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AS GCE APPLIED SCIENCE

G623/INSERT Cells and Molecules

PLAN FOR AN INVESTIGATION

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INFORMATION FOR CANDIDATES

- The abstract on page 2 of this insert is to give you some background information that you might find helpful in planning for the task that follows. Not all the information included will be directly relevant and you are expected to select the information that is relevant to the task.
- This document consists of **2** pages. Any blank pages are indicated.

Drought Tolerance in Potatoes

Climate change is expected to lead to an increase in drought events throughout the world, resulting in large-scale alterations in ecosystems and the failure of drought sensitive crops. In addition, periods of drought vary from year to year in severity and length, making it difficult for plants to adapt to more severe conditions.

Many modern varieties of potatoes (*Solanum tuberosum*) are considered to be drought sensitive. The predicted hotter drier summers mean that potato cultivars that are more efficient at capturing water will be required to maintain current yields. Plants that have longer thinner roots, more root hairs or symbiotic relationships with mycorrhizae, are likely to be more efficient in capturing resources, including water.

Plants experience drought either due to excessive transpiration and/or due to a limited water supply. Drought first causes stomata to close, reducing carbon dioxide uptake for photosynthesis, leading to reduced plant growth and yield. Although drought stress reduces plant water potentials, it affects root and leaf growth differently. Many studies have shown that root growth is more resistant to water shortage than shoot growth. Plants vary in the types and speed of responses to drought conditions. Scientists have identified about 2 000 genes that are differentially regulated under drought conditions. Many of these genes contribute to an increase in drought tolerance of some potato cultivars. One way that this is achieved is through an increase in solute concentrations in the cells of the potato and a lowering of solute potential in the cells (so creating a more negative water potential), to induce uptake of water from drying soils by the roots.

The International Potato Centre in Lima, Peru, maintains the world's largest collection of potato tubers in the interest of conserving the genetic diversity of the potato, investigating traits such as resistance to various insects and diseases, as well as cold, heat and drought. This is of paramount importance as farmers around the world cope with changes in temperature and water availability and struggle to maintain a food supply for growing populations.

The measurement of incipient plasmolysis is often used to determine solute potential in potatoes. This technique is commonly used in research laboratories using very thin sections of potato tissue. Suitable alternative tissues that are often used in schools and colleges include epidermal strips of onion or rhubarb.

The following table shows common examples of drought tolerant and drought susceptible potato cultivars.

***Solanum tuberosum* cultivars**	
drought tolerant	**drought susceptible**
Cara	King Edward
Desiree	Maris Piper
Kennebec	Pentland Dell
Maris Bard	Sarpo Mira