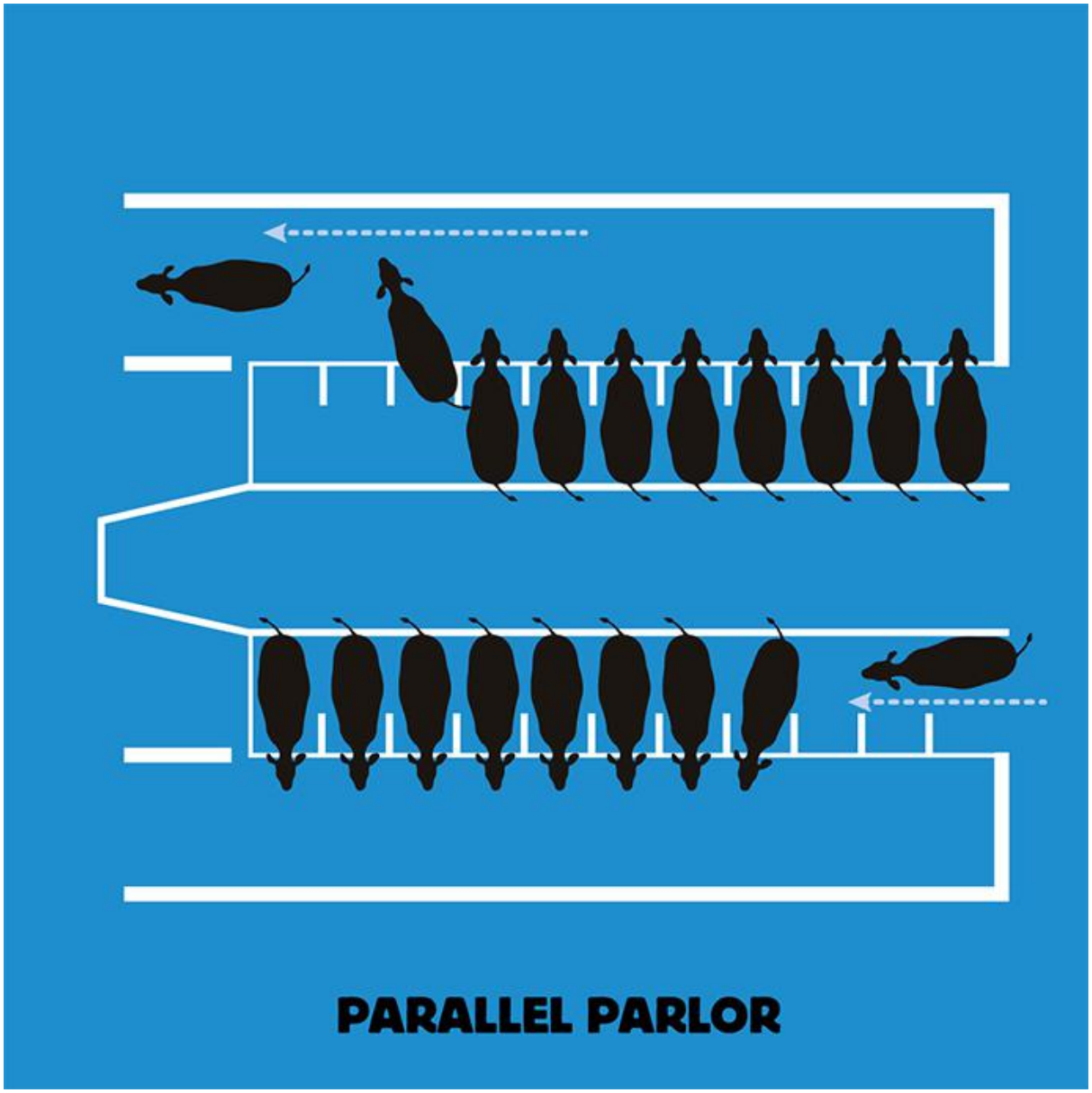
In simple terms, in order to improve the potential of a cow's offspring to milk more, you need to use bulls that have a higher PTA for milk kg than the cow itself. The same applies to all other traits, be it milk solids yield, fat and protein % or calving interval and survival.

When selecting a team of bulls for your cows you should pick bulls that are higher than the herd PTA for the traits you want to improve. To improve individual cow weaknesses use the cow PTA to help you determine the best bull to use on her.

Here are the four main designs of milking parlours used by dairy farmers.

