

Salinization Lab (Lab Report Required in Lab Notebook)

Purpose:

Farmers in the Central Valley of California have become increasingly concerned about the build-up of salt in the soil and water. Farmers know that small amounts of salt in the soil and water will not adversely affect the germination and growth of their crops. But as the salt concentration increases negative impacts occur. Eventually salt concentration may become so great that seeds will no longer germinate.

Central Valley farmers have gotten together and hired your "company" (lab group) to investigate the problem for them. They want your "company" to do the research and present them with a report, including graphs, on how increasing salt concentrations will affect the germination of their seed crops. They need to know the relationship between salt concentration and the percent of seeds germinating. Your group is responsible to develop a real world scientific investigation in which they design an experiment to determine how the concentration of salt in water affects the germination rate of seeds.

Background information:

Salt buildup is an existing or potential hazard on almost all of the 42 million acres of irrigated farmland in the United States. Much of the world's unused land is in arid and semiarid regions where irrigation will be necessary. Water contains a small amount of salt and over time this salt accumulates in the soil. A small amount of salt in the soil will not affect the germination and growth of crops. However, as salt concentrations increase, negative impacts occur. Eventually salt concentrations will affect the germination of seeds. Excessive salinity is presently costing the U.S. billions of dollars in lost food crops.

In the vast Wetlands Water District in Central California's San Joaquin Valley, which provides irrigation water to 600,000 acres of farmland in western Fresno and Kings Counties, as many as 190,000 acres have salinity levels that limit a grower's choice of crops. That usually means cotton or sugar beets, if they can grow anything at all.

Salt kills germinating seedlings by removing the water from their cells (plasmolysis, exomosis). Several salts and their ions are responsible: NaCl , CaCl , KCl , MgCl , MgSO_4 , HCO_3^- , CO_3^{--} , MgCO_3 , NO_3^- , NH_4^+ , K^+ .

In this investigation your team will be investigating the effects of just one salt; NaCl will affect germinating seeds in a similar way, as would other salts or combinations of salt.

NaCl has a solubility of 35.7 grams per 100ml of H_2O . It is known that ocean water has a 3.5% concentration (3.5 grams per 100ml of H_2O). Freshwater has a concentration of 0.005% salt (0.005 grams per 100ml of H_2O)

Procedure:

1. After reading, the first part of the lab, the "problem" has been identified. From this you should be able to formulate a hypothesis.
2. You must now identify your independent and dependent variables. To do this, make a question - What is the effect of the independent variable on the dependent variable? This will tell you not only the variables but also which variable to put on each axis of the graph. [Remember, the x-axis is the horizontal axis and is the independent variable. The y-axis is the vertical axis and is the dependent variable.] Do this within your methods.
3. Decide what you will use as a control. You will also need to identify the constants in the experiment. Do this within your methods.
4. Be sure to keep accurate data tables and check on your experiment each class period. When the experiment is completed, turn in a lab report including graphs. Be sure to complete the analysis questions and a conclusion.

Materials:

Ziploc bags	Sharpies	test tubes
distilled water	balance	Flasks and beakers for mixing solution
paper towels	graduated cylinders	
tweezers for seed placement	salts	

You are welcome to create or use other types of equipment!

Graphs: From your data table you should be able to draw two graphs.

1. Construct a line graph on which you compare the % of salt solution on the x - axis with the number of seeds that germinated on the y-axis. Be sure and give your graph a title and label the axes.
2. Construct a bar graph on which you compare the percentage of salt solution on the x-axis with the % of seeds that germinated on the y-axis. Be sure and give your graph a title and label the axes.

Analysis (Incorporate your responses to all of these in your conclusion, in paragraph form. Do not write them as numbered questions.)

1. Did your experiment validate your hypothesis? How?
2. Does there seem to be a relationship between the number of seeds that germinated and the concentration of the salt water? If so, what is that relationship?
3. Can you think of any errors that might have occurred that would invalidate your experiment? If so what were they and how might they be corrected?
4. Explain why increasing levels of salt concentrations affect seed growth and why irrigation seems to be the main cause of this. (Refer to your research and even use your textbook, if necessary)
5. Do you think all seeds would be affected in similar ways as the ones you used? How could you find out?
6. When soil becomes too salty, what are some methods of remediation?