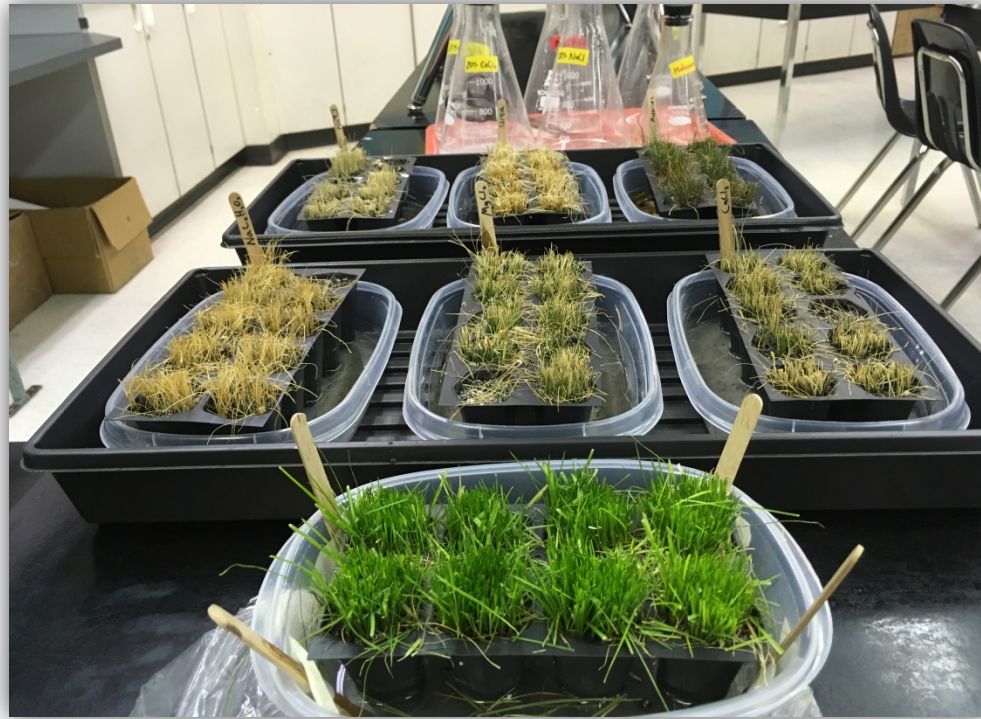


# The effect various de-icers have on grass health compared to their efficiency at melting ice



Dylan Walker

Fort Richmond Collegiate

# Purpose

- To find out the best de-icer weighing in its impact on the environment and its efficiency at melting ice.



# Hypothesis

- Inorganic de-icers will be the most efficient at melting ice but will have the greatest impact on grass health. Organic de-icers vice-versa.



Sodium chloride  
(inorganic)

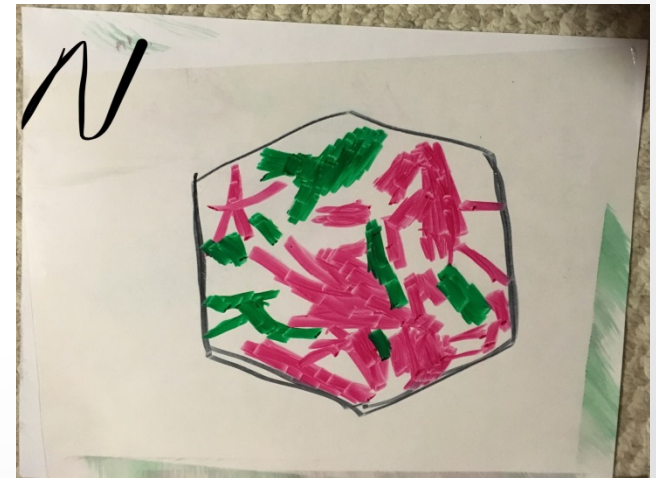


Urea (organic)