1. Parallel

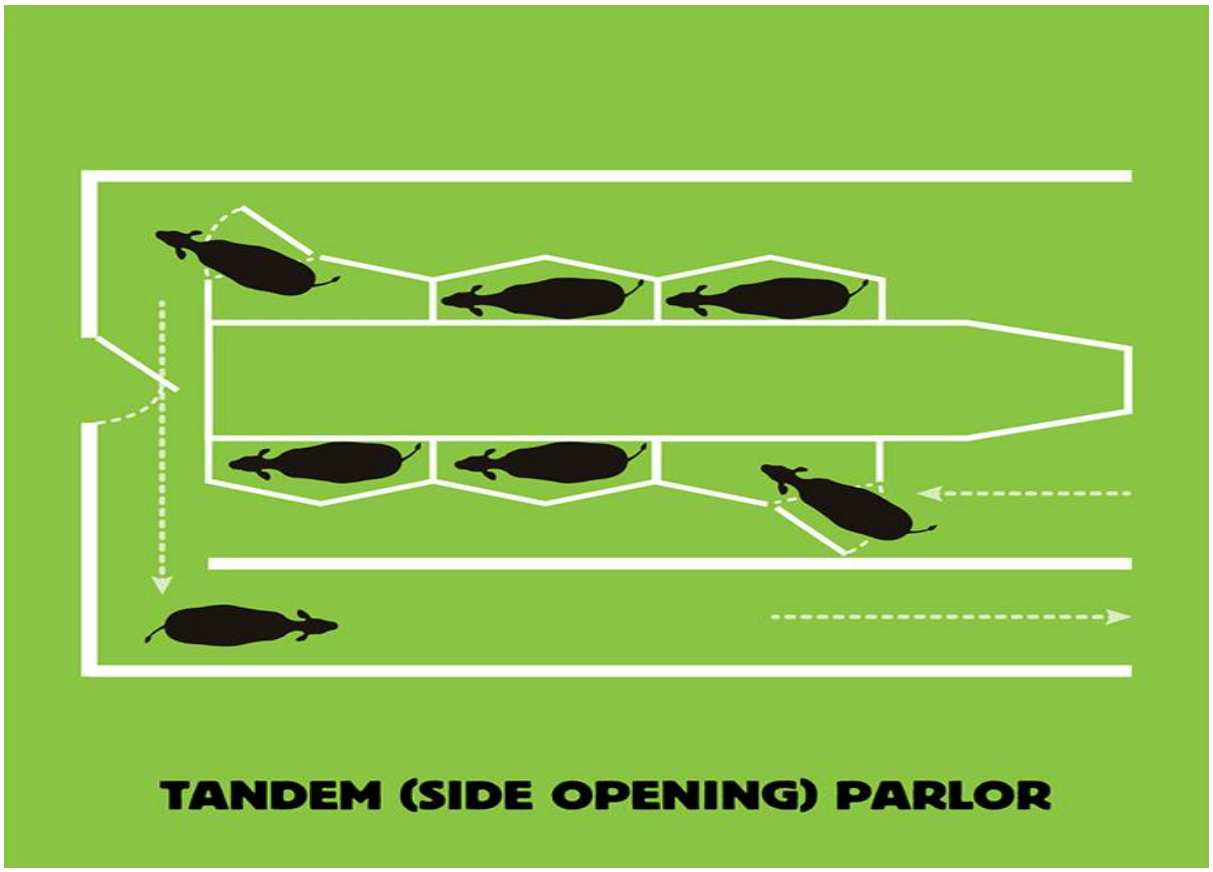
As the name suggests, cows stand parallel to each other in this design. So, if the cows are standing side to side, that only leaves one access point for the milker to reach the udder: the rear end! In parallel parlours, milking doesn't begin until all cows are in their stalls, and they are all released from the parlour at one time.



2. Tandem

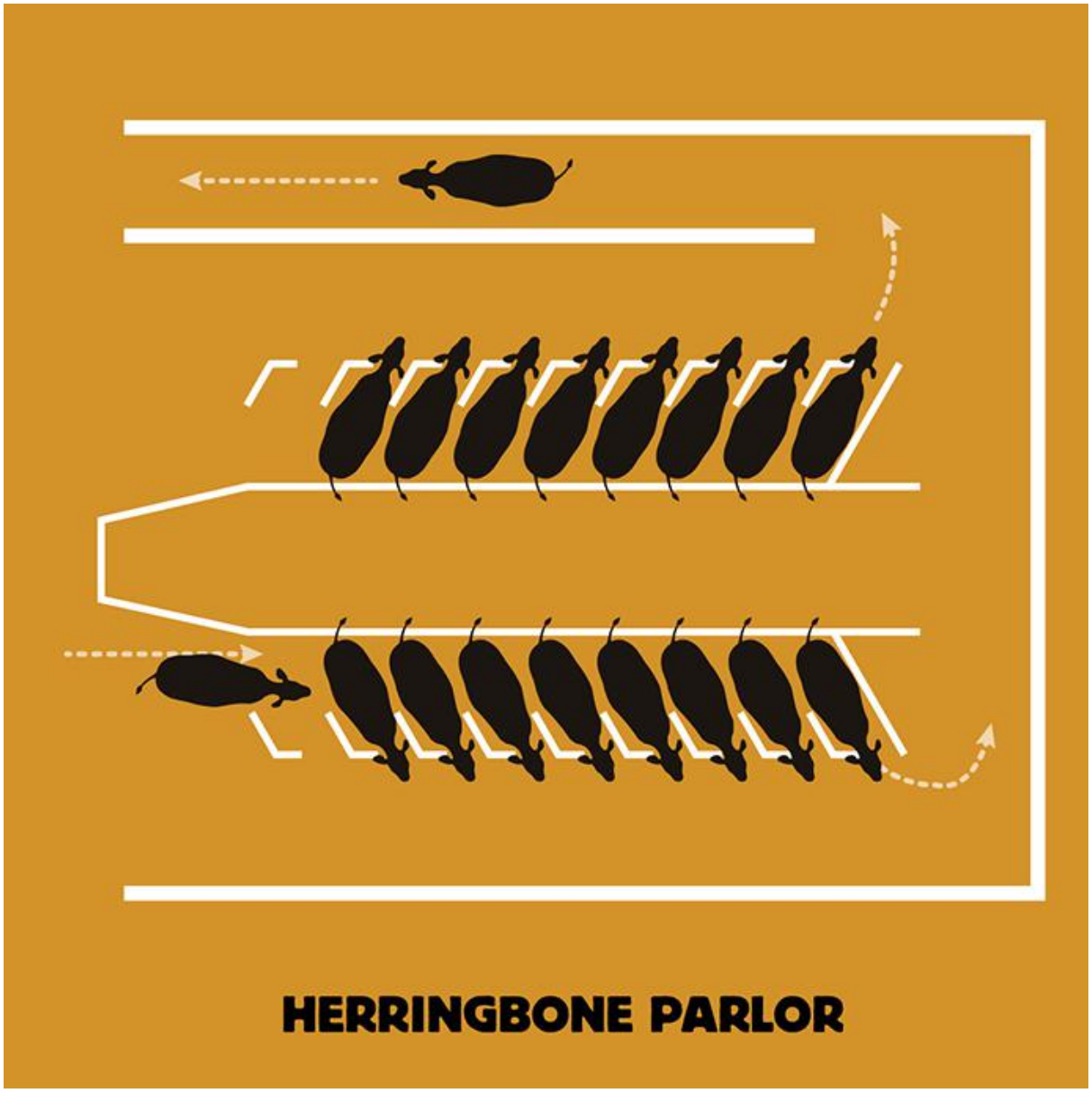
Tandem parlour designs are not all that different from tandem bikes, in that the cows stand nose-to-tail inside individual stalls. This gives the milker a side-on vantage point of the udder. Cows can be

released one at a time, too, so if one cow is moving a little slowly, all her friends don't have to wait for her to finish.



