

## Answer ALL questions

Some questions must be answered with a cross . If you change your mind about an answer, put a line through the box  and then mark your new answer with a cross .

- 1 Read the passage below. Use the information in the passage and your own knowledge to answer the questions that follow.

### Antitranspirants

Antitranspirants are substances applied to plants to reduce water loss. There are three types of antitranspirant, film-forming compounds, stomatal regulators and reflective compounds.

- 5 The first type of antitranspirant contains film-forming compounds. These compounds are oils or waxes that are mixed with water to form an emulsion. This emulsion is then sprayed onto the leaves of plants. The emulsion forms a physical barrier that covers the stomata. The film is designed to prevent water loss but allow gas exchange. Scientists have found that that the film-forming antitranspirant is effective in increasing yield and increasing photosynthesis  
10 in drought conditions. The increased leaf turgor in plants sprayed with film, compared to control plants, shows that the film decreases water loss and maintains turgor in drought conditions.

- Film-forming antitranspirants are used in horticulture to reduce water stress. This can occur during storage, transport and planting of container grown plants.  
15 Application of the antitranspirant before transplanting, helps the plant survive until the root system is established. The film-forming compounds are used to reduce drying out in rolled turf and in transporting flowering plants and trees with root balls.

- 20 The second type of antitranspirants are stomatal regulators that reduce the size of the stomatal pore. Stomatal pores affect diffusion as well as transpiration. Therefore, photosynthesis and growth may change when stomatal regulators are applied to leaf surfaces. If the stomatal pores close completely this will stop photosynthesis. However, if stomatal openings are only reduced in size, transpiration will be reduced but some photosynthesis will continue.

- 25 The third type of antitranspirants are reflective compounds. These work by adding a white coating to leaves. This changes the amount of light that is reflected by the leaf surface. The coating is only applied to the upper surface of leaves so does not block the stomatal pores. Coating a leaf with a reflective chemical can reduce leaf temperature, transpiration rate and also increase the efficiency of water use.  
30 Experiments show that transpiration rate can be reduced by up to 30% and leaf temperature reduced from 40 °C to 30 °C after a coating of reflective compound is applied to leaf surfaces.

- 35 Crops depend on photosynthesis for growth and final yield. Therefore, it is unlikely that currently available antitranspirants would increase the yield of a crop unless the crop suffers from a low water supply or very high rates of evaporation. Spraying film-forming or stomata regulating antitranspirants on a field-grown cereal crop under drought conditions, produced a grain yield increase of 17%. Experiments also show that any effect that antitranspirants have on the minerals supplied to the leaves has little effect on plant growth.

