



Most plants do not grow well in an acidic environment. Their leaves tend to yellow and curl, and their growth slows. In this activity, you will try growing radish seeds in normal and acidic conditions.

Materials

3 Paper towels
3 Plastic zip-closing bags (pint size)
Masking tape
Pen
Radish seeds
Disposable plastic spoon
Water
Vinegar
Measuring cup
Measuring spoon (tablespoon)



SAFETY: Be sure to follow Milli's Safety Tips! Do not eat or drink any of the materials used in this activity.

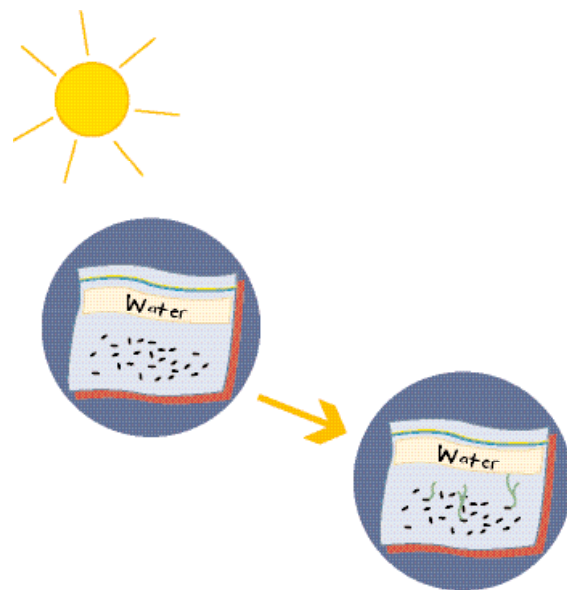
Procedure

1. Fold the paper towels into fourths and place one inside each of the plastic bags.
2. Using the masking tape and pen, label one bag "Water", and the other one "1 Tsp Vinegar + Water", and "Vinegar + Water".
3. Lay the bags down onto a flat surface with the labels facing up.
4. Place 25 radish seeds in each bag. Arrange the seeds on top of the paper towel so that you can see them through the bag.
5. Without lifting the bag, use your plastic spoon to carefully add enough water to the bag labeled "Water" to wet the paper towel completely.

6. Add 1 tablespoon of vinegar to the measuring cup, and then add enough water to fill the cup up to the 1 cup measuring line. Gently stir.
7. Without lifting the bag, use your plastic spoon to carefully add enough water to the bag labeled "1 Tsp Vinegar + Water" to wet the paper towel completely.
8. Pour the remaining liquid down the drain and rinse out the measuring cup with water.
9. Add $\frac{1}{4}$ cup vinegar and $\frac{1}{4}$ cup water to the measuring cup. Gently stir.
10. Without lifting the bag, use your plastic spoon to carefully add enough water to the bag labeled "Vinegar + Water" to wet the paper towel completely.
11. Pour the remaining liquid down the drain and rinse out the measuring cup with water.
12. Seal the bags, and press down on the tops of the bags so that the seeds are pushed down into the paper towel.
13. Place the bags in a sunny spot, and examine the seeds once a day for the next 5 days. Make note of the number of seeds that have sprouted in each bag in the "What Did You Observe?" section.
14. After the experiment is finished, throw the baggies and their contents into the trash. Clean your work area thoroughly, and wash your hands.

Where's the Chemistry?

Vinegar is a very weak acid that is commonly used in cooking and pickling. However, even a small amount of this acid can prevent plants from growing properly. The most common causes of acid rain in our environment are exhaust fumes from automobiles, factories, and power plants. These fumes contain small amounts of sulfur and nitrogen oxides that react with moisture in the air to form sulfuric and nitric acid. Chemists are working to reduce the amount of sulfur compounds produced in power plants by adding powdered limestone to the coal that they burn. The limestone reacts with the sulfur oxides and removes them from the exhaust. In a similar way, catalytic converters are now required on all new cars sold in the United States. These catalytic converters remove the nitrogen oxides from car exhaust fumes.



What Did You Observe?

	Water	Tsp Vinegar + Water	Vinegar + Water
Day 1: Number of seeds that have sprouted?			
Day 2: Number of seeds that have sprouted?			
Day 3: Number of seeds that have sprouted?			
Day 4: Number of seeds that have sprouted?			
Day 5: Number of seeds that have sprouted?			

Did the vinegar make a difference?

What is the appearance of the seedlings grown in the water?

What is the appearance of the seedlings grown in water with a tablespoon of vinegar added?

What is the appearance of the seedlings grown in $\frac{1}{2}$ water and $\frac{1}{2}$ vinegar solution?