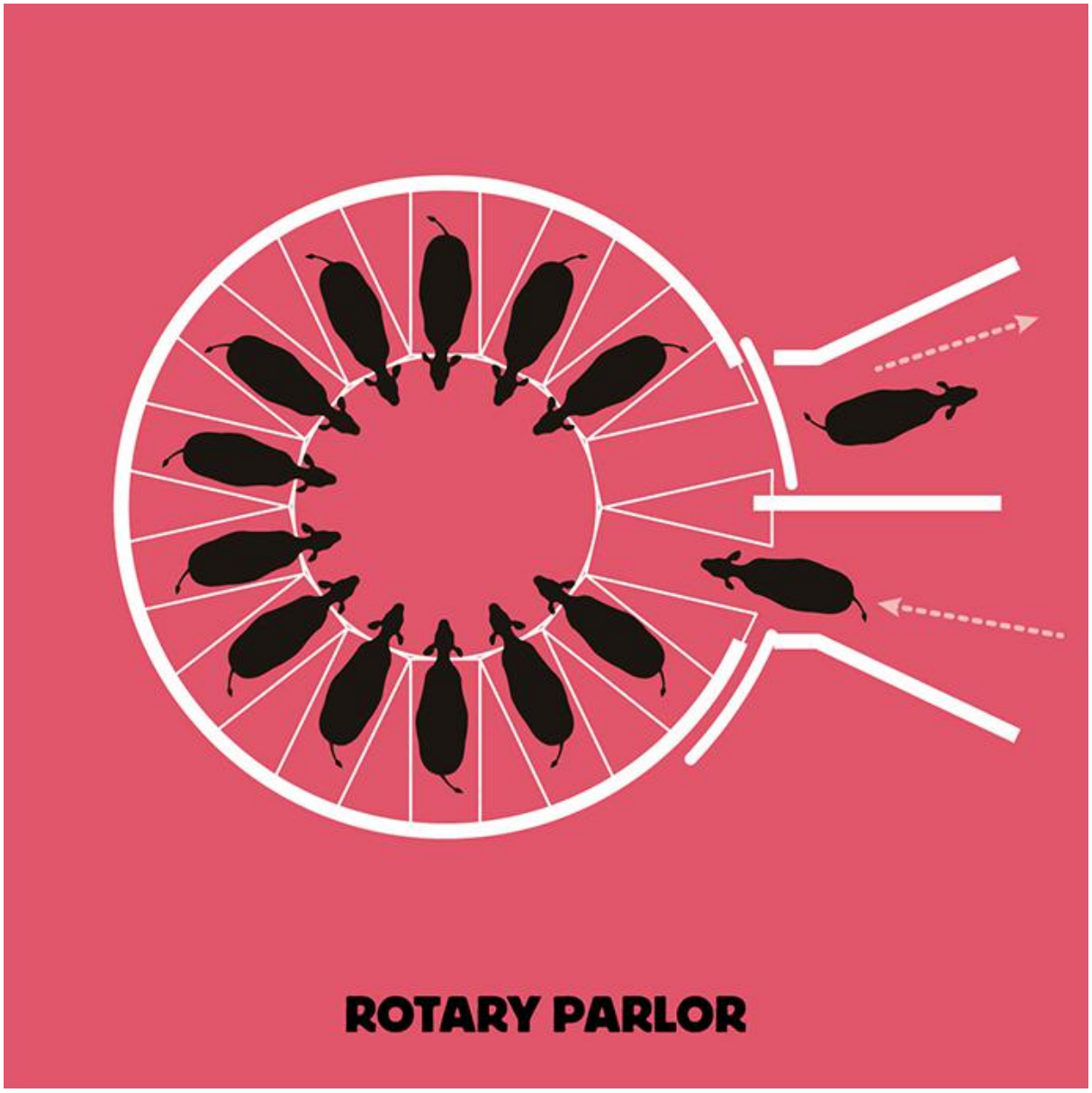
3. Herringbone

Herringbone parlours are the most common design used on dairy farms with smaller herds The cattle stand at a 45-degree angle. This design offers the milker a different access point to the udder than the parallel or tandem designs, and allows access for different types of equipment to be used.



4. Rotary

Rotary parlors are like carousel rides for dairy cows. The milking stalls are arranged in a large circle on a platform that rotates slowly. Cows can walk in, and depending on the size of the platform, finish milking by the time they've completed a lap or two. Rather than the milker having to walk around the parlor to attach the milking equipment to each udder, they can stay in one place and let the cows come to them!



5. Robots

Milking robots are becoming more and more popular amongst dairy farmers across the world, and now even in Ireland. But are they really worth the significant investment of approximately €120,000

Benefits:

There are many benefits to using an automated milking system. The main of which is the time farmers save by using these machines. It is estimated that a farmer can save themselves up to 4 hours of labour by using a robotic milking system. It also solves the labour crisis affecting the dairy industry as of late. This offers farmers more time for farm management and indeed for looking after the rest of their farm.

One of the other main benefits is the potential to increase the number of daily milkings. An automated robotic milking system can allow for up to three milkings per day, therefore increasing milk yields.

These systems have also been proven to be of benefit to an cow's health, offering useful data on the animal's feeding habits, weight and activity. While they also offer farmers information on Milk temperature, conductivity, colour and a change in milking speeds. Overall it enables a farmer to keep a close eye on their herd, without having to study them extensively on a daily basis.

Cons:

Whilst there are many pros to this system, there are also plenty of cons for farmers to consider.

The main disadvantage would be the price, with some systems costing as much as three times more than the traditional milking equipment. In fact, In Ireland, a standard robotic milking system would now cost in the region of €120,000, which represents a huge investment for farmers with a farm income well below those levels.

Studies carried out by Penn State University comparing traditional and new-age robotic systems found that Traditional systems were more cost effective in the long run. It also found that some robotic milking systems struggle to connect to darker teats found on cows, whilst they also need constant regular cleaning to avoid disease transfer. Costs again is the major reason, with any farmer needing to repair their system being heavily out of pocket.

Conclusion:

A robotic milking system does save farmers a lot of hardship and decreases their working hours considerably, but it does also add other jobs to the workload.

An expensive purchase which would be out of reach for most farmers, but all in all these systems help improve and make easier a lot of aspects of dairy farming.

Sure they may even lead to farmers taking holidays, who would have ever predicted that would happen?.

