

Overview

The UK government encourages the development of organic farming, as a way of promoting more sustainable and environmentally sound systems of livestock production (outdoor, free-range, maximum access to pasture, and so on). The aim is to optimise rather than maximise production – by breeding for traits other than yield or growth rate, such as disease resistance and forage utilisation, and feeding species-specific diets. Lower stocking densities (20–60% lower than in conventional systems) and production levels are typical.

The first activity uses real data on organic sheep production in the uplands, collected from a three-year research project. It is suitable for students to undertake after work on the differences and similarities between organic and conventional farming.

The other two activities would be suitable after work on balanced diets, or analysis of solutions for ions such as copper and iron. The symptoms shown by the cattle on West Hill, Oak Bank, Lane Ends and Southfield farms are caused by a deficiency of copper. Copper is required for the function of some essential enzymes. Molybdenum in the diet 'blocks' the absorption of copper, resulting in deficiency symptoms even if the levels of copper in the diet are adequate.

The activities

There are three activities in this unit. The first could be used as a stand-alone activity. The final activity requires information from the second.

Organic or conventional farming – what's the difference?

In this activity, students compare and analyse real data collected from conventional and organic sheep farms. It can be carried out in one of two ways, depending on the time available and the ability of your students.

Hilltop cattle

Students look at real data (from analyses of liver tissue and of stream water) to determine the cause of illness in cattle on some farms in the Hilltop area.

Keeping cattle healthy

Students discuss suggestions made by farmers to prevent trace element deficiency in cattle and produce a report suggesting how the farmers might improve the health of their sick cattle.

Curriculum links (for students aged 14–16)

How Science Works (from POS KS4 for England)

Data, evidence, theories and explanations

1a how scientific data can be collected and analysed

1b how interpretation of data, using creative thought, provides evidence to test ideas and develop theories

Practical and enquiry skills

2d evaluate methods of collection of data and consider their validity and reliability as evidence

Communication skills

3a recall, analyse, interpret, apply and question scientific information or ideas

3b use both qualitative and quantitative approaches

3c present information, develop an argument and draw a conclusion, using scientific, technical and mathematical language, conventions and symbols and ICT tools

Applications and implications of science

4a about the use of contemporary scientific and technological developments and their benefits, drawbacks and risks

4b to consider how and why decisions about science and technology are made including those which raise ethical issues, and about social, economic and environmental effects of such decisions

GCSE or equivalent 14–16 specifications

England (GCSE)

AQA Science A 4461

Biology Unit 1a: Human biology 11.2 What can we do to keep our bodies healthy?

Biology Unit 1b: Evolution and environment: 11.8 How do humans affect the environment?

AQA Science B 4462

Biology Unit 1: 11.2 What can we do to keep our bodies healthy?

Biology Unit 1: 11.8 How do humans affect the environment?

AQA Biology 4411

Unit Biology 1: 11.2 What can we do to keep our bodies healthy?

Unit Biology 1: 11.8 How do humans affect the environment?

AQA Chemistry 4421

Unit Chemistry 3: 13.3 What is in the water we drink?

Unit Chemistry 3: 13.5 How do we identify and analyse substances?

AQA Additional Applied Science (Single Award) 4863

Unit 2: Science at work

11.2 Food science – Food nutrients and their functions, Organic and intensive farming

11.3 Forensic science – Analysing evidence from the crime scene

AQA Applied Science (Double Award) 4861

Science for the needs of society Unit 2: 11.3 Countryside and environmental management – Agriculture and farming

Developing scientific skills Unit 3: 12.4 How analytical chemists find out about substances

Edexcel 360 Science 2101

Biology B1a: Topic 1 – Environment

Chemistry C1a: Topic 5 – Patterns in properties

Edexcel 360 Additional Science 2103

Biology B2: Topic 3 Energy flow

Edexcel 360 Science extension

Biology 2105 B3: Topic 1 Biotechnology

Chemistry 2107 C3: Topic 3 Chemical detection

OCR Science A (21C science) J630

Module C3 – Food matters C3.1 What is the difference between intensive and organic farming?

OCR Chemistry A (21C) J634

Module C3: Food matters, C3.1 What is the difference between intensive and organic farming?