# Materials



PHOTOSHOP CC 2018  
OFFLINE INSTALLER



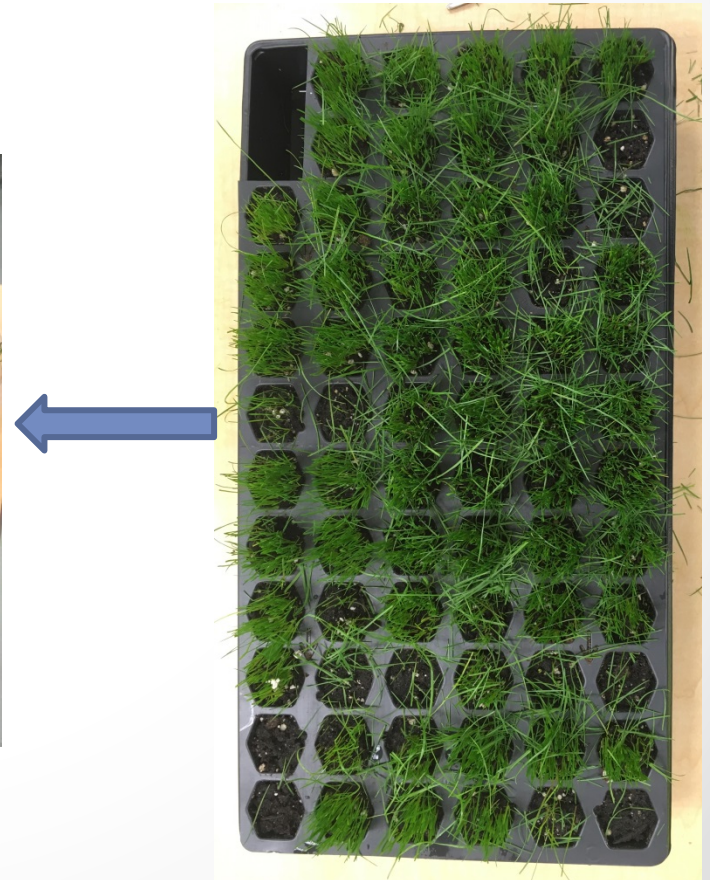
# Method (efficiency experiment)

- Mass 25mL of each de-icer in graduated cylinder.
- Pour 25mL of de-icer into tub of ice and then set a timer for 10 minutes.
- Once timer rings, pour contents of tub into separate beaker.