Grass Fed Benefits

- It is estimated that 10% of the global bovine milk supply is derived from pasture-based feeding systems. This allows Irish dairy manufacturers to capitalize on recent consumer trends for healthier more natural food products. There has been a recent surge in the availability of “Grass-fed” dairy products, often commanding a premium price. Recent research has shown that the typical Irish cow diet is composed primarily of pasture, accounting for 96% of the diet
- Cow feeding system has a significant effect on milk yield and milk solids yield. Pasture derived milk has significantly higher concentrations of total solids, driven by increased levels of fat and true protein. Pasture feeding has a beneficial effect on the nutritional profile of milk, with significantly higher concentrations of Omega-3 fatty acids, CLA, ß-carotene and other beneficial nutrients.
- Total Mixed Ration (TMR) feeding resulted in milk with increased contents of Omega-6 fatty acids and palmitic acid; the latter increases the hardness of high fat products such as butter. Cows on the TMR were offered, on a DM basis, 7.15 kg of grass silage, 7.15 kg of maize silage and 8.3 kg concentrates daily.
- Fresh pasture feeding produced butter with a characteristic “golden” yellow colour due to increased intake of ß-carotene in fresh grass.

Dairy Farming and the Environment

Grass from grazing land (pasture) is an important source of feed for dairy cows in many parts of the world. When managed correctly, pasture is a very nutritious feed, which allows dairy cows to produce milk rich in protein, omega-3, vitamins and minerals. Consumers' usually consider pastoral farming as healthy, animal friendly and an environmentally sustainable method of milk production

The rising consumer interest in how foods like milk are produced has led to the development of milk brands that require farmers to mainly feed their cows grass, e.g. Organic Valley's Grassmilk. These dairy products are in high demand in some nations and are sold at a market premium price

Consumers' intuition regarding pasture-based farming is not necessarily based on scientific research, but there are several research studies that support their opinion. For instance, regarding animal welfare, research comparing cubicle-housed and pasture-based dairy cows over a full production cycle showed that a pasture system improved cow welfare in terms of lameness. With regard to human health, a review of research studies highlighted that milk produced from grazing cows has higher levels of desirable or healthy polyunsaturated fatty acids (e.g. α-linolenic acid) than milk from housed cows fed total mixed ration diets.

Research has also highlighted how pasture can improve the environmental performance of primary dairy production by reducing greenhouse gas and ammonia emissions

In recent decades, growth in dairy consumption has typically seen farms in most developed nations become larger and more intensive. Normally, as farms intensify, cows have less or no access to pasture and are instead housed where they are typically fed ensiled forages and grains. Under those conditions, dairy farmers can carefully control the animal diet to produce more milk per cow than is possible by simply feeding pasture. This allows producers to generate more milk revenue and is often the main reason to move away from pastoral farming. However, this conflicts in some markets with consumer requirements for pasture feeding of cows. As a result, in certain nations, such as the Netherlands, some processors offer greater payments to milk suppliers when cows get access to grass for a minimum period.

Why is greenhouse gas policy relevant to dairy farming?

Key Facts
• In Ireland agricultural greenhouse gases (GHGs) account for 33% of total GHGs.
• The average for the EU 27 is 9%.
• Agricultural GHGs have fallen by almost 10% since 1990.
• Achieving Food Harvest 2020 targets is projected to lead to an increase of 7% in GHG emissions compared with 2010 levels.

The commitments
• The European Union has committed itself to a reduction of 20% below '1990 levels' by 2020 with an agreement to increase this to 30% as part of a global agreement.
• The EU is committed to a 40% cut in emissions by 2030.

From the market
• There is increasing pressure from manufacturers and retailers to reduce GHG emissions in the inputs/products being purchased. This will result in pressure on farmers to quantify GHG emissions of their output and to put measures in place to reduce it
What are the main greenhouse gases produced by farming?

There are three main agricultural greenhouse gases:
Carbon dioxide – CO2
Methane – CH4
Nitrous oxide – N2O

Methane
Methane is the most important GHG in Irish agriculture. It is 25 times more potent than CO2 (1kg CH4 = 25kg CO2 equiv.). The main sources are fermentation in the ruminant animal and manure storage and handling.

Nitrous oxide
Nitrous oxide is 296 times more potent than CO2. The main sources are the application of artificial and organic manures and animal excreta (mainly urine) deposited on grassland.

Carbon dioxide
Carbon dioxide from Irish agriculture arises mainly from the use of energy on the farm and in the transport of farm inputs and produce. While CO2 accounts for only a small proportion of agricultural greenhouse gasses, there is scope to reduce this on many farms.

Food produced in Ireland is very efficient when considered in terms of kg of CO2 per kg of product. In a report produced by the Joint Research Committee (JRC) of the EU, Irish dairy production was ranked first and beef production fifth in the EU 27, in terms of kg CO2 per kg of output. On the world stage, Ireland is amongst the most carbon efficient producers of milk and beef

The dilemma: carbon leakage
• Ireland has committed to challenging targets to reduce carbon emissions. Developing countries do not have the same targets.
• If Ireland reduces agricultural output to meet GHG targets, the production of food may shift to less carbon efficient countries.
• This will lead to a global increase in global GHG emissions.
• It is important to bear in mind that demand for food is growing in line with world population.

How can greenhouse gas emissions be reduced on dairy farms?

To improve sustainability and to meet legislative and market requirements, it is important for all dairy farmers to reduce their carbon footprint. There are opportunities to reduce CH4 emissions through increased efficiency and adoption of a range of management practices:

- ✓ Increased grazing season increases grass utilisation and reduces the volume of slurry to be stored and spread. A 10 day increase in the grazing season can reduce GHG per kg beef by approximately 2%.
- ✓ Better production and utilisation of grass means improved nitrogen efficiency and improved animal performance. Inclusion of clover in swards can significantly reduce GHG emissions by replacing purchased N with clover fixed N.
- ✓ Efficiency per cow. Each cow produces the same level of CO2 equivalents per year as an efficient car travelling 17,000 Km per annum. Unproductive cows increase carbon footprint. Reduce this by improving calving rates through improved fertility management, lowering the age at first calving.

