Soil Nutrients And Plant Growth

Topic

Effect of different nutrients on plant growth

Introduction

For plants to germinate and then grow strongly, they require sufficient water and energy from sunlight. For continued growth and strength, the roots need to take up nutrients from the soil. These nutrients are inputs into the soil system from the weathered rock, washed in by the rain or washed downwards by leaching of the humus. In this experiment, you will find out which nutrients are most important for plants like peas or scarlet runners.

Time required

1 week for germination
4 weeks for growth

Materials

Per group:
glass jar (e.g., empty coffee jar)
blotting paper (10 cm × 30 cm)
10 pea or bean seeds
5 test tubes
test-tube rack
5 pieces of raw cotton
self-adhesive labels
pen
3 × 50 ml beakers (approximately 1 cm × 5 cm)
stirring rod
distilled water
tap water

For solutions per class:
20 g calcium nitrate
10 g calcium chloride
7.5 g potassium phosphate
7.5 g potassium nitrate
5 g magnesium sulfate
2.5 g magnesium chloride
3 g ferric chloride
distilled water (3 liters to make up basic solutions plus sufficient to prepare volume of diluted solution required by students)

Safety note

The nutrient solutions should be mixed by a responsible adult. Do *not* taste any of the solutions used. Wash your hands after using the solutions.

Procedure

Part A: Seed germination

1. Dampen the piece of blotting paper, but do not soak it.
2. Space out the 10 seeds along the center of the paper. Roll up the paper (with the seeds) carefully so that it fits into the glass jar (see diagram 1 overleaf).

3. Place the jar where it will catch the sun.
4. Check regularly over the week to see that the blotting paper is still damp. If necessary, add a little distilled water to the bottom of the jar.

Seeds on blotting paper in jar

Part B: Comparing plant growth

This part of the experiment requires the seeds to have germinated; therefore, you need to allow about a week.

1. Have a responsible adult (e.g., science technician) make up the following solutions. The amounts will provide sufficient solutions for several experiments in a class group.

   Complete nutrient solution:
   10 g calcium nitrate
   2.5 g potassium phosphate
   2.5 g magnesium sulfate
   2.5 g potassium nitrate
   pinch of ferric chloride
   1 liter distilled water

   Dilute 1 part of basic solution in 4 parts distilled water.

   Nutrient solution lacking nitrogen:
   10 g calcium chloride (instead of calcium nitrate)
   2.5 g potassium phosphate
   2.5 g magnesium sulfate
   2.5 g potassium nitrate
   pinch of ferric chloride
   1 liter distilled water

   Dilute 1 part of basic solution in 4 parts distilled water.

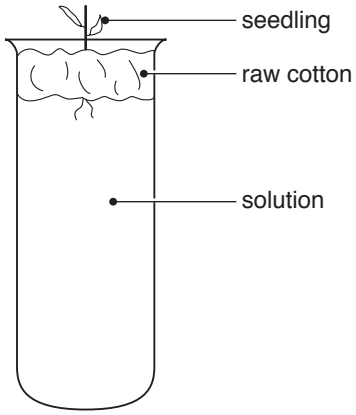
   Nutrient solution lacking sulfur:
   10 g calcium chloride (instead of calcium nitrate)
   2.5 g potassium phosphate
   2.5 g magnesium chloride (instead of magnesium chloride)
   2.5 g potassium nitrate
   pinch of ferric chloride
   1 liter distilled water

   Dilute 1 part of basic solution in 4 parts distilled water.

2. Label the test tubes "A," "B," "C," "D," and "E."

3. Fill the test tubes with the solutions as shown below and stand in the test-tube rack:
   A = complete solution
   B = solution lacking nitrogen
   C = solution lacking sulfur
   D = tap water
   E = distilled water
4. From the blotting paper, choose five seedlings that have germinated and are at a similar stage of development.
5. Carefully wrap each one in a piece of raw cotton so that the roots and leaves are showing (see diagram 2 below).
6. Put a wrapped seedling into the top of each test tube. Adjust the amount of raw cotton so that it holds the seedling in place. The roots should be in the solution – if necessary, add more solution.
7. Place the seedlings in sunlight and leave for four weeks. If necessary, add more fresh solution.

