

Agriculture and evaluating biotechnology

Revision notes • How to evaluate the benefits and risks of genetic engineering and selective breeding in agriculture and medicine, including ethical issues.

For Edexcel GCSE Combined Science 1SC0. **Higher tier** is only on the Higher paper.

Agriculture and evaluating biotechnology Spec 4.13B-4.14

Evaluating genetic engineering and selective breeding Spec 4.14

'Evaluate' means weigh up benefits and risks, including practical and ethical implications, and reach a judgement. Here are the main points for agriculture and medicine.

Benefits and risks		
	Benefits	Risks and implications
Selective breeding	Higher yields and better quality food; no special equipment needed; produces useful animals and plants	Takes many generations; reduces genetic variation; inbreeding can cause health problems in animals
Genetic engineering in agriculture	Crops with new characteristics such as insect resistance or greater nutritional value; quicker than selective breeding	Unknown effects on the environment and human health; genes may spread to wild species; some people think it is wrong to alter genes
Genetic engineering in medicine	Medicines such as human insulin can be made in large amounts from GM organisms	Possible unforeseen effects; ethical concerns about changing the genes of organisms, especially animals

Practical implications include time, cost, skill and the chance that it does not work. **Ethical** implications are about what people think is right or wrong, such as animal welfare and whether humans should change the genes of living things.

Interpreting yield data (practice data)

A farmer grows a non-GM crop with a yield of 4.0 tonnes per hectare, and a GM crop with a yield of 5.0 tonnes per hectare. Calculate the percentage increase in yield with the GM crop.

1. Increase = $5.0 - 4.0 = 1.0$ tonnes per hectare
2. Percentage increase = $\text{increase} \div \text{original} \times 100$
3. $1.0 \div 4.0 \times 100 = 25\%$

Answer: 25% increase.

Maths skill: When asked to plot or read data from graphs or tables, check the axis scales and units, and use values from the data in your evaluation.

Exam tip: In a 6-mark 'evaluate' answer, give benefits and risks, include both practical and ethical points, and finish with a clear conclusion that uses them.

Quick check

- 1 . What does 'evaluate' require you to do in a question about genetic engineering?
- 2 . Name one practical and one ethical implication of genetic engineering.
- 3 . Give one risk of selective breeding.

Quick check answers

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- 1 . Weigh up benefits and risks, including practical and ethical implications, and reach a judgement.
- 2 . Practical: it is costly or may not work. Ethical: some think it is wrong to alter the genes of organisms.
- 3 . It reduces genetic variation, or inbreeding causes health problems.