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| **INTRODUCTION**  ***The Origins of Our Idea***  On January 23rd, 2001, while vacationing with his family in Boston, Dan was confronted by the large impact snow, ice, and freezing weather conditions can have on travel. He saw the frozen roads and huge snowdrifts and in turn, witnessed the methods used to remedy these problems. After returning from his vacation, Dan met up with Steve and discussed the prospects of his observations as the basis for a biology project. Together, they drew the basis for their experiment.  ***Background***  When you think about it, the percentage of populations that live in conditions similar to those observed by Dan is very high. With the majority of industrialized nations lying in the northern hemisphere, icy conditions are a very common occurrence. Problems arise when the ice creates hazardous traveling conditions. As a result, many methods to solve this dilemma have been derived. These methods include, salting, sanding, plowing, and the use of other chemicals (some synthetic, some such as calcium chloride). However, each of these methods have detrimental effects and so there is no clear solution.  ***METHODS*** (Pollard Highway Products & Salt Institute)  **Synthetics:** The drawback of synthetics is that in comparison with salt and calcium chloride, they are cost ineffective. In addition, they require strict and careful monitoring, as many of the chemicals are toxic.  **Calcium Chloride:** One of the most commonly used methods, calcium chloride, though a highly effective and long lasting, does require active creation. It is formed by the reaction of hydrochloric acid with calcium carbonate (limestone). This increases cost in comparison with regular sodium chloride. However, calcium chloride is hygroscopic as it "absorbs moisture from the air or surface". In addition, it is a deliquescent as it "dissolves in the moisture it absorbs, forming a clear solution that is extremely resistant to evaporation."  **Plowing:** Plowing, a common method of reducing and cleaning out snowdrifts is practically ineffective in preventing ice formation, as it is impossible to remove the residual moisture on roads. In addition, it is slow and requires extensive manual labor, thus making it very expensive.  **Sanding:** Though not as effective as calcium chloride, sodium chloride, and some synthetics, sanding the road offers a seemingly lessened environmental impact while offering a low price. Once again, its effectiveness is limited.  **Salting:** Possessing one of the highest effectiveness to cost ratio, salting is seemingly the best solution. However, the environmental effect of salting is substantial as it greatly increases the salinity of the ecosystem�s water table. This change in salinity has the potential of doing substantial damage.  In our experiment, we hope to examine just how severe the effects of salting can have on a specific plant and compare it to the effects of sanding, another common de-icing agent.  ***General Plant Information*** (Raven & Johnson)  As we all know, plants possess two primary essential molecules: carbon dioxide (CO2 ) and water (H20). Carbon dioxide is brought in through the stomata of the plant during transpiration. When the plant requires CO2 molecules to, the plant�s guard cells swell as a result of increased turgor pressure and open up the stomata on the leaves allowing for carbon dioxide to enter. Water on the other hand, is drawn up through the root hairs. These tiny fibers, which cover the roots of the plant, have an "enormous surface area" (Raven & Johnson). This allows for maximum water absorption. Contrary to common belief, the plant does not actively bring in water; rather, water passes in as a result of the osmotic balance between the roots and its surrounding environment. Possessing a higher solute concentration than outside water, the roots are "hyperosmotic" and so water passes into the root, seeking to balance out the concentration gradient. To maintain the "hyperosmotic" conditions of the roots, ions are actively pumped into the root systems through the use of "ion transport channels". This allows for more water to enter the roots than passes out. From there, the effects of the water are vital to the survival of the plant. The primary function of water is to function with carbon dioxide in the process known as photosynthesis, the energy provider of the plant. However, a secondary function that can be considered equally important is the fact that water allows for guard cells to open, opening the stomata and allowing for the intake of carbon dioxide. In addition, a tertiary function of water is to maintain a rigid plant, which increases the surface area, which in turn allows for greater exposure to sunlight.  ***Problems as a Result of Salt***  When salt is introduced to the water surrounding a plant�s root hairs, one highly detrimental problem arises. Salt, which is a solute when placed in water negates the hyperosmotic condition of the roots. This drastically decreases the amount of water passing into the root system and in turn reduces water levels throughout the plant. An effect of this is decreased rigidity. This causes plants to shrivel up, greatly reducing the exposure to sunlight. Another effect is that with a decrease in water, the stomata of the plant are unable to open and so transpiration is unable to take place. As a result, photosynthesis is not carried out and without a source of ATP, the plant eventually dies.  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