- Mass beaker to find what mass of liquid is water and not de-icer (how much melted)
- Mass tub of ice to calculate difference in order to support above measurement.

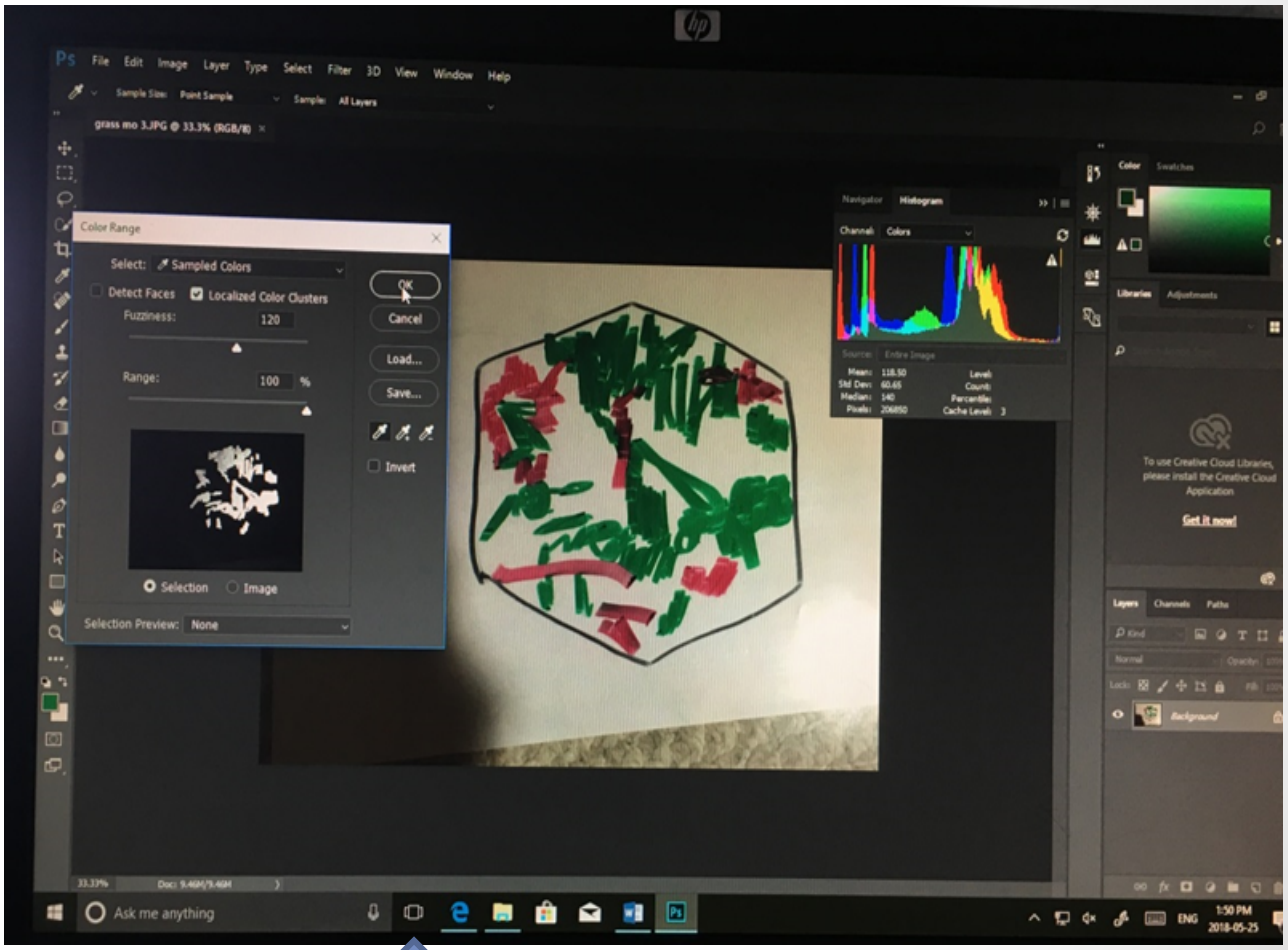
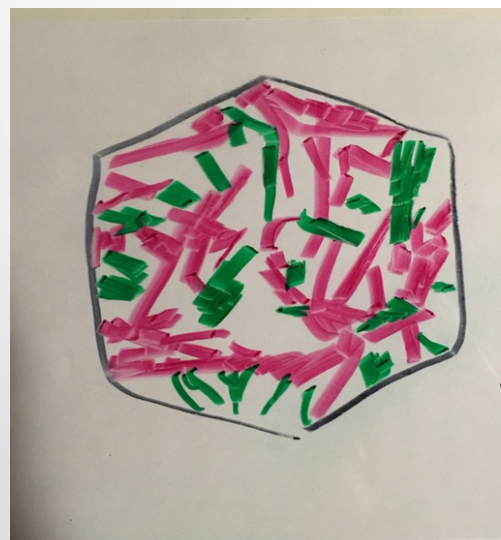
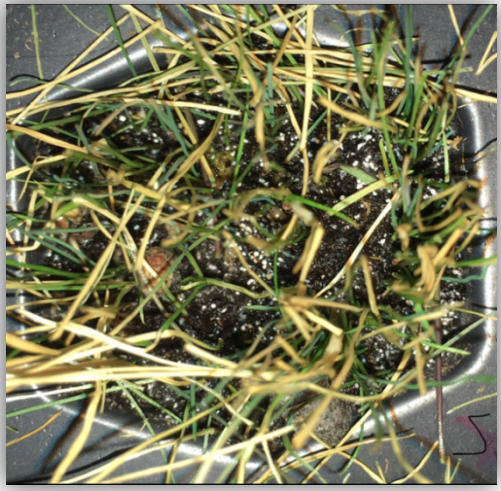


