Let's Grow Cleaner

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Question

What is the effect of chemical pollution on plant growth (height)?

Background Research

Pollution from car exhaust, factory emissions, fuel combustion and other sources can hang a brown cloud over some cities. Air pollution not only contributes to respiratory diseases in humans and damages buildings, it can also affect plants. The effects of air pollution on plants develop over time and can't be undone. Some plants are more susceptible to pollution damage than others. Chemicals such as sulfur dioxide, ozone, fluorides and peroxyacyl nitrate, damage the leaves of plants. If enough leaves are damaged, the entire plant will die. Sulfur dioxide, a byproduct of burning fossil fuels such as oil, coal and gasoline, causes changes in the colors of leaf tissue, which may turn white, brown or yellow. Some sulfur dioxide converts to sulfuric acid, which eats holes in the leaves. Ozone damage on leaves appears as mottled spots, which may be yellow, black or brown. If the damage by ozone is severe enough, the plant will drop its leaves altogether. Fluoride damages the edges of plants and causes them to turn brown or black. Peroxyacyl nitrate causes a condition known as silver leaf, in which the underside of the leaves turn silvery white or bronze.

Background Research

Pollution enters the environment from diffuse sources. The causes can be outright, such as the emissions from a coal-burning power plant. Other times, the source may be hard to identify, such as nonpoint source pollution (NSP), where there can be several contributors contaminating surface water. Pollutants can be substances, like pesticides, that do not naturally occur in the environment. Naturally occurring substances also carry risks by disrupting the chemical balance in the air or water. A pollutant, therefore, is any substance that can cause harm. The effects of pollutants can easily be detected on plant structure.Whether the source is acid rain caused by sulfur dioxide emissions or acidic mine drainage from abandoned mines, acidic soils create a complex scenario that results in plants' failure to thrive. Acidic conditions mobilize aluminum ions, normally present in a non-harmful form in the soil. The mobilized aluminum damages root systems and prevents calcium uptake. The result is an overall slowing of plant growth from a lack of nutrients. Aluminum and other heavy metals can further impact plant structure by reducing soil bacteria. A reduction in soil micro-organisms prevents the breakdown of organic matter, resulting in a reduction of available nutrients.

Purpose

The purpose of our project is to teach scholars or people the affect of everyday pollution and how it affects how plants grow. People are still careless about littering and disregard the negative effect it has on plant growth.

Hypothesis

If different types of liquid pollution (perfume, oil, and soap) are given to plants, then the plants given perfume will wither the most because of the chemicals found in perfume. We think the plants that are given just water will grow the most.

Variables

Independent Variable: liquid pollution (Oil, Perfume and Soap)

Dependent Variable: Height of the Plant

Control Group: Plant with water

Experimental Group: 1) Oil 2) Perfume 3) Soap

Materials

12, Three Inch Plant Pots
12 Red Bell Plants
12 Quarts of Soil
1,350 mL of Water
900 mL of Raspberry Perfume
900 mL of Hand Soap
900 mL of Vegetable Oil
4, 555 mL Bottles
1 Ruler
10 Sheets of Lined Paper
1 Beaker (mL and cups)

Procedures

1. Gather all materials.
2. Place 1 quart of soil into four plant pots.
3. Then, place 1 Red Bell plant in each plant pot.
4. Bury the Red Bell's roots with the soil.
5. Record the start height for each plant.
6. Then, in the three separate bottles, add 150 mL of water plus 100 mL of each substance (oil, perfume, and liquid soap). Leave the fourth bottle with just water.

