Farming techniques

4.7.5.2 · Ecology · revision notes

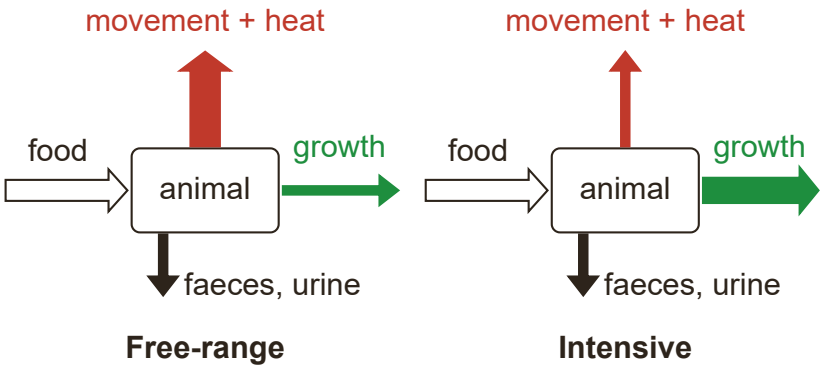
How farmers make food production more efficient by reducing the energy transferred from animals to the environment, and the ethical objections to intensive farming. Expect to explain why limiting movement and controlling temperature increase growth, and to evaluate intensive farming. This subtopic is in GCSE Biology only, not Combined Science.

Key facts

- Restrict energy transfer from food animals to the environment
- Warm surroundings → less energy transferred to keep warm
- More of the food eaten becomes biomass (more efficient)
- % of food converted to biomass = gain in mass ÷ mass of food eaten × 100
- Limit movement → less energy used for movement
- High-protein food → faster growth
- Objections: welfare, crowding, disease spread, antibiotic resistance, energy use

Improving efficiency

- Farmers can make food production more efficient by **restricting the energy that food animals transfer to the environment**.
- Animals respire to release energy for movement and, in mammals and birds, to keep their body temperature constant. This energy is transferred to the surroundings, and the glucose respired does not become new biomass.
- **Limiting movement**, e.g. keeping animals in pens, cages or sheds, means less energy is used for movement.
- **Controlling the temperature** of the surroundings, e.g. keeping animals in warm sheds, means less energy is transferred to the surroundings to keep warm.
- So a greater proportion of the food eaten becomes animal biomass, and the animals grow faster on less food.



Limiting movement and keeping animals warm means less energy is lost, so more food becomes biomass.

- Feeding animals **high-protein food** also makes them grow faster.

Intensive farming

- These methods are used in **intensive farming** of animals such as chickens, pigs and fish.
- Advantages: more meat, eggs or fish from less food and less land, so food is cheaper.

Disadvantages and ethical objections

- Animals are kept in crowded, restricted spaces and cannot behave naturally, which many people think causes stress and suffering.
- Diseases spread quickly between animals kept close together, so antibiotics may be used a lot, which can lead to antibiotic-resistant bacteria.
- Heating and lighting the sheds uses a lot of energy, which costs money and may add to carbon dioxide emissions.
- Large amounts of animal waste can pollute nearby water.
- Some people believe animals should be able to live a natural life, whatever the effect on food prices.

How to answer each type of question

Explain how a farming method increases efficiency

2 to 3 marks | Grade 5

1. Name the method (limiting movement or controlling temperature).
2. Say that less energy is transferred to the environment (less energy used for movement or for keeping warm).
3. Say that more of the food becomes biomass, so the animals grow faster on less food.

Example. Chickens reared for meat are often kept in warm sheds where they cannot move much. Explain how this increases the efficiency of meat production. (3 marks)

Model answer. The chickens move less, so less energy is used for movement (1). The warm shed means less energy is transferred to the surroundings to keep warm (1). So less glucose is respired for these purposes and more of the food is converted into biomass / the chickens grow faster on less food (1).

Calculate the percentage of food converted into biomass

2 marks | Grade 5

1. Use the increase in mass of the animal, not its final mass.
2. Divide by the mass of food eaten and multiply by 100.

Example. A farmer compared two pigs, one kept indoors and one kept outdoors.

Pig	Mass of food eaten in kg	Gain in mass in kg
Kept indoors	250	80
Kept outdoors	300	75

Calculate the percentage of food converted into biomass for each pig. (2 marks)

Model answer.

Indoor pig: 80 ÷ 250 × 100 = 32% (1)

Outdoor pig: 75 ÷ 300 × 100 = 25% (1)

6-mark: evaluate intensive farming

6 marks | Grade 7

1. Give advantages: efficient, more food, cheaper, less land.
2. Give disadvantages and ethical objections: welfare, disease, antibiotic use and resistance, energy use, pollution.
3. Use any data given.
4. Finish with a justified conclusion.

Example. Evaluate the use of intensive methods to farm chickens.

Model answer. Level-marked. A level 3 answer (5 to 6 marks) might include: less energy is transferred to the environment, so more of the food becomes biomass; the chickens grow faster, so meat is cheaper and more can be produced from less land; however, the chickens are crowded and cannot behave naturally, which many people think is cruel; disease spreads easily, so antibiotics are used, which can lead to antibiotic-resistant bacteria; heating the sheds uses a lot of energy. Conclusion, e.g. intensive farming helps to feed more people, but welfare standards should be improved, such as more space and less antibiotic use.

Don’t lose marks

- Saying limiting movement means animals 'save energy, so they have more energy'. Say less energy is transferred to the environment, so more of the food becomes biomass.
- Saying warm sheds help animals grow because they are 'comfortable'. The reason is that less energy is transferred to keep warm.
- Leaving out the ethical objections in 'evaluate' questions, or giving opinions without reasons.
- Using the final mass instead of the gain in mass in percentage calculations.
- Writing that energy is 'produced', 'made' or 'used up'. Energy is released by respiration and transferred to the environment, mainly as heat.

More tips

Memory tricks

- Less moving, less heating, more growing.
- Energy used to move or keep warm is energy not stored as meat.
- Ethical objections, WADE: Welfare, Antibiotics, Disease, Energy costs.

Exam technique

- Use the phrase 'less energy is transferred to the environment'; it matches the specification.
- In 'evaluate' questions, balance efficiency and food supply against welfare, disease and antibiotics.
- Make each link clear: less energy used for movement or warmth, so more biomass, so faster growth.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 4

Name ways to make animal farming more efficient

Limit the animals' movement, control the temperature of their surroundings, and feed them high-protein food.

Grade 5

Explain why high-protein food increases growth

Protein is digested into amino acids, which animals use to make the proteins needed for growth.

Grade 5

Explain how limiting movement increases efficiency

Less energy is used for movement, so less energy is transferred to the environment and more of the food becomes biomass.

Grade 5

Explain how controlling temperature increases efficiency

In warm surroundings less energy is transferred to the environment, so less food is respired to keep warm.

Grade 5

Calculate the percentage of food converted to biomass

Gain in mass ÷ mass of food eaten × 100.

Grade 7

Evaluate intensive farming, including ethical objections

Weigh cheap, efficient food production against animal welfare, disease spread and antibiotic use.

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