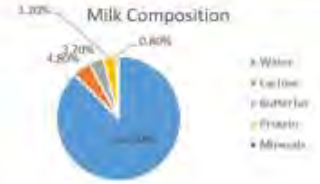
Milk Quality Farm Based Case Study

Milk Production - Factors affecting Content and Quality

Ireland status as the lowest carbon-emitting dairy sector in the northern hemisphere due to our grass based system is recognised across a growing global customer base. It is one of the main producers of infant milk formula in the world. Therefore we have continue to maintain our excellent standard of milk quality. Farmers are paid on the amount of fat, protein and lactose present in the milk. Dairy industry produced over 8.1 billion litres and is worth over €4 billion to economy.



Factors affecting Milk Content (Composition)	
Breed	Vary greatly between breeds and within herds e.g. Holstein Friesian – butterfat ~3.7% and protein ~ 3.2% Jersey – butterfat ~ 5.4% and protein 4.0%
Diet	Quality, quantity and type of feed will influence milk composition. • High fibre feed (silage) - increase butterfat • High DMD grass - increase protein
Stage of lactation	Milk solids are high after calving, decrease during peak yield, increase towards end of lactation
Stage of Milking	% fat increase during milking as fat globules are trapped in alveolus at start of milking
Milking Interval	Time between cows being milked → with 14 hour / 10 hour interval cows produce more milk in the morning, therefore butterfat is lower.
Health	Disease of udder (e.g. mastitis) - % fat, protein & lactose decrease & white blood cells increase
Age	% fat & protein decrease with age → identified by milk recording & culled

Milk Quality Standards	
Milk collected from farms must comply with quality standards of EU Regulation 583 of 2004. The sample of milk is subject to several milk quality tests:	
Total Bacterial Count (TBC)	Low level of bacteria (<50,000 / ml) - manufacture of high-quality dairy products Good hygiene is essential
Somatic Cell Count (SCC)	Level must be < 200,000 / ml to ensure good protein extraction High SCC reduces lactose content - < 4.2% cannot be processed into premium products High SCC indicates a high number of white blood cells in the milk which indicates an infection in the udder (sub - clinical mastitis) Clinical mastitis – white clots in milk – California Mastitis Test (CMT) Good hygiene is vital
Thermoduric test	Organisms that can withstand pasteurization - reducing shelf life of milk Good cow & machine hygiene essential
Excess water	Excess water - dilutes protein content
Sediment test	Sediment in milk due to soil etc. entering milk due to poor pre - milking routine Ensure new milk filter socks are used at each milking
Milk temperature	Milk only collected from refrigerated tanks & it must be < 6°C
Antibiotic test	It is an offence to supply milk that contains antibiotics - penalised Adhere to withdrawal period indicated on antibiotics & don't send milk during that period Farmers can test milk on farm using the Delvo test
Trichloromethanes (TCM)	Chlorine comes in contact with milk – ensure machine thoroughly washed out

Procedures required to Produce Good Quality Milk	
Good Hygiene	Machine and housing
Wear clean gloves	Disinfect gloves after treating infected cows
Fore-milking	Hand milk prior to putting on machine (clusters): • Identify early cases of clinical mastitis • Removes any milk that has been in teat canal since previous milking • Quicker milking due to natural oxytocin let down
Machine is serviced & milk liners changed	Liners should be changed after 2,000 milkings / twice per year
Teat dip	Iodine
Milk infected cows at end of milking	Avoid contamination of clusters
Milk recording	Identify milk composition of each cow and SCC levels
Dry cow treatment	Long acting antibiotic / teal seal
Cool milk	<4°C as quickly as possible – plate cooler and bulk tank
Fly control	Prevent summer mastitis

Ways to Increase Protein & Butterfat Content of Milk

Good grassland management – rotational / strip grazing	70% + DMD silage	Ensure cows are completely milked out at each milking
Addition of clover	Calve in early spring – out protein drop at turnout	Regular milking interval
Select daughters from high protein yielding cows and sires	Maintain healthy udder – control mastitis	