# Method (effect on grass experiment)

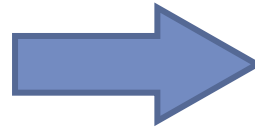
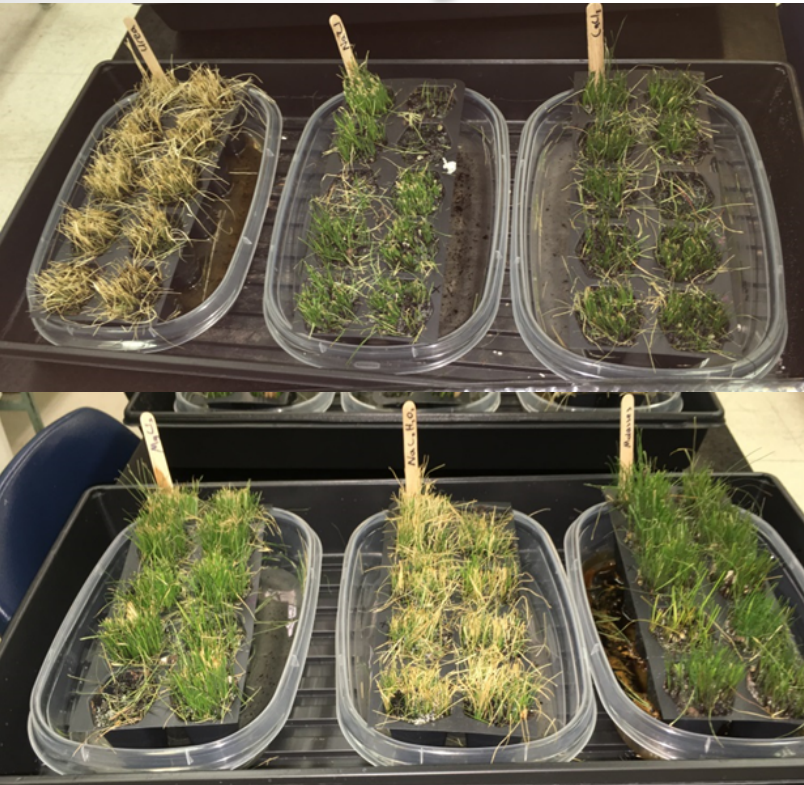
- Place six 2 by 5 pocket trays of grass into different plastic containers containing de-icer. (one tray of grass placed in water as control)
- Place grass in Conviron grass chamber and over the course of 14 days, every 2 to 3 days take a picture of the same three select pockets of grass for each container.



