Salinization Lab

Objectives

After this lab you should be able to do the following:

1. Explain why Salinization hurts agriculture.
2. Design a lab to test the effect of different levels of salinity on germination of seeds.
3. **Explain the effect of different levels of salinity on germination of radish seeds.**

Materials

Materials for this lab are:

Seeds

Sodium Chloride

Paper Towels

Plastic Zip Bags or petri dishes

Introduction

Salinization refers to a build up of salts in soil, eventually to toxic levels for plants. (3,000 - 6,000 ppm salt results in trouble for most cultivated plants.) Salt in soils decreases the osmotic potential of the soil so that plants can't take up water from it. When soils are salty, the soil has greater concentrations of solute than does the root, so plants can't get water from soil. The salts can also be directly toxic, but plant troubles usually result primarily from inability to take up water from salty soils. Problems with salinization are most commonly associated with excessive water application, rather than with too little.

All irrigation water contains dissolved salts derived as it passed over and through the land, and rain water also contains some salts. These salts are generally in very low concentration in the water itself. However, evaporation of water from the dry surface of the soil leaves the salts behind. Sometimes, whitish salt crust can result on the surface of soils. In extreme cases, when the salt crust is too thick, it can't be flushed, as water just runs off the salty surface.

Salinization is especially likely to become a problem on poorly drained soils when the groundwater is within 3 m or less of the surface (depending on the soil type). In such cases, water rises to the surface by capillary action, rather than percolating down through the entire soil profile, and then evaporates from the soil surface.

Salinization is a worldwide problem, particularly acute in semi-arid areas which use lots of irrigation water, are poorly drained, and never get well flushed. These conditions are found in parts of the Mideast, in China's North Plain, in Soviet Central Asia, in the San Joaquin Valley of CA, and in the Colorado River Basin; all areas where the soil profile never (or rarely) gets well flushed.

Globally, something on the order of 20% of the world's irrigated acreage is estimated to be affected by salinization, with salt concentrations high enough in about 10% of irrigated acreage to decrease yields significantly. (This is one of those places where you can read all kinds of figures -- estimates of affected acreage range from the relatively conservative 20% that I cite above to upwards of 50% of irrigated acreage!)

Salinization obviously reduces crop productivity. In the US, salinization may be **lowering crop yields on as much as 25-30% of the nation's irrigated lands.** In Mexico, salinization is estimated to be reducing grain yields by about 1 million tons per year, or enough to feed nearly million people. In extreme cases, land is actually being abandoned because it is too salty to farm profitably.

For convenience your team will study the effects of NaCl, ordinary table salt. An assumption will be made that the effect of NaCl will be characteristic of all the salts on the germinating seeds.

Pre-lab Questions 1. Explain what salinized soil is and how it happens in general.

2. What can be the effect of salinized agricultural land on developing crops?

3. How do humans increase the salinization of land?

4. Create a Question and an "If-then-because" Hypothesis for objective #3. Define the independent and dependent variables for your hypothesis.

5. Define the control(s) and constants for this lab (be sure to include this in your procedure).

Procedure Create an appropriate procedure to collect information about salt concentrations from 0-5% NaCl by mass. You will record information for one week. Prepare your procedure and then have Mrs. B approve it.

Conduct your experiment next class and collect data in a table over the week.

Write a <u>full lab report</u> (see rubric) including the following sections:

Data Anaylsis Create a graph showing the data you collect. Make sure that your independent variable is on your X-axis and your dependent variable is your Y-axis.

Claim: related to question

Evidence: use your graph to support your claim

Explain: How do you know what you know? What is the implication of your findings?

Conclusion Topic sentence, hypothesis rejected or accepted, tie to content, error and how it affected results, improvements