**Laboratory** 2**: Effects of Road Salt on Growth of Winter Rye**

**Goal:** To set up a 2-week lab experiment looking at effects of contamination on growth of winter

rye plants

**Background:**

Much of what we know about the specific effects of individual contaminants on organisms comes from controlled experiments, especially in the critical field of toxicology. These results are used to set exposure tolerances for many substances. Experiments are typically done on ‘model organisms’ such as mice, rats, and certain kinds of fish and zooplankton. The results are then extended to reflect the best guess that we have for the effect of the substance on humans or the environment. The role that these experiments play, while not ideal, is in providing us with our best idea of the effects of the substance with which to build informed policy decisions.

The typical experimental model used is called the controlled experiment. Here, response measurements of interest are observed relative to one or more levels of the substance being tested (treatments), alongside experimental groups with no exposure to the treatments at all (control). In this lab we are going to observe the effect that varying concentrations of road salt have on the growth and germination of winter rye, in comparison with a control group.

**Road salt**

Salt is spread on roads during winter when there is a risk of icing, since salt substantially reduces the freezing point of water in solution. For this reason, icy roads exposed to road salt magically melt away when exposed to road salt, especially in the sun when the blacktop can interact with the sun’s energy as well. It therefore makes wintertime driving safer. However, there is an unintended consequence of road salt which may be detrimental to the environment. Rain causes the salt to runoff into soils and waterways. What is the effect of the salt? Pulses of salinity move through area streams which can harm salt sensitive species. Many plants have a low tolerance to salt, so we can reasonably hypothesize that salt will have a negative effect on plants which are exposed.

While there are a number of different kinds of plants that are tolerant of salt, even surviving submergence in salt water (e.g. mangrove, salt marsh hay), these plants are the exception and they must have special adaptations. In order to provide a conclusion from which we can build a consensus about the effect of road salt on plants, we will look at the effect of salt on winter rye.

Winter rye is a grain, in the grass family, producing an edible seed (rye). The winter type is very cold hardy and is planted as a cover crop by farmers during the winter. This prevents erosion of soil during that time and is harvested or plowed under the following season. Winter rye is also planted during construction projects in order to provide rapid stabilization of disturbed earth. It is a fast sprouter as well and should be able to tolerate our general lack of warmth and light at this time of year.

**Procedure**

The class will divide into groups and each will do a complete experimental setup. Pots containing a small amount of soil and 10 winter rye seeds each will be exposed to three different treatment levels:

* -  Treatment level 1 (equivalent to sea water)
* -  Treatment level 2 (equivalent to measured salt runoff – 1/3 strength of seawater)
* -  Control (no salt exposure)
* Each of these will have 3 replicates (completely repeated), resulting in a total of 9 pots per group and experiment. The plants will be treated again by you next week as the plants sprout and grow, and will be watered by the lab assistants as needed with the treatment during the week. During the second week of the experiment, the number of seeds germinating (sprouting) in each pot will be counted and the length of all shoots in the pot will be measured. Recall that for the control, everything needs to be the same as the treatment. So, if you water the treatment with 25 ml of brine, you must water the control with 25 ml of water.
* **Materials**
* Lab tape and markers
* Clear plastic drink cups (9 per group)
* Graduated cylinders
* Wetted potting soil
* Gloves
* Paper towels
* Two large stock solutions: seawater and runoff concentrations of salt (1/3 strength sea-water),
* Winter rye seeds
* **Setting up**

1. Each pot must be ***labeled with tape for section, group, and treatment***. Do this before you add soil, seeds, or water. Use masking tape to label.
2. Put on gloves.
3. Grab a small handful of soil, wringing out the soil of excess water. Fill each of the nine cups 2/3 full of soil, about your thumb’s width below the top of the cup. Ensure that each pot has roughly the same amount of soil.
4. Each pot is to receive 10 seeds of winter rye, planted just below the soil line – try to space them evenly and cover them with soil.
5. Water each pot with 25mL of either water or brine, depending on the assigned treatment. Use a graduated cylinder to measure the proper volume of treatment.
6. Place all cups on paper towels in clear plastic bins. The bins will be taken to the upstairs lab where we have windows and the plants can receive sunlight. We will water them again next week with treatment- same amount as outset. The plants will be kept watered and the soil kept moist by lab staff during the rest of the two weeks. We will then harvest the plants at the end of the two weeks.
7. Make sure your lab station is clean before leaving!