- Highlight alive and dead grass in each photo with markers and then use Photoshop to calculate percentage of green (alive) grass in each photo.



# Day 5



# Day 7





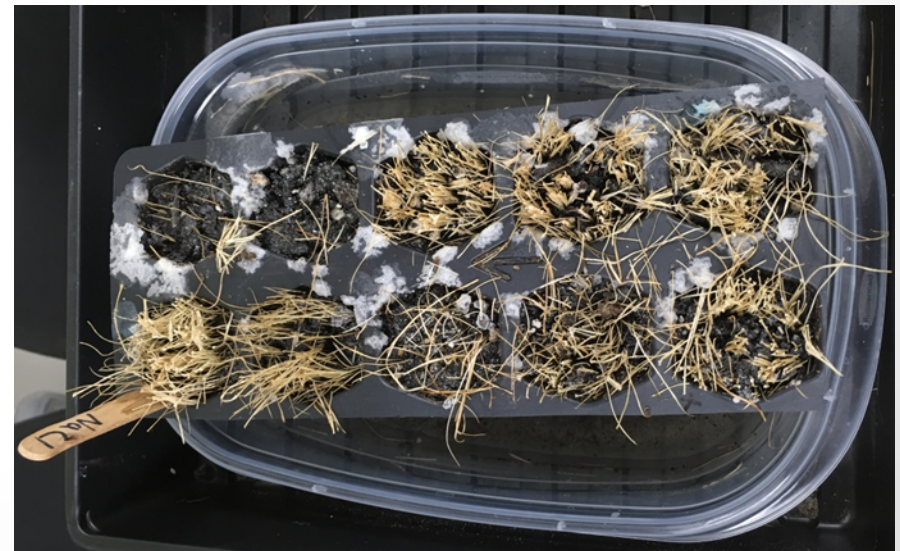
# Observations

Molasses

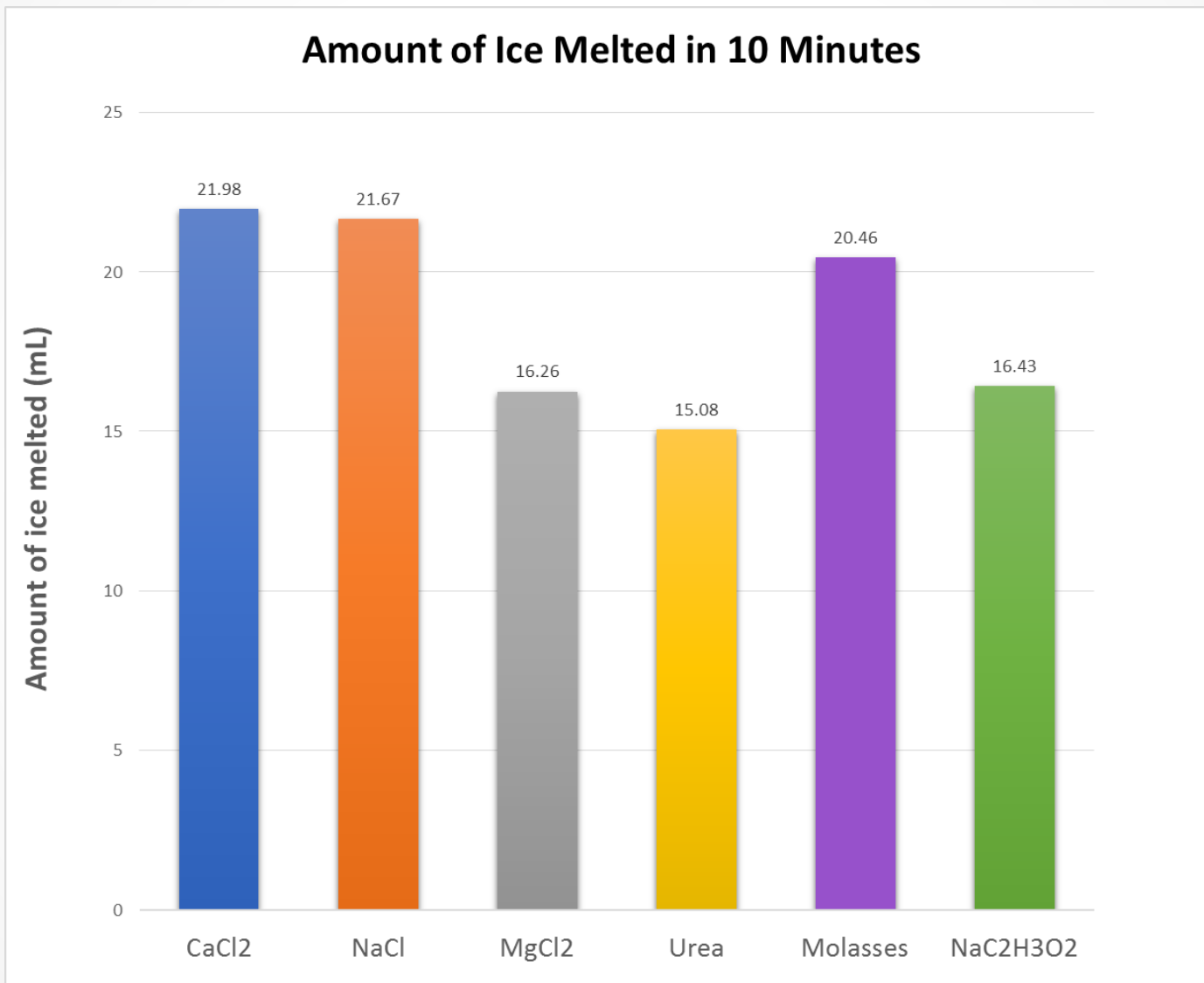


