

APES LD-50/Bioassay Salinization Experiment

Purpose:

The purpose of this lab is to study how a bioassay is used to determine the toxicity of a chemical. Students will determine the LD50 of salt on the growth of radish seeds.

Objectives:

1. Conduct a controlled experiment to test the toxicity of salt on the growth of radish seeds
2. Apply the experimental results to environmental problems

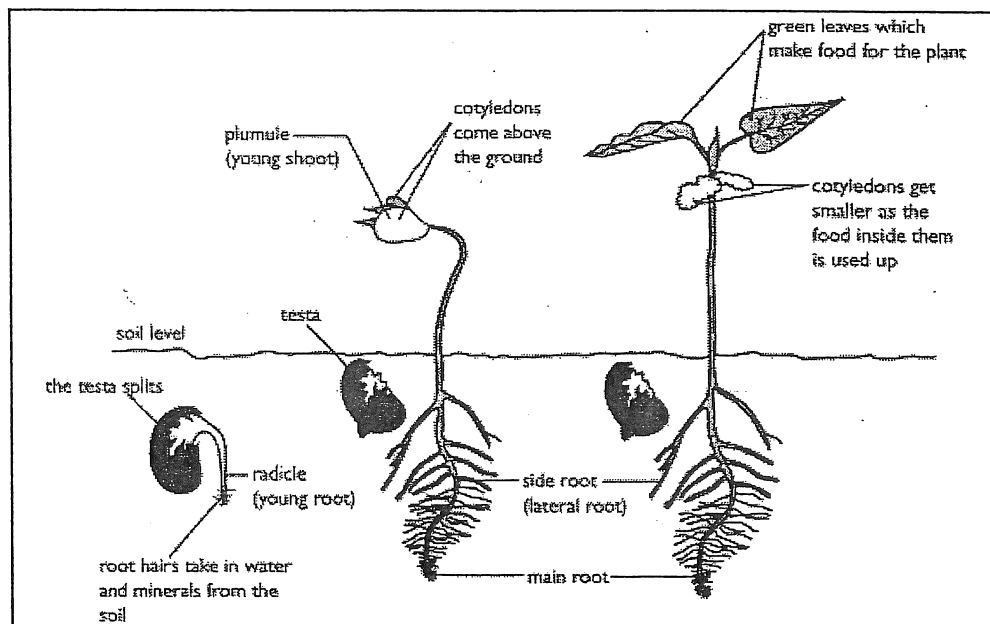
Introduction:

Over 15% of the earth's agricultural land is irrigated in order to maximize crop yields. Irrigation water contains a variety of dissolved salts including NaCl , MgCl_2 , CaCl_2 , Na_2SO_4 , CaSO_4 , CaCl , KCl , MgSO_4 , Na_2CO_3 , CaCO_3 , and MgCO_3 among others. These salts are leached from soil and rocks during percolation or runoff of surface water.

Groundwater can have significant amounts of salts, leached from sedimentary rocks comprising the aquifer. When a field is irrigated, much of the water can evaporate, leaving these salts behind as a thin layer on top of the soil. If you take a glass of tap water and leave it in the sun until all the water evaporates, a film will be left on the glass. These are salts. Soil salinity can affect crop germination levels and yields. Over time, salts build up on fields until the soil is so salty (salinized) that seeds will no longer germinate in the soil. Excessive salinity costs the United States billions of dollars each year. As new land comes into use, it is often in arid areas, which are highly susceptible to the problems associated with soil salinization.

The use of a biological organism to test the toxicity of a chemical compound is termed **bioassay**. In this method it is assumed that a tested organism will react in a predictable way to increasing amounts of a particular chemical compound. Bioassay has been used by drug companies to test new products on laboratory animals before humans. Bioassays are also used in environmental testing. They can determine the degree of harm to be expected from toxic soil, industrial effluents, agricultural runoffs, dredge spoils, and drilling and mining wastes, as well as to test for the effectiveness of the clean-up of a contaminated site.

In this investigation, you will perform what is called a **dose/response experiment**. This method requires you to increase the dose of a chemical incrementally and record how the organism responds to the exposures. For a test organism, you will use radish seeds. Radishes are commonly used in bioassays because their root growth, rather than just germination rate, is especially sensitive to many chemicals. For a variety of reasons salt solution will be the toxin. Salt is inexpensive and safe to use, and is a widespread environmental problem for plants.



Materials:

Radish seeds (60 per group)

Ziploc bags (6 per group)

Salt

Water

Beakers

100 mL graduated cylinder

Paper towels

Scales

Procedure – Day 1:

1. Prepare your salt solutions. **Remember that a 1% solution contains 1 gram of salt in 100 mL of water!**
2. Label 6 Ziploc bags with your name and the pre-selected salt concentrations (0%, 0.5%, 1%, 1.5%, 2%, and 3%).
3. Wrap 10 seeds in a paper towel. Place the paper towel in a Ziploc bag and moisten it with plain water. This is your 0% solution. Seal your bag.
4. Repeat step 3 for each the other 5 Ziplocs, **but use the salt solution that pertains to each petri dish instead of plain water.**
5. Place the Ziplocs in a dark place at room temperature for 4 days.

Procedure – Day 2: (4 days later)

1. Retrieve your bags.
2. Fill out the data table based on your data.
3. Find the class average once everyone has written their data on the board.
4. Graph the class data and answer the questions.