- ✓ Slurry spreading and storage. Timing and spreading technology have a significant impact on GHG emissions. Reducing N losses to water and air are important from an environmental perspective but also lead to increased availability for plant growth.
- ✓ Correct nitrogen usage. Getting the timing and type of nitrogen fertiliser type right for the prevailing conditions can significantly reduce losses and improve the effectiveness of N fertiliser
- ✓ Improved liveweight gain improves GHG efficiency by reducing finishing age and/or increasing carcass weight and thereby reducing the emissions per unit of output.
- ✓ Land Use – sequestration. Grassland and forestry take carbon dioxide out of the atmosphere and store it in wood and soil. Fortunately, most of the mitigation options outlined above are consistent with improving the efficiency and profitability of the dairy farm. Adopting these technologies could significantly reduce the carbon footprint of Irish dairying

Why is water quality important for dairy farmers?

When compared with other EU member States, Ireland has good water quality. The 2010-2012 water quality report, published by the EPA, shows evidence of improvements in water quality in Ireland. However, there is a considerable challenge to meet the target of good status for all water bodies (currently 72.9%). The main pressures on Irish water quality arising from agriculture include: phosphorus, nitrate, sediment and pathogens. These pressures are controlled under the Nitrates Regulations
The Nitrates Regulations were introduced in Ireland in 2006 and updated in 2010, and 2014. The regulations are designed to control diffuse and point source pollution from agriculture. It is vital that dairy farmers play their part in protecting water quality by ensuring that they put in place an effective nutrient management plan, ensure that there is no point source losses to the environment and comply with the provisions of the Nitrates Regulation.

Key Actions Nutrient Management

• Carry out soil nutrient analysis on all fields on the farm
• Prepare a nutrient management plan consistent with nutrient status and level of output
• Apply lime as per recommendation
• Utilize slurry effectively
• Apply the correct level of appropriate chemical fertiliser at the right time
• Ensure clean water is separated
• Make sure there is adequate slurry storage
• Pay particular attention to farm roadways, yards and silage pits to ensure that there is effective collection of soiled water and no potential for losses to watercourses.

Approximately 80% of the world's population live in areas where the fresh water supply is not secure. International research has shown that grass-based dairy systems, such as we have in Ireland, have the lowest water footprint. This places Ireland in a strong position to continue to produce milk competitively with both a low water and carbon footprint.

How can countryside management benefit dairy farmers?
Biodiversity enhances farms and the rural countryside. It contributes to the 'green' image of dairying. Leaving space for biodiversity maintains assets for future generations. Dairy farms can help to halt the decline in Ireland's biodiversity and contribute to a living landscape in their own rural area.

Examples of biodiversity enhancement on dairy farms are:
- planting native Irish trees in corners or rows
- erecting bird or bat boxes
- creating a pond
- growing a small area of a crop for wildlife
- planting new stock-proof hedgerows and maintaining/ improving existing hedgerows.

The decline in biodiversity can be halted by a network of biodiversity areas on all farms in the country. Agri-environment schemes provide opportunities to invest in the future of every farm farm.

Hedgerows
Common images which market Irish farm produce inevitably feature cattle in lush green fields with scenic hedgerows in the background. Hedgerows are now landscape features which means the area beneath them is eligible for the single payment scheme. In order to avoid penalties under cross compliance, farmers must replant an equivalent length elsewhere before removal of any hedgerows. Hedgerows must not be trimmed from March to August to avoid the destruction of nesting birds.

Archaeological and historical features
The Irish countryside is rich in ancient settlements and ritual monuments. These tell the story of generations of farming communities who have made their living from the land and are essential to our understanding of the past. The traditions and beliefs of older generations have prevented much interference with the 'fairy rings' or 'giants' graves' and mass rocks. They are now protected by law and any interference can lead to penalties under cross compliance.

The Sustainable Dairy Assurance Scheme (SDAS)
The Sustainable Dairy Assurance Scheme (SDAS) was developed by a Technical Advisory Committee (TAC) representing Bord Bia – the Irish Food Board; Teagasc; the Food Safety Authority of Ireland (FSAI); the Department of Agriculture, Food and the Marine (DAFM); industry (producers and processors) and other technical experts.

The SDAS has been developed in response to the demands of the marketplace. Increasingly purchasers of Irish dairy products are requiring proof that the milk is produced sustainably on farms that are certified members of an accredited quality assurance scheme
The SDAS has been designed to assess and record data to demonstrate the sustainability of Irish dairying in a systematic way at individual farm level and will therefore provide the necessary proof to customers of dairy products that milk has been produced under the Sustainability and Quality Assurance criteria. The farm visit is conducted by an independent auditor on every member's farm at 18 month intervals and a comprehensive report is produced on the performance of the farm under the Sustainability and Quality Assurance criteria.

The primary objectives of the Sustainable Dairy Assurance Scheme are:
- To demonstrate to customers of dairy products that milk is produced sustainably under an accredited scheme;
- To provide a uniform mechanism for recording and monitoring:
  - Dairy farm quality assurance criteria and;
  - The sustainability criteria of the farm.
- To set out the criteria for best practice in Irish dairy farming;
- To provide an on-going means of demonstrating best practice at Producer level.

Scheme Detail
The two main components of the SDAS are Sustainability and Quality Assurance.

Sustainability
Sustainable agriculture is defined as "the productive, competitive and efficient production of safe agricultural products, while protecting and improving the natural environment and the socio-economic conditions of farmers and local communities." In other words sustainability is about ensuring that not only do we farm efficiently but that we pass the land on to the next generation in as good or indeed better condition than when we inherited it. In the dairy sector most of the leading multinational customers are looking for suppliers who have credibility in sustainable production. In order to retain and grow long–lasting business relationships with these customers, sustainability initiatives (in areas such as minimising greenhouse gas emissions, conservation of water, good soil management and improving biodiversity) are required. During the farm visit the auditor will collect additional information about the farming enterprise that will enable milk processors to substantiate claims with regard to carbon footprint, water use, etc. and this information will be used by Bord Bia to assess the sustainability performance of the farm.

Quality Assurance
The Scheme is accredited to the European Standard for Product Certification (ISO2 17065: 2012), as are all other Bord Bia National Quality Assurance Schemes. This means that they have been independently assessed and judged to be as good as or better than leading schemes in other countries. During the Bord Bia farm visit, Members' compliance in areas relating to legal, quality and customer requirements including farm safety and welfare, food safety, traceability and animal welfare is assessed.