Control

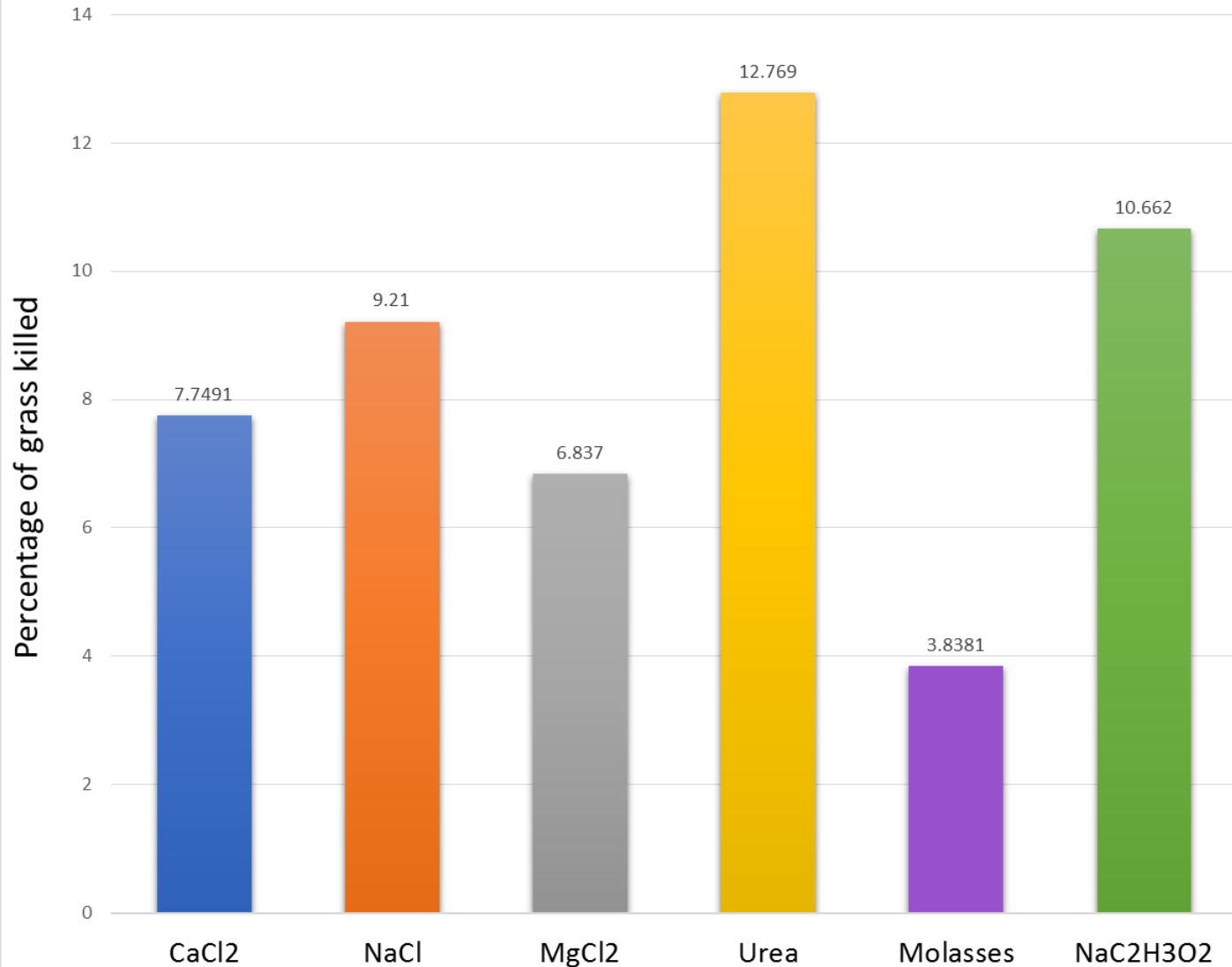
- Grass placed in molasses darker green and more rigid and stiffer than control grass placed in water (left)
- Development of white fungi or mold on the soil and grass placed in de-icer. Most present on grass placed in NaCl (below)



