

# AGRICULTURAL SCIENCE STUDY GUIDE

## Week 6



### Milk production

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# Factors affecting milk content and quality

The dairy industry in Ireland is worth over €4bn to the economy, but there are a number of factors affecting milk quality that farmers must watch out for

Ireland has to continue to maintain its excellent standard of milk quality, so farmers are paid on the amount of fat and protein and lactose present in the milk. There are a number of factors affecting milk content (composition):

↻ **Breed:** this varies greatly between breeds and within herds, as shown in Table 1.

**Table 1**

| Breed    | Butterfat | Protein |
|----------|-----------|---------|
| Holstein | 3.7%      | 3.2%    |
| Friesian |           |         |
| Jersey   | 5.4%      | 4.0%    |

↻ **Diet:** quality, quantity and type of feed will influence milk composition. High-fibre feed (silage) will increase butterfat, while high DMD grass will increase protein.

↻ **Stage of lactation:** milk solids are high after calving; decrease during peak yield and increase towards the end of lactation.

↻ **Stage of milking:** the percentage of fat increases during milking as fat globules are trapped in the alveolus at the start of milking.

↻ **Milking interval:** the time between cows being milked. Cows on 14-hour/10-hour intervals produce more milk in the morning. Therefore, butterfat is lower.

↻ **Age:** the percentage of fat and protein decreases with age. This is identified by milk recording.

↻ **Health:** disease of udder (eg mastitis) – the percentage of fat, protein and lactose decreases and white blood cells increase.

#### Ways to increase protein and butterfat content of milk

↻ Good grassland management – rotational/strip grazing.

↻ Addition of clover.

↻ Select daughters from high protein-yielding cows and sires.

↻ 70%+ DMD silage.

↻ Calve cows in early spring – avoid protein drop at turnout.

↻ Maintain healthy udder – control mastitis.

↻ Ensure that cows are milked out completely at each milking.

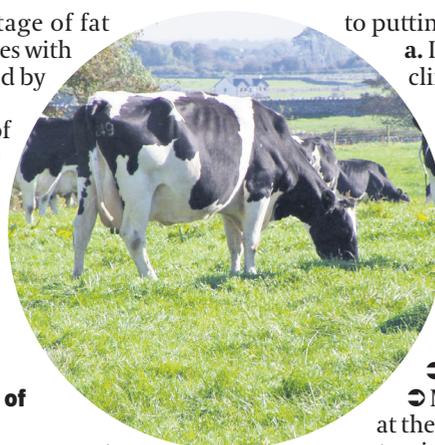
↻ Regular milking intervals.

#### Procedures required to produce good-quality milk:

↻ **Good hygiene:** machine and housing

↻ Wear clean gloves.

↻ Fore-stripping cows: hand milk prior



to putting on machine to:

a. Identify early cases of clinical mastitis.

b. Removes any milk that has been in teat since the previous milking.

c. Quicker milking due to natural oxytocin letdown.

↻ Machine is serviced and milk liners are changed regularly.

↻ Teat dip (iodine).

↻ Milk cows with mastitis at the end and treat – avoid contamination of clusters.

↻ Milk recording.

↻ Use dry cow treatment.

↻ Cool milk to <math>4^{\circ}\text{C}</math> as soon as possible (plate cooler and bulk tank).

↻ Fly control during summer months – prevent summer mastitis.

#### 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 (<math><50,000</math> / ml) – manufacture of high-quality dairy products.

↻ Somatic cell count (SCC).

• Level must be <math><200,000</math>/ml to ensure

good protein extraction.

• High SCC reduces lactose content – <math><4.2\%</math> 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).

• Good hygiene is vital.

↻ Thermoduric test.

• Organisms that can withstand pasteurisation – reducing shelf life of milk.

• Good cow and machine hygiene is 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 milk filter socks are used at each milking.

↻ Milk temperature:

• Milk only collected from refrigerated tanks and it must be <math><6^{\circ}\text{C}</math>.

↻ Antibiotic test.

• It is an offence to supply milk that contains antibiotics – penalised.

• Adhere to withdrawal period indicated on antibiotics and don't send milk during that period.

• Farmers can test milk on farm using the Delvo test.

### Sample experiments



To assess the bacterial quality of a sample of milk (Resazurin)

#### Method:

1. Label four test tubes: A, B, C and D.
2. Add 10cm<sup>3</sup> of milk samples to each of the following:
  - A = Fresh pasteurised milk
  - B = Sour pasteurised milk
  - C = Fresh unpasteurised milk
  - D = Sour unpasteurised milk
3. Add 5cm<sup>3</sup> of resazurin to each test tube
4. Place in a water bath at 37°C for 10 minutes.
5. Record colour change

#### Result

| Test tube | Milk sample         | Colour change |
|-----------|---------------------|---------------|
| A         | Fresh pasteurised   | Blue          |
| B         | Sour pasteurised    | Pink          |
| C         | Fresh unpasteurised | Mauve         |
| D         | Sour unpasteurised  | White         |

To determine the water and solids percentage in a sample of milk

#### Method:

1. Weigh a crucible on an electronic balance (A)
2. Add 10cm<sup>3</sup> milk to the crucible using a pipette and reweigh (B): B - A = weight of milk = (C)
3. Place the crucible over a boiling water bath and leave until the water has evaporated.
4. Reweigh the crucible (D).

#### Result:

D - A = weight of milk solids

Example calculation:

Weight of crucible = 50g

Weight of crucible & milk = 65g

Weight of milk = 65 - 50 = 15g

Weight of dried crucible = 51.9g

Weight of milk solids = 51.9 - 50 = 1.9g

% milk solids:  $\frac{1.9}{15} \times 100 = 12.7\%$  milk solids

### Exam question

Question 5, 2016  
Higher level



(a) The average lactation yield and the fat and protein composition of milk for three dairy breeds are shown in the table below:

| Breed | Milk yield (kg) | Fat (%) | Protein (%) |
|-------|-----------------|---------|-------------|
| A     | 4350            | 5.3     | 4.1         |
| B     | 6450            | 4.1     | 3.5         |
| C     | 5240            | 4.8     | 3.9         |

(i) Which breeds are represented by A, B and C?

A = Jersey

B = Holstein / Holstein cross/Mount-belliarde

C = Friesian / Friesian cross/Jersey cross/Norwegian Red

(ii) Give a reason for your choice in

each case.

A = Lower yields/higher solids.

B = Higher yields/lower solids.

C = Intermediate yield/intermediate solids

(iii) State the percentage (%) value of fat and protein in colostrum.

Fat = 4 - 7%

Protein = 14 - 16%

(b) The fat content of the milk of individual cows can be affected by many factors. List and explain any four of these factors, other than breed.

| Cause              | Effect                                    |
|--------------------|---|
| Age of cow         | Decreases with age                        |
| Stage of lactation | Lower during early or higher at end       |
| Stage of milking   | Increases with milking                    |
| Diet               | Feed high quality feed or fibre increases |
| Health             | Mastitis reduces                          |
| Milking interval   | Lower with long interval                  |