Module C7: Further chemistry, C7.4 Analysis

OCR Additional Applied Science (21C)

Module AP2 Agriculture and food – AP2.1 The agricultural and food industries, AP2.3 Animal farming for food, AP2.5 Quality, value and sustainability

OCR Science B (Gateway Science) J640

Module B1: Understanding ourselves, Item B1b: What's for lunch? Item B1c: Keeping healthy

OCR Additional Science B (Gateway Science) J641

Module B3: Living and growing, Item B3e: Growing up

Module C3: Periodic table, Item C3g: Transition elements

Module B4: It's a green world, Item B4f: Farming

OCR Biology B (Gateway Science) J643

Module B1: Understanding ourselves, Item B1b: What's for lunch? Item B1c: Keeping healthy

Module B3: Living and growing, Item B3e: Growing up

Module B4: It's a green world, Item B4f: Farming

OCR Chemistry B (Gateway Science) J644

Module C3: Periodic table, Item C3g: Transition elements

OCR Applied Science (Double Award) J649

Section 2.1 Living organisms: 2.1.5 Farming methods

Scotland (SCE standard grade)

no links

Wales (WJEC GCSE)

Science

Biology B1:2 Variation

Additional Science

Biology B2:7 The impact of human activity on the environment

Chemistry

Chemistry 3:5 Inorganic qualitative analysis

Applied Science (Double Award)

Unit 1: Developing scientific skills 4 Chemical analysis

Unit 2: Science and society (b) Man and the Environment

NI (CCEA GCSE)

Science (Single Award)

Module 1 Staying alive: Food and diet 1.3

Biology

3.1 Living organisms and life processes – Animals, Diet 3.1.8, Healthy diet 3.1.9

3.2 Environment – Cycles 3.2.9, 3.2.10

Applied Science (Double Award)

Unit 1: Developing scientific skills: Chemical analysis – quantitative analysis, qualitative analysis

Unit 2: Science for the needs of society – Living organisms

Learning objectives

By working through the unit, students come to understand:

- some of the differences and similarities between organic and conventional sheep farming
- that organic farming has lower stocking densities and lower production levels than conventional farming
- that organic farming uses only natural fertilisers
- the importance of minerals/trace elements in the diet
- how quantitative analysis for trace elements can identify the cause of a deficiency disease
- that trace-element deficiency cannot be treated by administering excess levels of the nutrient
- that one nutrient (molybdenum) in the diet may block the absorption of another (copper), resulting in deficiency symptoms even if the levels of copper in the diet are adequate.

For further information about Learning Skills for Science (LSS) click here.

Teaching and learning approaches

Learning Skills, learning by/from:

- interpreting and evaluating data (LSS1, LSS4)
- discussing ideas in a small group (LSS2)
- 'case-studies' in a variety of contexts (LSS3)
- argumentation
- devising 'visual' ways of expressing and communicating ideas (LSS3, LSS6)

Downloads

Organic or conventional farming – what's the difference?

- Presentation
 - slide 1 – starter stimulus
- Data sheet A1 – Sheep farm data
- Data sheet A2 – Sheep farm data
- Data sheet A3 – Sheep farm data
- Data sheet A4 – Sheep farm data
- Data sheet A5 – Sheep farm data
- Data sheet B – Sheep farm data (simplified version)
- Activity sheet A – Sheep farm data analysis
- Activity sheet B – Sheep farm data analysis (simplified version)

Hilltop cattle

- Presentation
 - slide 2 – Why are the cattle not healthy?
 - slide 3 – The farms and streams of Hilltop
 - slide 4 – Hilltop cattle – strange symptoms
 - slide 5 – Testing for trace elements
 - slide 6 – Liver analysis results
 - slide 7 – Trace elements in stream sediments
- Activity Sheet A – Trace elements questions
- Activity Sheet B – Trace elements questions (simplified version)
- Map – The farms and streams of Hilltop
- Information sheet – Trace elements

Keeping cattle healthy

- Presentation
 - slide 8 – What's the best way to keep the cattle healthy?
- Activity sheet – Solving the problem
- Map – The farms and streams of Hilltop
- Information sheet – Trace elements

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