Effect of nutrient solutions on plant growth (hydroponics)

Teacher and technician sheet

This is more complex and time-consuming than using soil culture or floating culture. However, it does give students an insight into a techniques used by some professional growers.

The method may be used to investigate the effect of deficiencies in a number of nutrients. A full study would probably take a student or pair of students too long. Instead, students could be allocated one or two nutrients to investigate, done in a way that ensures the class as a whole investigates the effects of deficiencies in each of the essential nutrients.

Equipment and materials

Each student or pair of students will require:

- Healthy barley seedlings, germinated one week in advance on moist vermiculite or on moist OASIS.
- Complete-nutrient solution and nutrient-deficient solution (containing none of the nutrient you are investigating).
- For each seedling:
  - test tube
  - cotton wool
  - aluminium foil
  - dropping pipette

Nutrient solutions

- Complete-nutrient solution. Dissolve the following compounds in 1 dm^3 of deionised water.
  - 0.70 g KNO_3
  - 0.25 g $CaH_4(PO_4)_2.2H_2O$
  - 0.25 g $CaSO_4.2H_2O$
  - 0.25 g $MgSO_4.7H_2O$
  - 0.005 g $FeCl_3.6H_2O$
  - 0.08 g NaCl
- Nutrient-deficient solutions. Make the following changes to the complete nutrient solution formulation:

  Deficient in

  Nitrogen: replace KNO_3 with 0.52 g KCl

  Phosphorus: replace $CaH_4(PO_4)_2.2H_2O$ with 0.16 g $Ca(NO_3)_2.4H_2O$

  Potassium: replace KNO_3 with 0.59 g $NaNO_3$

  Calcium: replace $CaSO_4.2H_2O$ with 0.2 g K_2SO_4 and $CaH_4(PO_4)_2.2H_2O$ with 0.71 g $NaH_2PO_4.2H_2O$

  Sulfur: replace $CaSO_4.2H_2O$ with 0.16 g $CaCl_2$ and $MgSO_4.7H_2O$ with 0.21 g $MgCl_2.6H_2O$

  Magnesium: replace $MgSO_4.7H_2O$ with 0.17 g K_2SO_4

  Iron: omit $FeCl_3.6H_2O$

Wear eye goggles, iron (III) chloride is corrosive