Milk Recording Data from Pat and Mary's Dairy Farm

Cow ID / Cow name / Sire ID	I&R-Tag / Cow Classification	Calv. Date / Age / Group	Lact. / Days / Test	Last test day / Yield to date / 305 day yield (predicted) M Kg	M Gall	F%	P%	L%	F Kg	P Kg	F+P Kg	SCC Tests>200 / No. Treats	EBI (Euros)
1796	-1796	23/02/19	1	16.6	3.5	4.45	3.61	4.44	0.7	0.6	1.3	33	-36
key Ivy 1796		2y 11m	244	5710	1220	3.83	3.08	4.79	219	176	395	0	
IE211351991403	GP 83	Spring	5	*6591*	*1408*	*3.96*	*3.16*	*4.79*	*261*	*208*	*469*	0	
1800	-1800	11/03/19	1	11.6	2.5	6.89	3.83	4.40	0.8	0.4	1.2	320	57
eiss Swiss 1800		2y 11m	228	4719	1008	4.23	3.35	4.65	200	158	358	1	
S2195	G 79	Spring	4	*5631*	*1203*	*4.52*	*3.42*	*4.65*	*254*	*192*	*446*	0	
1801	5-1801	12/02/19	1	13.7	2.9	6.63	3.65	4.26	0.9	0.5	1.4	61	36
eiss Hilda 1801		2y 11m	255	5436	1161	4.38	3.24	4.75	238	176	414	0	
S2195	GP 82	Spring	5	*6042*	*1291*	*4.61*	*3.29*	*4.75*	*279*	*199*	*478*	0	
1804	8-1804	18/02/19	1	14.3	3.1	4.40	3.60	4.81	0.6	0.5	1.1	111	21
Alma 1804		2y 11m	249	5851	1250	4.64	3.16	4.91	272	185	457	1	
KKM		Spring	5	*6543*	*1398*	*4.70*	*3.20*	*4.91*	*307*	*209*	*516*	0	
1810	31810	16/02/19	1	14.0	3.0	8.36	3.36	4.25	1.2	0.5	1.7	60	-2
y Lorna 1809		2y 10m	251	5771	1233	3.83	3.28	4.77	221	189	410	0	
IE211351991403	F 70	Spring	5	*6437*	*1375*	*4.30*	*3.30*	*4.77*	*277*	*212*	*489*	0	
del 1089		9y 7m	206	5950	1271	4.20	3.29	4.73	250	196	446	0	
IE211351920927	EX 90	Spring	4	*7324*	*1565*	*4.42*	*3.31*	*4.73*	*324*	*243*	*567*	0	
1112	-1112	19/02/19	6	15.1	3.2	5.61	3.82	4.22	0.8	0.6	1.4	97	
2 Sarah		9y 6m	248	6518	1392	4.29	3.24	4.70	280	211	491	0	
	EX 90	Spring	5	*7207*	*1540*	*4.45*	*3.30*	*4.70*	*321*	*238*	*559*	0	
1170	2-1170	07/04/19	6	16.1	3.4	4.96	3.47	4.35	0.8	0.6	1.4	233	-50
e 2 1170		8y 7m	201	5325	1138	3.94	3.25	4.51	210	173	383	3	
IE211351920927	VG 87	Spring	4	*6673*	*1426*	*4.14*	*3.30*	*4.51*	*277*	*220*	*497*	0	
1176	-1176	08/05/19	6	19.9	4.3	10.22	3.16	3.94	2.0	0.6	2.6	6672	-19
e Swift 1176		8y 7m	170	5388	1151	4.39	3.02	4.69	236	163	399	3	
IE182316831033	VG 87	Spring	4	*7552*	*1613*	*5.56*	*3.09*	*4.69*	*420*	*233*	*653*	0	
1186	1-1186	18/10/18	6	12.6	2.7	4.62	3.76	3.17	0.6	0.5	1.1	426	12
ze 1186		8y 7m	372	10790	2305	3.81	2.98	4.61	411	322	733	1	
IE211351920927	F 69	Winter	7	*9692*	*2070*	*3.74*	*2.93*	*4.61*	*363*	*284*	*647*	0	
1189	-1189	01/11/18	5	17.6	3.8	4.50	3.25	4.58	0.8	0.6	1.4	166	-52
wdrop 1189		8y 7m	358	11740	2508	4.20	2.99	4.78	493	351	844	1	
IE211351920927	GP 84	Winter	4	*10620*	*2269*	*4.20*	*2.98*	*4.78*	*446*	*316*	*762*	0	
1202	-1202	26/02/19	5	16.1	3.4	4.99	3.33	4.42	0.8	0.5	1.3	2351	-45
e 1202		8y 6m	241	6070	1297	4.19	3.10	4.68	254	188	442	4	
IE211351920927	VG 87	Spring	4	*6895*	*1473*	*4.31*	*3.13*	*4.68*	*297*	*216*	*513*	0	

https://www.agriland.ie/milk-price-index/ - use this website to vary the % protein and % fat to determine milk price

2011 Teagasc research shows that the SCC of the herd has an effect on net farm profit. As an example, 94 cows on a 40 ha farm:

SCC range cells/mL	Net Farm Profit
100,000 - 200,000	€24,954
200,001 - 300,000	€18,369
> 400,000	€11,055

Source: Teagasc

Example: How fat and protein values affect the milk price

Assumptions:
Value per kg of fat = €3.057
Value per kg of protein = €7.354
Volume of milk = 1,000 litres (conversion from litres to kg = X 1.03)

