

Food production

Revision notes • Food security, intensive farming, sustainable fishing and the role of biotechnology, including mycoprotein, GM bacteria and GM crops.

For AQA GCSE Biology 8461 and Combined Science: Trilogy 8464. **Triple only** is not in Combined Science. **Higher tier** is only on the Higher paper.

Food production Spec 4.7.5 Triple only

Factors affecting food security Spec 4.7.5.1

Food security Having enough food to feed a population.

Biological factors which are threatening **food security** include:

- the increasing birth rate has threatened food security in some countries
- changing diets in developed countries means scarce food resources are transported around the world
- new pests and pathogens that affect farming
- environmental changes that affect food production, such as widespread famine occurring in some countries if rains fail
- the cost of agricultural inputs
- conflicts that have arisen in some parts of the world which affect the availability of water or food.

Sustainable methods must be found to feed all people on Earth.

Maths skill: You may be given population and food production statistics to evaluate food security. Compare how fast the population and the food supply are each increasing.

Farming techniques Spec 4.7.5.2

The efficiency of food production can be improved by **restricting energy transfer** from food animals to the environment. This can be done by:

- limiting their movement
- controlling the temperature of their surroundings.

Animals that move less and are kept warm transfer less energy to their surroundings, so more of the energy from their food is used for growth. Some animals are fed **high protein foods** to increase growth.

Modern intensive farming techniques

Advantages

More meat produced from the same amount of food, so food is cheaper

Less land is needed for the number of animals

Helps meet the demands of a growing population

Disadvantages

Some people have ethical objections: animals are kept in restricted, unnatural conditions

Costs of heating, buildings and feed

Disease can spread quickly between animals kept close together

Exam tip: For 'evaluate', use both columns and then give a conclusion. Link ethical objections to animals' welfare, and benefits to the efficiency of energy transfer.

Sustainable fisheries Spec 4.7.5.3

Fish stocks in the oceans are declining. It is important to maintain fish stocks at a level where **breeding** continues or certain species may disappear altogether in some areas.

Method	How it helps
Control of net size	A larger mesh lets small, young fish escape. They survive, grow and breed
Fishing quotas	A limit on how much fish can be caught, so enough fish are left to breed and stocks recover

These techniques promote recovery of fish stocks and conserve them at a sustainable level.

Exam tip: Link both methods to breeding: they leave enough fish to reproduce, so the population is maintained.

Role of biotechnology Spec 4.7.5.4

Biotechnological and agricultural solutions, including genetic modification, can help meet the demands of the growing human population. Modern biotechnology techniques enable large quantities of microorganisms to be cultured for food.

Mycoprotein

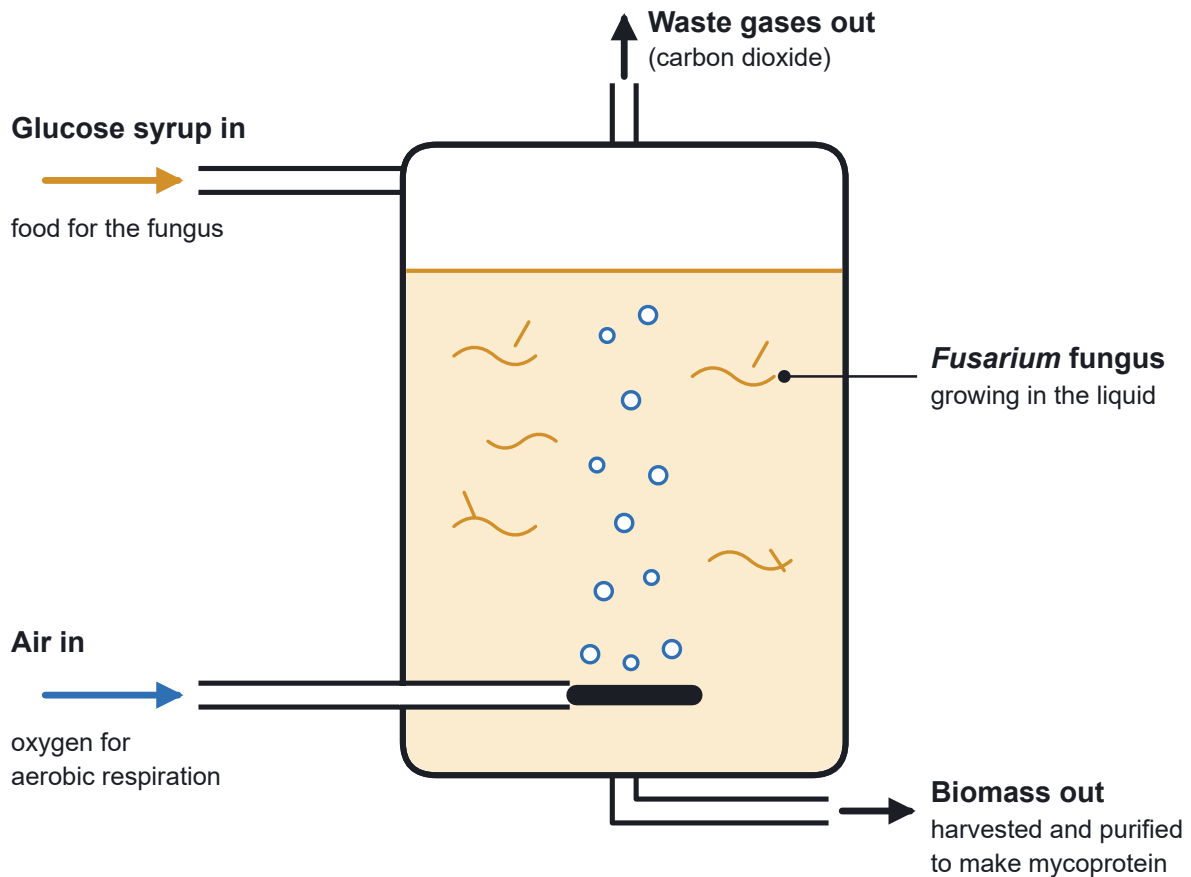
The fungus *Fusarium* is useful for producing **mycoprotein**, a protein-rich food suitable for vegetarians.

1. The fungus is grown on glucose syrup.
2. It is grown in aerobic conditions (with oxygen).
3. The biomass is harvested and purified.

Genetically modified organisms

A genetically modified bacterium produces **human insulin**. When harvested and purified this is used to treat people with diabetes.

GM crops could provide more food or food with an improved nutritional value, such as **golden rice**.



Fusarium is grown in a fermenter on **glucose syrup** in **aerobic conditions**, then the biomass is harvested and purified to make mycoprotein.

Exam tip: Link each product to its use: mycoprotein as a protein source for vegetarians, insulin to treat diabetes, and golden rice to improve nutrition.

Quick check

1. Define food security.
2. Why does limiting the movement of food animals increase efficiency of food production?
3. Give two ways to keep fish stocks sustainable.
4. What is mycoprotein and what is it grown on?
5. What is produced by a genetically modified bacterium to treat diabetes?

Quick check answers

Food production

1. Having enough food to feed a population.
2. Less energy is transferred to the environment, so more goes into growth.
3. Control of net size and fishing quotas.
4. A protein-rich food made from the fungus *Fusarium*, grown on glucose syrup in aerobic conditions.
5. Human insulin.