(2)

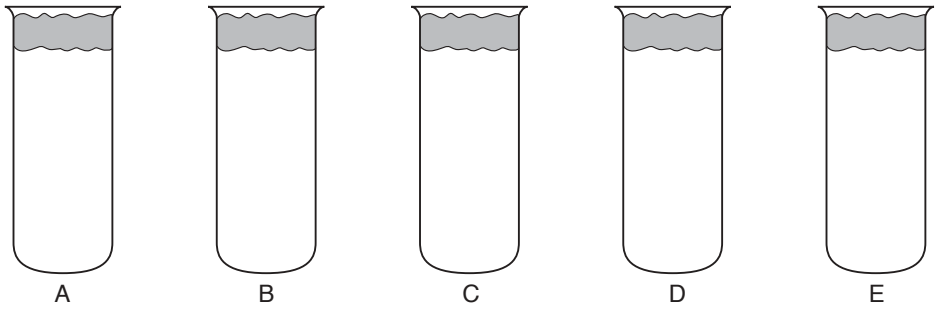


Seedling in test tube

Analysis

1. Draw a scale diagram of each plant – including its roots – on diagram 3 below.
2. Which solution gave the most and which the least vigorous growth? Suggest reasons.

(3)



Scale diagrams of growng plants

3. How did growths in tap and distilled water compare? Give reasons.
4. Why is it important for an arable farmer (one who raises crops) to know the mineral content of the soil?

Want to know more?

Our Findings

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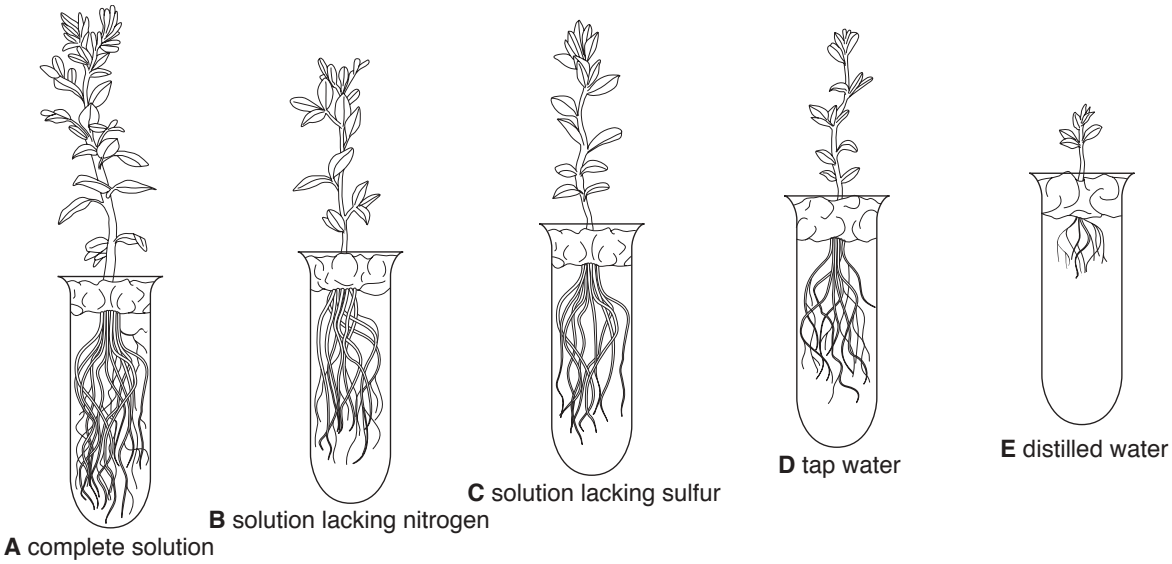
1. Results shown below.
2. Expect seedling A to have the most vigorous growth and seedling E the least vigorous. Seedling A has a greater variety of nutrients while seedling E has very few.
3. Tap water is not completely pure; the plant can use the dissolved substances for growth.
4. Different plants require different proportions of minerals to grow healthily.



A complete solution

B solution lacking nitrogen

C solution lacking sulfur

D tap water

E distilled water