# Is Too Much Road Salt Harmful to the Environment?



Image sources: https://www.theconservationfoundation.org/resources/outreach-materials/salt-smart/ https://stock.adobe.com/search?k=hand+watering+plant ID: 2402 Category: EA Senior Division Science Type Project

# Introduction/Study Background

- Road salt (e.g., NaCl) is used in the winter to maintain road safety because it is easy to get and doesn't cost much (Hintz and Relyea, 2017).
- Michigan uses about 450,000 tons of road salt a year (<u>www.wilx.com</u>, Jan. 11, 2022)
- Road salt can help keep people safe in the short term, however, long-term, it hurts the environment (Szklarek, Gorecka, and Wojtal-Frankiewincz, 2022).
  - It causes car and infrastructure corrosion
  - Negative influence nearby soil, groundwater, and freshwater ecosystems
  - Hurts animals and plants



### Problem

•Many studies show the negative impacts of road salts on the soil, groundwater, and freshwater environment.

•However, the impacts of road salt concentrations on the early-life stage plants are not well discovered.

### Purpose

To examine how different concentrations of road salt impact early-life plants' health and growth to see how necessary it is to reduce the amount of road salt immediately.



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### Variables

#### Independent

Solution given to plant Salt: 5%, 10%, 15%, 20%, 25% Bleach: 1%, 2%, 3%, 4%, 5% Salt and Bleach: 5% and 1%, 10% and 2%, 15% and 3%, 20% and 4%, 25% and 5% Dependent

- Number of plants killed
- Number of plants wilted
- Number of healthy plants

#### <u>Controls</u>

- Room temperature
- Amount of soil
- Plant container
- Plant type
- Duration of observation

### Hypothesis

I hypothesize that salt will have a severe impact on plants, causing lower concentrations of salt to wilt and higher concentrations of salt to die, showing the need to reduce the amount of salt used in the winter.

# Methods

#### **Procedure:**

1. I used 15 Korean cabbage sprouts and divided them into 3 groups (5 plants in each group).

2. I gave each group 2 teaspoons (around 10 ml) of a specific solution. Specifically, I gave each plant in Group 1 different concentrations of road salt solution (5%, 10%, 15%, 20%, 25%). I gave each plant in Group 2 different concentrations of bleach solution (1%, 2%, 3%, 4%, 5%). I gave each plant in Group 2 different concentrations of bleach solution (5% salt 1% bleach, 10% salt 2% bleach, 15% salt 3% bleach, 20% salt 4% bleach, 25% salt 5% bleach). One additional control plant was given just water as a control group.

3. I then recorded any signs of wilting, drooping, dried up leaves, or growth. I also counted how many plants in each group died or were wilted within each group.

4. For one week, I recorded data every day and every two days rewatered the plants according to their assigned solution.

#### <u>Variables</u>

The variables I tested were regarding the health of the plant (observing the number of plants killed, number of plants wilted, and number of healthy plants).

#### Control Group

The control group is the plant given just water.



# **Testing and Analysis**

I recorded observations daily using three different categories:

How many plants died in the group
How many plants wilted in the group
Other signs of growth disruption.

I compared data of how many plants died and how fast they began to die in the salt solution group to the bleach group and the salt/bleach group.



### Results (0-1 days)

### Before experimentation (after zero days)

Feb. 24, 2023 (Day 0)

Before Exposing to a different condition



### After one day

~The control plant has zero wilting or dead leaves.

~The plants given higher concentrations of their solutions (25% salt, 5% bleach, 25% salt and 5% bleach, 20% salt, 4% bleach, 20% salt and 4% bleach) had one or two drooping sprouts.

~The plants given medium concentrations(15% salt, 3% bleach, 15% salt and 3% bleach, 10% salt, 2% bleach, 10% salt and 2% bleach) had one or two wilted leaves.

~The 5% salt, 1% bleach, 5% salt and 1% bleach had no wilted or drooping leaves.

### Results (4-5 days) After four days

~The control plant has zero wilting or dead leaves.

~By Day 4, plants given the higher and middle concentrations of solutions (25% salt, 5% bleach, 25% salt and 5% bleach, 20% salt, 4% bleach, 20% salt and 4% bleach, 15% salt, 3% bleach, 15% salt and 3% bleach) had dried up completely.

~Plants given 10% salt, 2% bleach, 10% salt and 2% bleach, and 1% bleach were also dried up with only one or two leaves that were wilted.

~The lower concentrations of 5% salt and 5% salt and 1% bleach only had 1 wilted leaf.

After five days

Mar. 1 (After 5 Days)



# **Results (Day 7)**

### After seven days

~The control plant has zero wilting or dead leaves.

~By Day 6 and 7, all the plants had dried up completely, except the 5% salt solution plant and the 5% salt with 1% bleach solution plant.

~The 5% salt and 1% solution plant was in critical condition with all its leaves dead except two wilted leaves.

~The 5% salt solution had four wilted leaves but was not completely dead.



# **Discussion/Implications**

#### Results

My results prove that exposure to road salt disrupts plant growth. This aligns with my expected results and past research done on road salts impact of plant growth (New York Times, Virginia State University, etc.). However, my study focused on young plants unlike other research, so my plants received much more significant damage and at a faster rate.

### **Possible Errors**

- The sprouts could have been in slightly different health conditions and size.
- A difference in initial health conditions of the sprout may have caused results to vary. So, some sprouts could have wilted or died due to reasons other than from the salt or bleach solution (such as diseased plants, unhealthy plants, plants unable to adapt their new container)
- The holes that were made on the bottom of the containers could have been slightly different sizes, resulting in differences in water loss.



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# Conclusion

### <u>My results...</u>



~**support other work** that has already been done and several research reviews.

*For example,* Virginia State University states that "the salt spray can cause burnt (browning) patches on plants and vegetation and dried out buds on deciduous trees, resulting in stunted growth and likely infestation from pathogens." My data shows that my plants' leaves dried up/obtained burnt patches and faced major disruptions in growth.

~address my research question of how different concentrations of salt impact a plant

*because* in the short-term (a week), higher concentrations of salt completely killed the plant and only the plant given 5% salt solution did not kill it. However, even the plant given 5% salt solution showed signs of growth disruption and wilted leaves, suggesting that in the long term, even lower concentrations of plants may cause major damage to a plant, although higher concentrations damage it more rapidly.

~**support my hypothesis** that salt will have a severe impact on plants, causing lower concentrations of salt to wilt and higher concentrations of salt to die *because* the results showed that salt solutions of 25%, 20%, 15%, and 10% died and 5% had wilted leaves.

#### Application

My work can be applied as evidence that road salt kills plants within a short amount of time and has even more damaging affects on younger plants. In addition, Virginia State University explained how "the salt spray can cause aerial and root damage," and knowing younger plants receive more damage, future research can be made to see the aerial and root damage on younger plants, with expectations that damages will be more severe.

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