Procedures

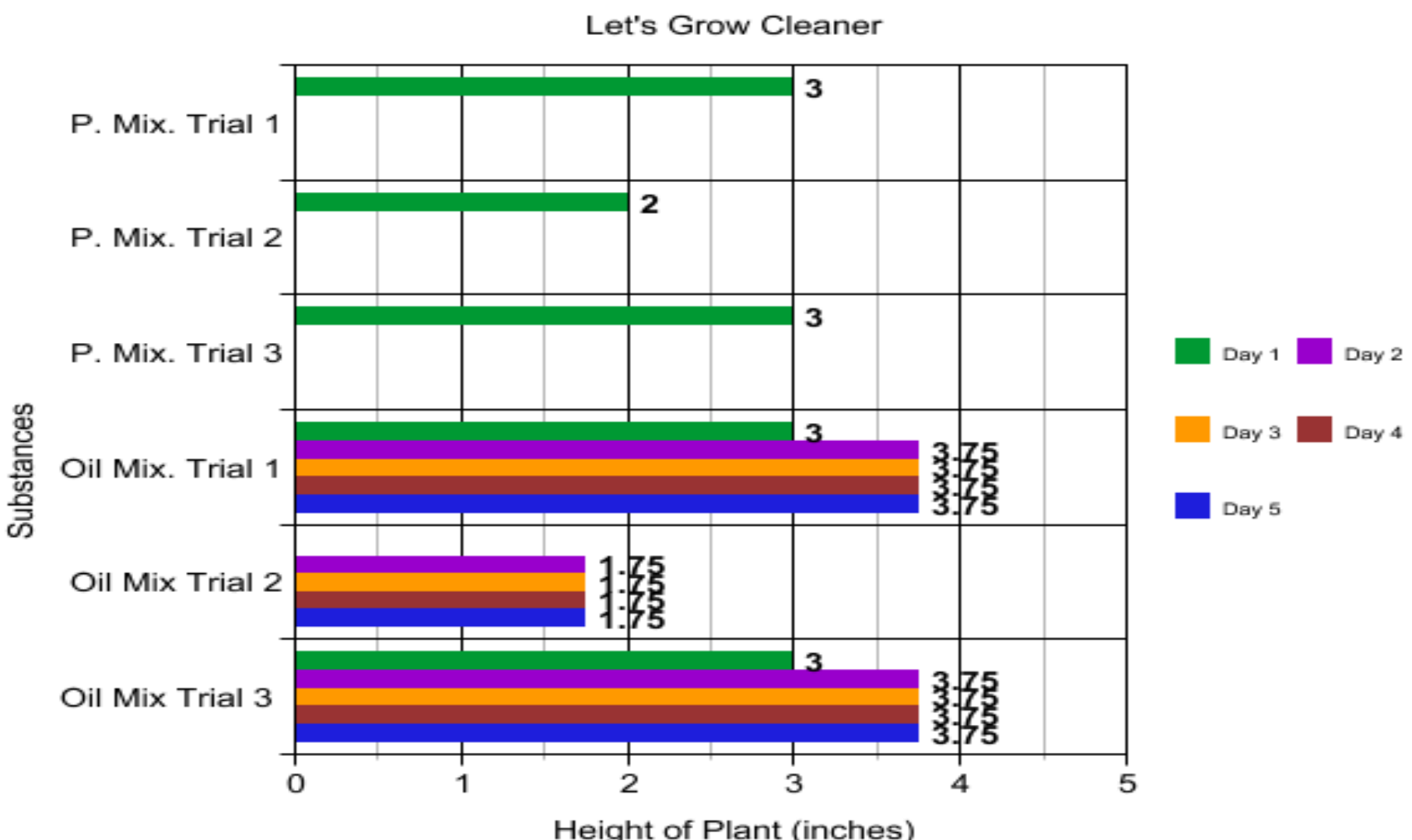
7. Shake each bottle for 5 seconds after adding the substances.
8. Record observations (height of plant) using a ruler (inches) every day for the next 10 days, while watering each plant with the beaker with their desired mixture every other day for the next 10 days.
9. Water each plant with $\frac{1}{4}$ of a cup with their desired mixture. Everyday's observations, belong on 1 sheet of lined paper. Don't forget to clean the beaker thoroughly after watering each plant with their desired mixture.
10. Do this for two more trials.