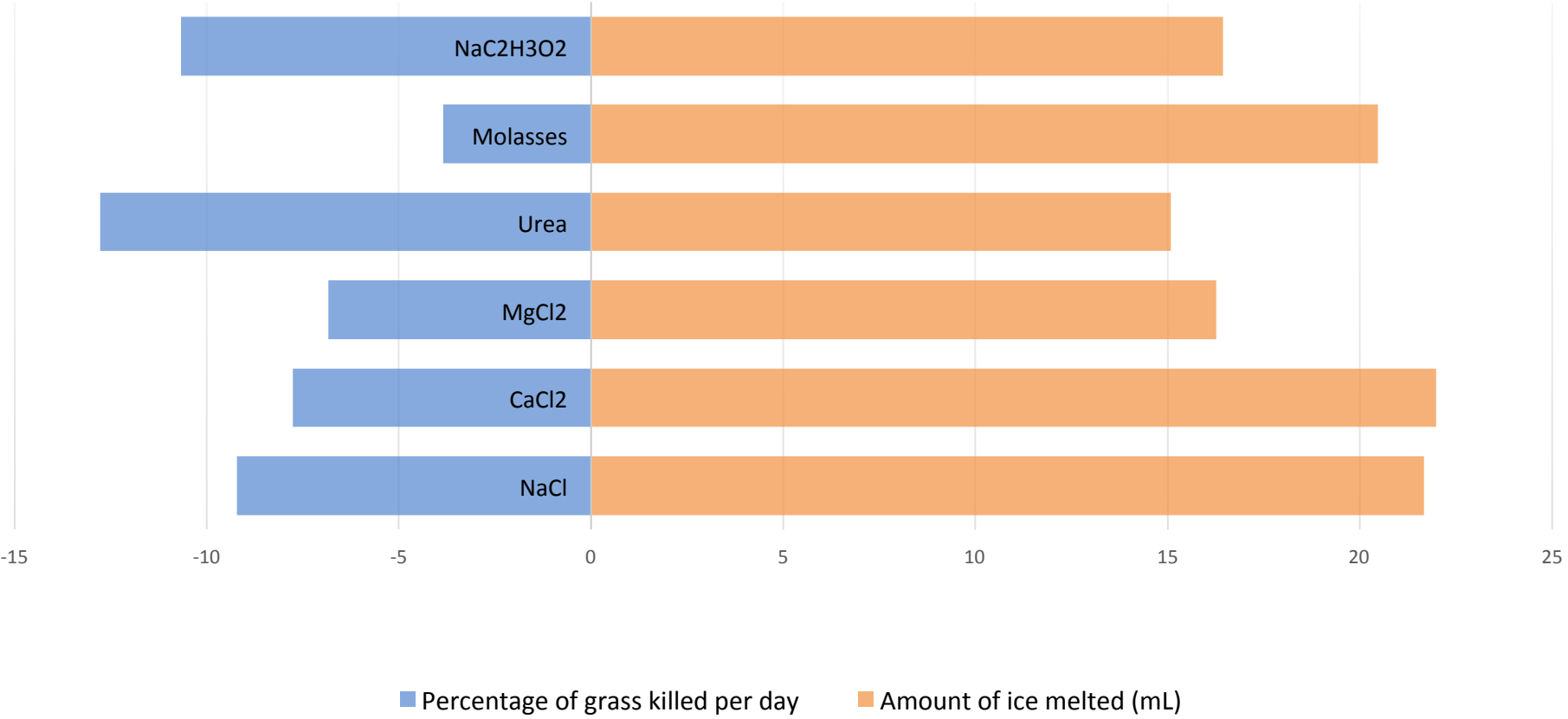
# Results



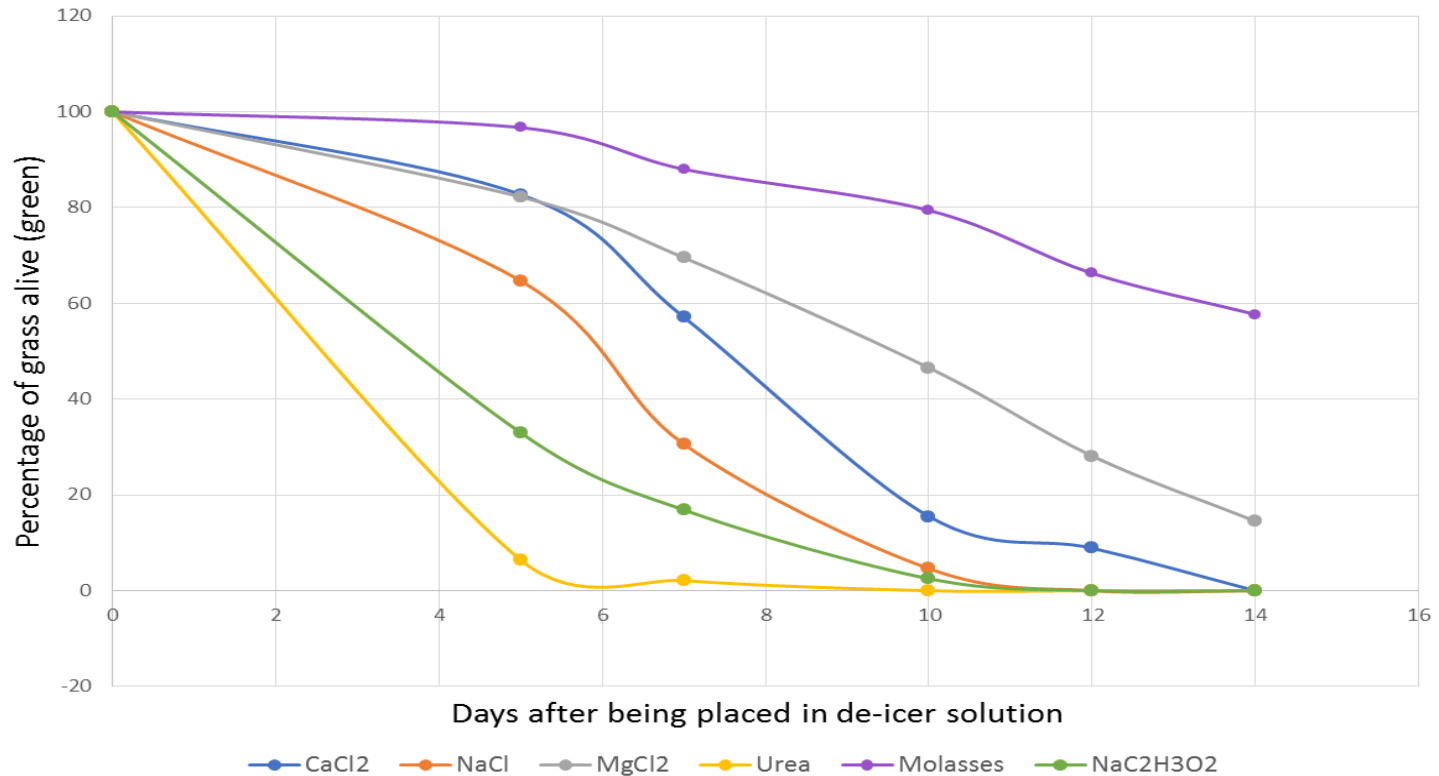
## Percentage of Grass Killed Per Day for Different De-icers



# Comparison for De-icers Impact on Grass and Efficiency at Melting Ice



## Percentage of Grass Alive Over Two Weeks



### De-icer's impact on grass health experiment results

Days after grass is placed in de-icer solution	CaCl <sub>2</sub>	NaCl	MgCl <sub>2</sub>	Urea	Molasses	NaC <sub>2</sub> H <sub>3</sub> O <sub>2</sub>
0	100%	100%	100%	100%	100%	100%
5	82.71%	64.68%	81.12%	6.41%	96.69%	32.98%
7	57.1%	30.58%	69.53%	2.13%	88.01%	16.87%
10	15.51%	4.62%	46.55%	0%	79.42%	2.52%
12	8.89%	0%	28.13%	0%	66.28%	0%
14	0%	0%	14.53%	0%	57.7%	0%

