Use of plant hormones

4.5.4.2 · Homeostasis and response · revision notes

How people use auxins, ethene and gibberellins in agriculture, horticulture and the food industry. Expect short 'give a use' and 'explain why' questions, sometimes with data from a crop trial. This subtopic is Higher tier only, and in GCSE Biology only (not Combined Science).

Key facts

- Auxins: weed killers, rooting powders, tissue culture
- Weed killers reduce biodiversity: fewer plant species, less food and shelter for animals
- Ethene: controls fruit ripening during storage and transport
- Selective weed killers: kill broad-leaved weeds, not narrow-leaved crops such as wheat
- Rooting powder: cuttings grow roots quickly → many identical plants
- Gibberellins: end seed dormancy, promote flowering, increase fruit size

Notes

Auxins

- **Weed killers**: some synthetic auxins affect **broad-leaved weeds** but not narrow-leaved crops such as wheat. The weeds grow too quickly and die, so the crop has less competition for light, water and mineral ions.
- Widespread use of weed killers **reduces biodiversity**: fewer wild plant species survive, so insects and other animals lose food and habitats.
- **Rooting powders**: dipping a cutting in auxin makes it **grow roots quickly**, so growers can produce many identical plants (clones).
- **Tissue culture**: auxins promote the growth of new plants from small groups of cells.

Ethene

- Ethene is used in the food industry to **control the ripening of fruit** during **storage and transport**.
- Fruit such as bananas can be picked unripe, when it is firm and less easily damaged, then exposed to ethene so it ripens just before it is sold.
- Keeping ethene levels low slows ripening, so fruit can be stored for longer and less is wasted.

Gibberellins

- **End seed dormancy**: seeds can be made to germinate when the grower wants, even without the conditions that would normally trigger it.
- **Promote flowering**: plants can be made to flower earlier or at a time that suits the grower.
- **Increase fruit size**: e.g. to grow larger seedless grapes.

How to answer each type of question

Give a use of a plant hormone

1 to 2 marks | Grade 5

1. Match the hormone to its uses: auxins (weeds, roots, tissue culture), ethene (ripening), gibberellins (dormancy, flowering, fruit size).
2. Give as many uses as the marks ask for, and no more.

Example. (a) Name the type of plant hormone in rooting powder.
(b) Give two uses of gibberellins.

Model answer.

(a) Auxin (1)

(b) Any two from: ending seed dormancy; promoting flowering; increasing fruit size (2)

Explain the advantage of controlled ripening

2 to 3 marks | Grade 7

1. Say why unripe fruit is picked: firm, less damage in transport.
2. Say what ethene does: causes ripening.
3. Say why timing matters: ripe when it reaches the shops, less waste.

Example. Bananas are picked while they are green and unripe. They are transported to the UK and then exposed to ethene gas.
Explain the advantages of doing this.

Model answer. Unripe bananas are firm, so they are less likely to be damaged during transport (1). Ethene makes them ripen (1), so they can be ripened just before they are sold, reducing waste (1).

Explain how a selective weed killer increases yield

3 marks | Grade 7

1. Say what the auxin does to the weeds: they grow too quickly and die.
2. Say that the crop now has less competition.
3. Name the resources: light, water, mineral ions.

Example. A farmer sprays a wheat field with a weed killer containing a synthetic auxin. It kills broad-leaved weeds but not the wheat.
Explain how this increases the yield of wheat.

Model answer. The auxin makes the weeds grow too quickly, so they die (1). The wheat has less competition (1) for light, water and mineral ions, so it grows better and produces more grain (1).

Analyse data from a hormone trial

3 marks | Grade 8

1. Percentage change = change ÷ original value × 100.
2. The original value is the untreated (control) result.
3. When asked for a reason not to use a hormone, think about cost.

Example. A grower treated some grape vines with gibberellin. The mean mass of a grape from untreated vines was 3.2 g. The mean mass of a grape from treated vines was 4.8 g.
(a) Calculate the percentage increase in mean grape mass.
(b) Suggest one reason why the grower might decide not to use gibberellin.

Model answer.

(a) 4.8 − 3.2 = 1.6 g (1); 1.6 ÷ 3.2 × 100 = 50% (1)

(b) The cost of the gibberellin may be more than the extra income from the larger grapes (1)

Don’t lose marks

- Writing 'ethanol' or 'ethane' instead of ethene.
- Saying selective weed killers kill all plants. They kill broad-leaved weeds, not narrow-leaved crops.
- Saying rooting powder makes the whole plant grow faster. It makes cuttings grow roots.
- Mixing up the uses of gibberellins and auxins.

More tips

Memory tricks

- Auxin uses: weeds, roots, tissue culture.
- Gibberellin uses: make seeds go, make flowers come, make fruit grow.
- Ethene has one job in the food industry: ripening.

Exam technique

- When asked why a use helps, link it to yield, damage or waste: more crop, less bruising, fruit ripe at the right time.
- Name the hormone precisely: auxin, ethene or gibberellin.
- In percentage change questions, divide by the original (untreated) value.

What each grade needs

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

Grade 5 — **Give uses of auxins**
As weed killers, as rooting powders, and for promoting growth in tissue culture.

Grade 5 — **Describe how ethene is used for fruit**
It controls the ripening of fruit during storage and transport.

Grade 6 — **Give uses of gibberellins**
Ending seed dormancy, promoting flowering and increasing fruit size.

Grade 7

Explain how selective weed killers increase yield

Auxin kills broad-leaved weeds but not narrow-leaved crops, so crops have less competition.

Grade 7

Explain the advantages of controlled ripening

Unripe fruit is firm and less easily damaged in transport; ethene ripens it when needed.

Grade 8

Analyse data on plant hormone use

Calculate changes from trial data and weigh up benefits against costs.

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