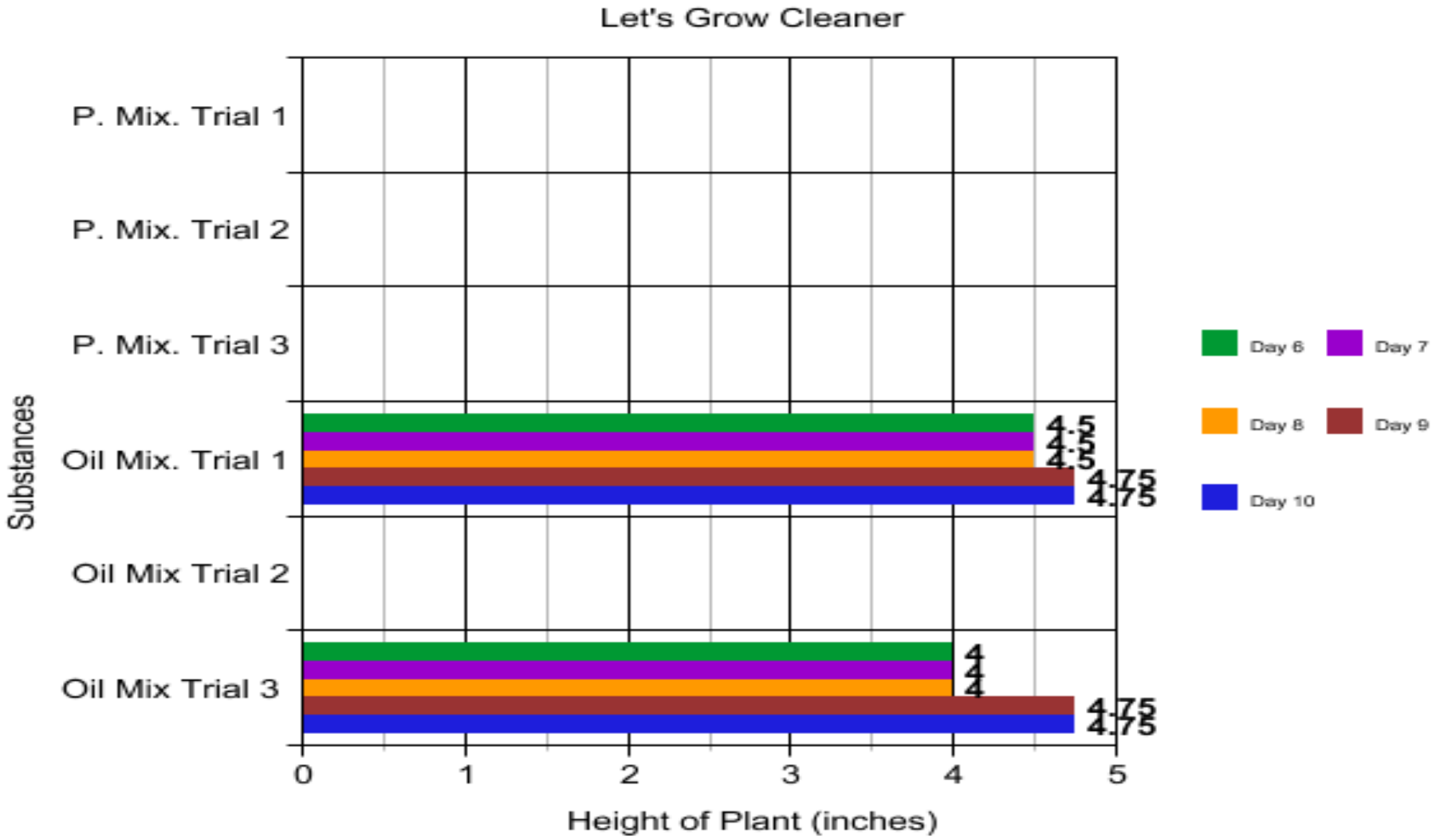
Height of Red Bell Plants

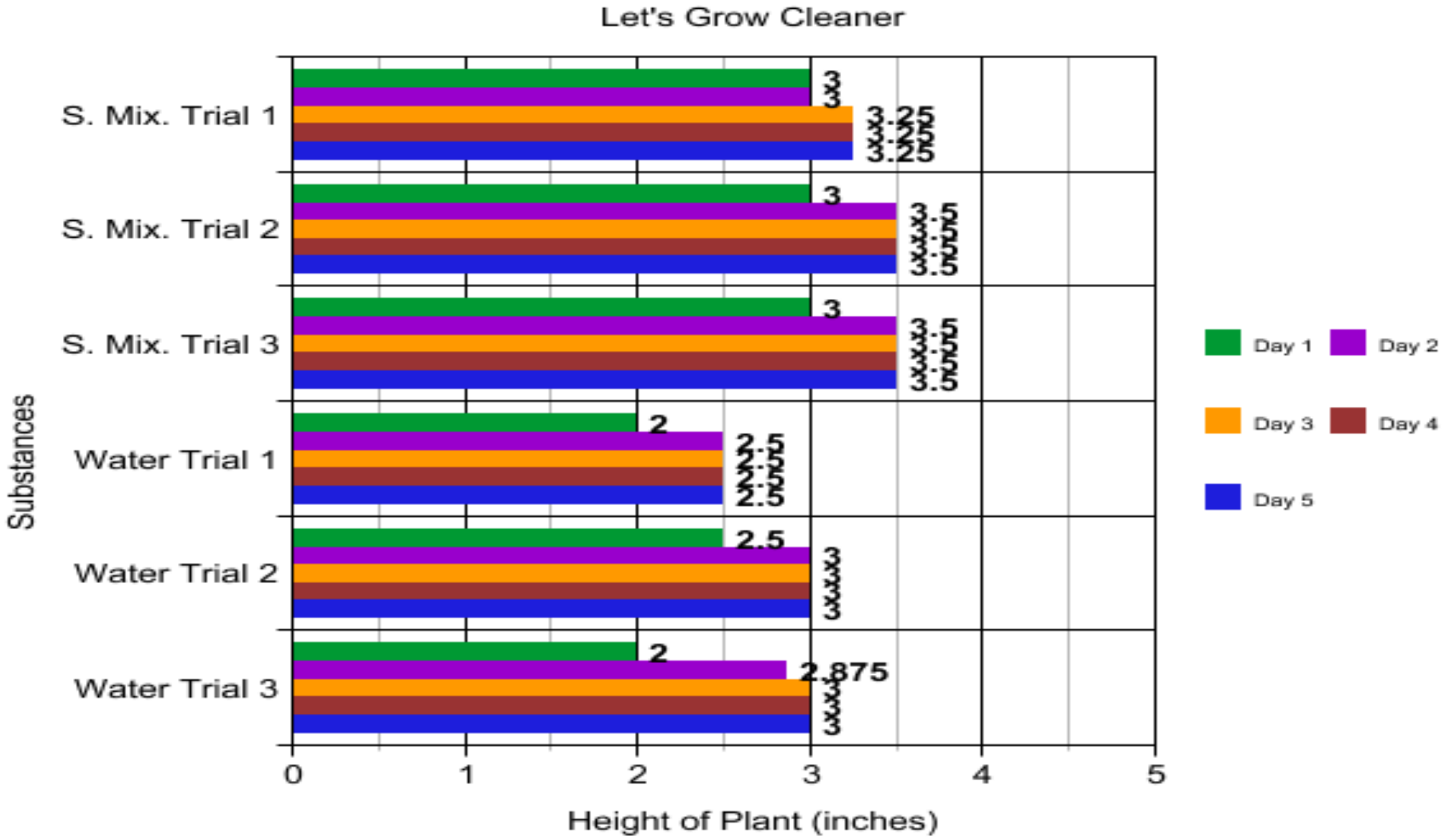
	Perfume Mixture Trial 1	Perfume Mixture Trial 2	Perfume Mixture Trial 3	Oil Mixture Trial 1	Oil Mixture Trial 2	Oil Mixture Trial 3	Soap Mixture Trial 1	Soap Mixture Trial 2	Soap Mixture Trial 3	Water Trial 1	Water Trial 2	Water Trial 3
Day 1	3 in.	2 in.	3 in.	3 in.	1 ½ in.	3 in.	3 in.	3 in.	3 in.	2 in.	2 ½ in.	2 in.
Day 2	Dead	Dead	Dead	3 ¾ in.	1 ¾ in.	3 ¾ in.	3 in.	3 ½ in.	3 ½ in.	2 ½ in.	3 in.	2 ⅞ in.
Day 3	Dead	Dead	Dead	3 ¾ in.	1 ¾ in.	3 ¾ in.	3 ¼ in.	3 ½ in.	3 ½ in.	2 ½ in.	3 in.	3 in.
Day 4	Dead	Dead	Dead	3 ¾ in.	1 ¾ in.	3 ¾ in.	3 ¼ in.	3 ½ in.	3 ½ in.	2 ½ in.	3 in.	3 in.
Day 5	Dead	Dead	Dead	3 ¾ in.	1 ¾ in.	3 ¾ in.	3 ¼ in.	3 ½ in.	3 ½ in.	2 ½ in.	3 in.	3 in.