Identification and Traceability
The SDAS Standard seeks to assure the consumer with regards traceability on the farm. Producers will be therefore aware of the importance of being able to establish full traceability for all cattle on their farm(s). The central system for ensuring identification and traceability of livestock on farms is the DAFM Animal Identification & Movement system (AIM) on which all movements are finally recorded.

Each participant must have a valid DAFM herd number and a current valid herd register (Critical).
Each participant must have a system for recording bovine movements2 that meets the regulatory requirements.
b) There must be a current listing of all bovines on the holding.
c) All animal movements onto and off the farm must be recorded with AIM Compliance Certificates and where relevant retained.
d) Records of all bovine births and deaths must be retained.
e) All cattle on the farm must be tagged with two (matching) official ear tags by 20 days of age.
f) All calves must be registered on AIM within 7 days of tagging using the Calf Registration form or other approved means.
g) There must be a valid passport (or approved alternative) available for each animal within 40 days of birth.
h) The disposal of dead cattle must be done in compliance with the current DAFM requirements and the required disposal evidence must be available (e.g. receipt for collection / AIM record).

Animal Welfare

Farmers realise the value of having suitable training and experience in animal husbandry, health and welfare. This includes having a knowledge of the following: maintaining healthy, stress free, and properly nourished animals; appropriate animal feeding and grassland management; good animal housing; good animal husbandry and handling; maintaining normal animal behaviour; a planned herd health programme; prompt treatment of sick animals; responsible use of animal medicines.

a) Where stock bulls (including vasectomised animals) are housed individually, they must have sight of other farm animals or other farm activity.
b) Calving facilities must be available that permit cows to be restrained promptly and safely as required.
c) Calves under 8 weeks may only be housed in individual pens where they have direct and visual contact with other calves. Calves over 8 weeks must only be individually penned where under veterinary supervision / treatment.
d) Calving pens must be maintained in a hygienic and safe condition so as to minimise risk of infection and injury during calving.
e) Where castration using a clamp (e.g. Burdizzo) is carried out, it must be completed before 6 months of age, or if older by a veterinary surgeon.
f) Where castration is carried out using rubber rings, it must only be carried out in the first week of life.
g) Disbudding of calves without veterinary intervention must be carried out before 2 weeks of age and must be done in a competent manner that minimises pain.
h) Dehorning of older dairy animals must only be carried out by a veterinary surgeon using appropriate anaesthesia and analgesia (pain killing drugs).
i) Routine tethering of calves is prohibited.
j) Siring (either by stock bulls or AI) must be managed to minimise calving difficulties (particularly for heifers).
k) Tail docking of cows and calves is prohibited.
l) Documentation must be available to demonstrate that synchronisation of oestrus, where practiced, was carried out under veterinary supervision.
m) Routine induction of calving is prohibited.

Other Welfare Points
a) To verify that the welfare requirements of the animals are being met, Producers must have a regular inspection routine (including inspection during milking) for all animals and the frequency of inspections must be increased during vulnerable periods including calving, adverse weather conditions and other relevant times.
b) Producers must have animal handling facilities for the management of their livestock (e.g. a pen, crush, restraining gate where relevant). These facilities must be appropriate to the enterprise, permit animals to be restrained to minimise risk of injury and stress and must be maintained in a manner that ensures the safety of both the livestock and the stockperson.
c) Animals must be treated and handled in accordance with Animal Welfare Guidelines, i.e. without excessive physical force, in a manner that avoids injury and minimises stress.
d) Where the destruction of an animal is deemed necessary on humane grounds, it must be carried out under direct veterinary supervision or by a licensed slaughter service (who may be a knackery employee). The death must be recorded on the AIM database by the knackery and in the herd register or equivalent by the Producer.
e) Producers must ensure that the health and welfare of the animals is provided for in the event of unplanned absences of a stockperson.
f) The herd must be under the routine care of a veterinary surgeon.
g) All bovine animals must be presented for testing in accordance with the DAFM disease eradication and control requirements.

h) Each Producer must follow a documented Animal Health Plan that is based on the needs of the farm and that is drawn up by the Producer.
i) Boundaries and fences must be maintained in a stock-proof condition to minimise contact with animals of other herds and must be maintained to minimise risk of injury to animals.
j) Sick animals must be treated promptly and segregated where required.
k) Producers must be aware that certain diseases can be transmitted from animals to humans and familiarise themselves with possible preventative measures
l) All purchased stock must be monitored for signs of disease for a period after purchase.
m) Lactating cows must normally be milked daily.
n) A record of significant animal health events (e.g. abortions, disease incidences including respiratory, leucosis, salmonellosis, leptospirosis, paratuberculosis / Johne's, blackleg , etc) must be maintained.
o) The authorities must be informed in the event of incidences of notifiable diseases

Farm Safety

The Risks from Working with Cattle

Any work with cattle involves some level of risk. Injuries from animals are by far the biggest cause of farm accidents and most of these arise from cattle. The general causes of injuries from animals on farms are listed here:
> Knocked over or attacked 54%
> Kicked 29%
> Crushed 11%
> Catching an animal 3%
> Fell from horse 3%

From 2000 to 2010 approximately 15% of all fatal farm accidents have involved livestock. Bulls and cows with newborn calves pose the greatest risk. Bull attacks account for approximately 54% of all the fatal accidents involving livestock

In addition to fatal accidents, there are an unknown number of deaths from illnesses arising from cattle, in particular from infections such as leptospirosis, salmonella and E.coli strain 0157. The risks of injury are higher:
> When cattle are not handled frequently.
> When handling cattle with bad past experiences.
> When cattle are handled by unfamiliar persons.
> Where the handler lacks the necessary experience, agility or ability to assess the possible risks.
> When in unfamiliar surroundings.
> With some breeds.
> With bulls.
> With cows with newborn calves.
> With bad tempered or fractious cattle.
> When cattle are alone, isolated and away from their herdmates.
> When cattle are handled at close quarters, such as in a race or a crush.
> When cattle are being loaded and unloaded for transport.