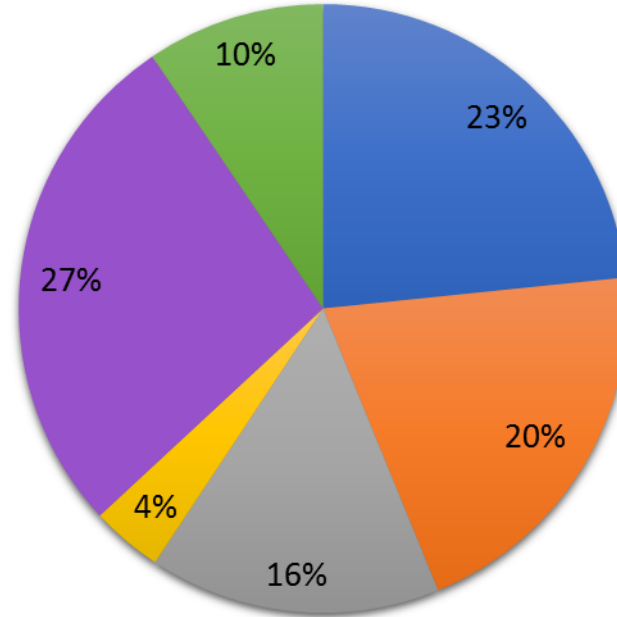
\*The percentage represents the percentage of grass that is green (alive) in the pots

# Conclusion

- Inorganic de-icers as a collective are the most effective at melting ice and have the least impact on the environment. The results were very close and staggered however.
- Molasses is the best overall de-icer to use when weighing in its efficiency at melting ice and minimal environmental impact.



## Best De-icer Weighing in Efficiency and Minimal Environmental Impact



■ CaCl<sub>2</sub>  
 ■ NaCl  
 ■ MgCl<sub>2</sub>  
 ■ Urea  
 ■ Molasses  
 ■ NaC<sub>2</sub>H<sub>3</sub>O<sub>2</sub>

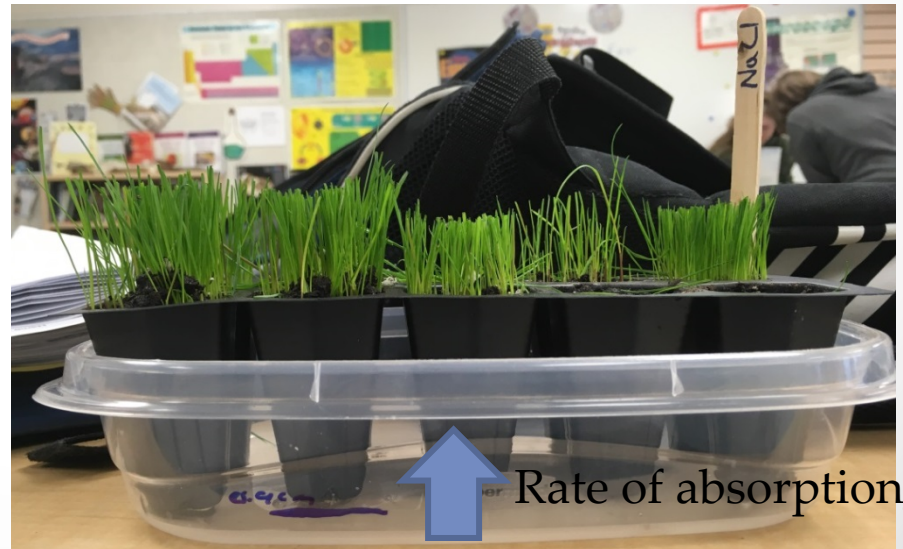
### Final formula to calculate best overall de-icer

De-icers	CaCl <sub>2</sub>	NaCl	MgCl <sub>2</sub>	Urea	Molasses	NaC <sub>2</sub> H <sub>3</sub> O <sub>2</sub>
% of grass killed per day	-7.75	-9.21	-6.84	-12.77	-3.84	-10.66
Amount of ice melted in 10 minutes (mL)	21.98	21.67	16.26	15.08	20.46	16.43
Overall rating (sum of above two values)	14.23	12.46	9.42	2.31	16.7	5.77

\*Higher overall rating indicates a better de-icer

# Sources of error

- The rate from which each de-icer was absorbed into the soil was different between the de-icers
- The amount of grass and soil that was put into each pocket wasn't exactly the same
- The lighting of the photos taken and the clarity of the photos as well as the clarity of the markers when highlighting the grass could've differed





# Applications & Implications

- De-icers are globally used
- Extensions to this project could include:
  - Testing these de-icers corrosion on concrete
  - Testing their level of water toxicity
  - Testing experimental de-icers like molasses (Ex: pickle brine)
  - Testing different combinations of de-icers on tests above
    -



## *A new product for the **De-icer** market*

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Holz RIVA presents a newly developed, research-based and tested, high-performance de-icing mixture.

Composition of the *de-icer* mixture: **sodium chloride, molasses, urea, additional corrosion inhibitor.**