Milk Sample 1 – Fat 3.6% and Protein 3.3%	Milk Sample 2 – Fat 3.4% and Protein 3.7%
1,000 litres of milk with this composition has: 37.1 kg of fat 34.0 kg of protein	1,000 litres of milk with this composition has: 35.0 kg fat 38.1 kg of protein
Milk Price Calculations = A + B - C	
Fat calculation (37.1 X €3.057) + Protein Calculation (34 X €7.354) – Carrier calculation (1,000 X €0.04) €113.41 + €250.04 - €40	Fat (35 X €3.057) + (38.1 X €7.354) - (1,000 X €0.04) €107 + €280.19 - €40
1,000 litres of milk with 71.06 kg of milk solids = €323.45 + VAT	1,000 litres of milk with 73.1 kg of milk solids = €347.19 + VAT
Milk with higher fat and protein percentage yields have a higher milk price (Source: Teagasc)	

Dairy Farm Case Study – Improving Milk Quality

128 dairy cow farm in east Galway run by husband and wife Pat and Mary and their 3 children Sean, Rory and Claire.

Farm has 61.5 hectares of well drained grassland.

The herd is a spring calving herd of Holstein Friesian cows with 65% calving within 6 weeks. Artificial Insemination (AI) is carried out for the first 2 rounds of breeding and then a Hereford stock bull is let out to cover any late calvers or repeat breeders. Breeding season starts on the 15th April. The 30 replacement heifers were bred at the start of the breeding season using Enigma (EBI €221) and Diesel (EBI €221) bulls (Active Bull List, Progressive Genetics) with low calving difficulties of 2.9 and 3.0 respectively. Heat detection methods used are tail painting and observation.

Pat noticed that the bulk somatic cell count (SCC) in the herd has increased from 325,000 to 380,000 cells / ml during the breeding season and is unsure why this has happened.

Freshly calved cows were turned out on the 2nd of March 2020 to fresh grass to reduce winter feed costs and reduce amount of slurry storage required. As cows calved they were subsequently turned out.

A new 12 unit herringbone parlour was installed in 2010 with computerised feeding, automatic cluster removers (ACRs) and automatic drafting system.

The old parlour was converted into a calf rearing shed for replacement heifers with constant outside access for calves and automatic feeding to reduce labour and all male and beef calves sold. The cluster liners are changed once per year before the cows start calving and machine serviced. Milk recording is carried out once per month. The milking parlour is washed after each milking with cold water and a hot wash put through it every 2 weeks. They have to be careful no excess water enters the tank at the beginning of washing after the milking. The bulk tank is washed using an automatic washer every second day after each collection. The collecting yard is washed down once per week.

One person milks the cows at 6am and 4pm interval. Cows are fed 2 – 4 kg meal, using computerised feeders, in parlour at beginning of their lactation to help increase their body condition prior to breeding and to provide magnesium to prevent grass tetany.

Cows' udders are only washed prior to milking if they are very dirty. Cows with mastitis are not milked at the end as with one operator it is too hard to separate them. Teat dipping is carried out after milking by operator (not automatic) but can sometimes be delayed due to the operator being busy putting on clusters etc. and teats could have already sealed. There is a milk filter (sock) to catch dirt and it is changed once per day, after the morning milking. There is no plate cooler installed so the bulk tank has to work hard to get the milk down to 4°C. Foremilk is not checked as there is only one milking operator in the pit so they only check for mastitis when milk clots are noticed in the filters, then all cows are milked onto the ground to check for mastitis. Cows are treated with antibiotics, number recorded and cow marked to ensure milk doesn't get into the bulk tank. Sub clinical mastitis identified using the milk recording data and persistent cases culled.

Average Herd Milk Quality Results - Annual Report	
Somatic Cell Count (SCC)	325,000 cells / ml
Total Bacterial Count (TBC)	25,000 cells / ml
% Fat	3.5%
% Protein	3.2%

Cows are fed grass only for the summer months and operate a 21 day rotational grazing system with some fields being strip grazed. The grass is made up of PRG and white clover and grass measurement using a plate meter is carried out. Cows are fed silage (68% DMD) in winter.

Cows are dried off 8 weeks and heifers (after 1st lactation) 10 weeks prior to calving. Cows are given dry cow antibiotics but they are thinking of teat seals instead going forward with low SCC cows. When they are close to calving they are moved out of the cubicles and are housed in loose straw bedding until calving. The straw can get dirty at times due to the large number of cows in the shed and lime is put on the cubicles every second day. The feeding and cubicle passage are on slats but they can get dirty and need to be hand scrapped.

Task

Pat and Mary have recently sat down and looked at the price (28c / l) they were getting for their milk and they realised they are not getting the top price and are potentially losing out on a lot of money. Can you advise Pat and Mary how they could improve the quality of their milk both in the short term and long term? What tests they could carry out to test the quality of milk? What would be the implications of improving the quality of milk have at farm level, national level and international level?