Main Points

1. Well designed and maintained handling facilities are essential for the safe handling of cattle and prevention of injury to handlers
2. Keep the Yard Clean and Tidy - A lot of accidents on farms result from simple trips, slips and falls
3. Non-Slip Surfaces Some muck is inevitable in the farm yard, especially in winter. Sheet ice can also be present and is very dangerous. These hazards lead to many slips and fall accidents. Concrete surfaces can be grooved to reduce the chance of slipping. Areas that are continually damp should be powerwashed at the beginning of winter to maximise grip and to remove any accumulated dirt. Ice can be dissolved by spreading salt grit
4. The yard and equipment must be suitable for the type of cattle being handled. The essential components of good yards include the collecting pen, race, forcing pen, raised catwalk alongside the race, crush, skulling gate, dispersal pen, worker escape points, all with gates that swing and latch freely. The layout should always ensure there is always an 'escape' route for the handler, should that be required
5. Cattle have a strong herd instinct to 'follow the leader' and will stop moving if they lose sight of the leader. The cattle race should be of sufficient length to take account of this characteristic
6. The fences and gates on the farm must be able to contain the classes of cattle on the farm. In particular, all road boundaries must be stock proof and internal fences able to ensure that unplanned mixing does not occur.
7. Cattle of broadly similar age and size should be penned together where possible. This social group should be allowed to develop and reallocation of animals to other pens should be minimised. Sick or weak cattle should be segregated where necessary for their welfare.
8. The wintering shed(s) for cows must have easy access to a calving pen that is clear of other cattle. Lighting must be strong enough to allow good vision for the farmer, particularly of the ground hazards
9. A well designed bull pen is essential for the proper management of the bull(s) when he is away from the herd. The bull pen should be located so that the bull(s) can see other cattle and daily farm activity in the farmyard. The structure must be strong and high enough to stop them escaping. A well designed bull pen will allow the bull to be fed and watered from outside the pen
10. The calving area should provide adequate space, be tidy and well-bedded with clean dry straw, free of obstructions with good lighting. Well designed calving pens and gates minimise the direct physical contact between the cow/heifer and the farmer. The facility should provide the farmer with access to both sides of the animal. Other desirable features would include areas to perform Caesarean sections and for the suckling of newborn calves. Calving jacks if properly used can reduce the risk of back injuries. Mechanical lifting aids such as a pulley system in the calving pen can also prevent back injury
11. The design of the parlour and the yard must ensure that the cows can be milked safely and rapidly. It is most important that cows have adequate room in the milking parlour and that the Kick Rail is at the correct height to prevent the 'milker' getting kicked
12. Stray electrical current can be a problem in the milking parlour, causing the cows to become frightened and very nervous. This can cause cows that are otherwise very docile to kick out at the milker.
13. Many injuries arise from loading and unloading cattle. A suitable loading ramp is essential for safe loading of trailers or trucks. All ramps must have ramp gates in place; gates must be strong and secure and must operate freely and lock in securely when closed. Cattle escaping to the sides at this time can create a huge problem. The cattle generally will dislike being

loaded onto a trailer and understandably some will resist. The stockman should be patient and calm and allow adequate time for cattle to load.

14. Cattle that are known to be fractious, dangerous or unpredictable pose a continuing risk. Cattle that have attacked once are more likely to do so again. Culling these cattle to the abattoir is always the safest course. Cattle known to be dangerous should not be sold through a mart or directly to other farmers
15. The demeanour of cattle usually tells of their state of arousal. This can be in the form of the head and tail positions, pawing the ground with its legs, or bellowing. Seriously distressed cattle often bellow loudly – a sure sign to the farmer to be especially careful and to its herdmates that there is danger
16. Persons handling bulls should be aged between 18 and 65 years, fit and agile. They should be fully aware of the dangers when handling bulls and properly trained. All bulls should be ringed in the nose when 10 months old and the ring should be examined regularly. From an early age the bull should learn to associate the presence of people with pleasant things, such as feeding, grooming and exercise In all cases, without exception, have an aggressive bull sent to the abattoir. When a bull is taken from a pen, he should be led using suitable equipment (head chains, bull poles and leading ropes). Never attempt to handle a bull on your own. At least two people should be available when handling a bull.
17. The risk of attack from stock bulls running with the herd is greatest during the summer months when the most mating is occurring. Avoid grazing a bull in a field where there is a right of way or where members of the public may have access. A safety sign warning of the bull's presence should always be posted.
18. Consider using a tractor or other suitable farm vehicle (i.e. Jeep) as a mobile sanctuary when you need to go into a field where the bull is running with the cows. If cornered by a bull it is best not to move too fast but to slowly move out of the bull's 'flight zone'. Turning and running from the bull invites being chased. They will usually be faster than you. If there is no refuge point to escape then stepping sideways out of his best vision will confuse him as to where you have gone. No bull can be trusted and will be unpredictable at some time. This applies even to young bulls and seemingly quiet bulls. The requirement to keep a bull for breeding purposes can be largely eliminated if artificial insemination is used for all mating. This is by far the safest option
19. Cows: Cows have attacked and killed several farmers. There have been countless serious injuries from cows. Cows and heifers are more unpredictable during stressful periods such as calving, weaning and at their first milking. Suckler cows which are handled less frequently generally pose a greater risk than dairy cows. However, some dairy cows are very protective of their calves. Continually aggressive cows should be culled. All cows with newborn calves should be treated with caution.
20. Calving: Many farmers suffer serious injuries while attending cows at calving time. Several farmers have been killed by cows immediately after calving. Work practices such as taking a newborn calf from a cow, hand milking, navel dipping and stomach tubing pose a risk of injury. Never turn your back on cows with new born calves. She may perceive you as a threat and attack. A freshly calved heifer may present an even greater threat.
21. With a dairy farm where the milking parlour is on the other side of the road away from most of the fields, consider getting an underpass constructed. The cows must not be allowed to drift individually across a road. They must be held until milking is finished then the whole herd moved as a group

22. It is safest to drench small cattle in a cattle crush. Large cattle should be held in the gate or given a pour-on anthelmintic. Never get into the race with large cattle. The drenches used will affect the farmer so be very careful not to 'treat yourself' or others in the vicinity
23. Vaccination always requires sharp needles and with that comes the risk of injecting yourself or a workmate instead of the animal. Some vaccinations can be dangerous to humans and should be done by a veterinarian. e.g. the leptospirosis vaccination of heifers and the toxoplasmosis vaccine. This risk is greater if the animal is not adequately restrained. Cattle should always be injected in the anterior neck area to reduce the cost of carcass damage, should an abscess develop. When the work is finished the needles must be placed in a secure container and locked away, especially from children.
24. Often it becomes necessary to lift a new borne calf. This results in many back injuries to farmers. The key is to lift using your legs and to keep your back as straight as possible. To lift, squat down bedside the calf, pull it in close with one arm around the front and the other around the hind legs. Then straighten your knees to lift it. Hold it firmly and don't let it struggle loose. If you are moving it any distance tie the legs and put it in a barrow or trailer
25. Several aspects of cattle husbandry such as housing of animals during the winter, castration, scanning, freeze branding, drenching, vaccination, dehorning and transportation have the potential to cause serious injury if not managed correctly. Certain tasks such as castration, freeze branding and scanning will involve getting into the cattle crush with the animal. In these circumstances the following basic rules should be followed:
    • Only allow one animal at a time into the crush.
    • Restrain the animal's head in the crush gate.
    • A second person should hold the tail straight up.
    • Have a slip gate into the crush just behind the first animal.

Dairy Industry

There were approximately 16,146 Dairy farms, with an average FFI of €66,570 in 2019, a 9 percent increase year on-year

Approximately 42 percent of Dairy farms belong to the 50 to 100 hectares size category, with a further 32 percent in the 30 to 50 hectare bracket. Smaller farms represent 16 percent of the Dairy farm population, with the remaining 10 percent above 100 hectares.

In terms of the proportion of Dairy farms located in each region, the vast majority, 11,708 (72 percent) are located in the South, which would be considered a traditional dairy area. A further 2,352 are located in the Northern and Western region, with 2,014 in the Eastern and Midlands region, where more recent dairy expansion has been occurring since the abolition of EU milk quota

The average Dairy herd size, the figure increased from an average of 64 cow per farm in 2010 to an average of 80 cows in 2019

Substantial structural change has taken place on Irish Dairy farms in preparation for, and since the abolition of EU milk quota in 2015. Overall milk production has increased and production efficiency has improved

Gross new investment on Irish farms increased by 4 percent in 2019. On aggregate, this totalled almost €980 million nationally. Investment on Dairy farms was highest at an average of €33,091 per farm, accounting for more than half of total investment in 2019

The Targeted Agricultural Modernisation Scheme (TAMS) and the Young Farmer Capital Investment Scheme continue to assist on-farm investment in recent years

On an average Dairy farm, with a herd of 80 cows, purchased concentrate expenditure totalled €36,521 in 2019, a reduction of 14 percent relative to 2018. Although much lower in value terms, expenditure on purchased bulky feed also decreased substantially, down 20 per cent (to €4,763) on average.
Fertiliser expenditure increased in 2019, up 4 percent to €14,400 on average. This was due to lower levels of usage being more than offset by higher prices. Likewise, machinery hire expenditure, which relates to contracting charges also increased, up 3% per cent to €11,444. Other livestock and veterinary costs remained stable on average, accounting for €10,759 on the average dairy herd. Overhead costs increased on Dairy farms in 2019, increasing 3 percent year-on-year. This was due for the most part to depreciation costs for buildings and machinery, where increases ranged from 4 to 14 percent reflecting the continuing investment that has taken place on dairy farms. Hired labour costs continued to increase on Dairy farms in 2019.

In 2010 the average Dairy stocking rate was 1.9. The average dairy stocking rate has increased appreciably since then, dropping slightly in 2018, due to the adverse weather conditions, but increasing again in 2019 to 2.09 livestock units per hectare.

Due to their size, Dairy and Tillage farms receive the highest farm level direct payment. However, across the various farm categories, Dairy and Tillage farms are least reliant on such payments as an income source

A farm business is defined as being economically viable if Family Farm Income is sufficient to remunerate family labour at the minimum wage (which is assumed here to be €20,129 per labour unit), and provide a 5 percent return on the capital invested in non-land assets, i.e. machinery and livestock. In 2019, 75 percent of Dairy farms were found to be viable (up from 72 per cent in 2018).

Dairy Farming and Milk Production
18,000 Dairy farmers
Average herd size approx. **90 cows**
Average production: **450,000 litres**
Yield per cow : **5,300 litres** (relatively low yield reflects grass-based system)
National dairy herd : **1.5 million cows** (+400,000 cows in the last 5 years)
National milk production: **8 billion litres** (2019)
Production is essentially grass-based, and therefore very seasonal, with **peak/trough ratio rising to 10 to 1** (May versus January) in 2019. This ratio has increased as a result of the ending of quotas in March 2015.

Production of the main dairy products in 2019:

Liquid milk	536 m litres
Butter	251,000t
SMP	142,500t
Cheese (mostly cheddar)	224,100t (2018)

Ireland exports about 90% of its dairy output, to 120 countries. The value of exports has doubled from €2 billion to €4bn, since EU milk quotas were removed in 2015.

In 2019, Irish dairy exports reached €4.4 billion, making it the largest food and drink export category. This was the third consecutive year in which the value of dairy exports exceeded the €4bn mark. Driving this was exceptional performance in butter, cheese and dairy powders including skimmed milk powder (SMP), whey and casein - with value growth well ahead of volume in all these dairy powder categories.
While Ireland exported dairy to 124 countries in 2019, the largest destinations are The UK, The Netherlands, China, Germany and the US.

Asian destinations were the location of some extraordinary growth figures for Irish dairy exports, particularly for ingredients, albeit these are coming from a very low base. Dairy exports to priority markets like Indonesia and Malaysia increased 85% and 50% respectively to be worth more than €50m cumulatively.
Butter accounts for the greatest proportion of our dairy exports at €1.1 billion, or one quarter of the total export value. Irish butter has enjoyed unprecedented demand in recent years, particularly in the US. Kerrygold is now that country's number two butter brand and the US is Ireland's second largest overall market for butter. Irish butter exports also grew in Japan and in South East Asia in 2019, with markets such as Singapore, Indonesia, and the Philippines all showing increased demand. Cheese was Ireland's second largest dairy category in value terms in 2019 reaching €998m.