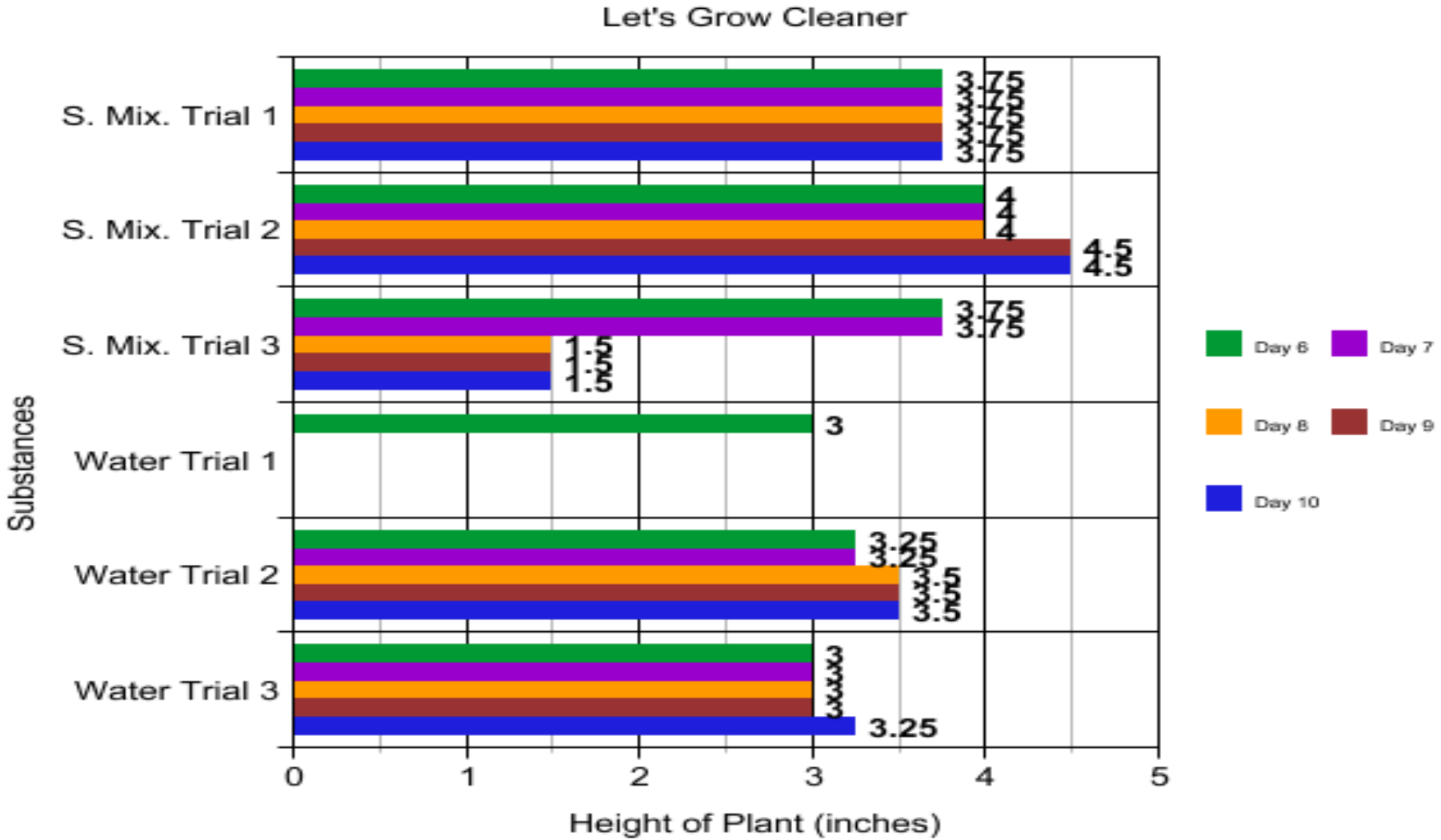
Height of Red Bell Plants

	Perfume Mixture Trial 1	Perfume Mixture Trial 2	Perfume Mixture Trial 3	Oil Mixture Trial 1	Oil Mixture Trial 2	Oil Mixture Trial 3	Soap Mixture Trial 1	Soap Mixture Trial 2	Soap Mixture Trial 3	Water Trial 1	Water Trial 2	Water Trial 3
Day 6	Dead	Dead	Dead	4 ½ in.	Dead	4 in.	3 ¾ in.	4 in.	3 ¾ in.	3 in.	3 ¼ in.	3 in.
Day 7	Dead	Dead	Dead	4 ½ in.	Dead	4 in.	3 ¾ in.	4 in.	3 ¾ in.	Dead	3 ¼ in.	3 in.
Day 8	Dead	Dead	Dead	4 ½ in.	Dead	4 in.	3 ¾ in.	4 in.	1 ½ in. dying	Dead	3 ½ in.	3 in.
Day 9	Dead	Dead	Dead	4 ¾ in.	Dead	4 ¾ in.	3 ¾ in.	4 ½ in.	1 ½ in. dying	Dead	3 ½ in.	3 in.
Day 10	Dead	Dead	Dead	4 ¾ in.	Dead	4 ¾ in.	3 ¾ in.	4 ½ in.	1 ½ in. dying	Dead	3 ½ in.	3 ¼ in.
Total	0 in.	0 in.	0 in.	1 ¾ in.	¼ in.	1 ¾ in.	¾ in.	1 ½ in.	¾ in.	1 in.	1 in.	1 ¼ in.


Let's Grow Cleaner
P. Mix. Trial 1
P. Mix. Trial 2
P. Mix. Trial 3
Oil Mix. Trial 1
Oil Mix Trial 2
Oil Mix Trial 3
Substances
3
2
3
3
1.75
3.75
0
1
2
3
4
5
Height of Plant (inches)
Day 1
Day 2
Day 3
Day 4
Day 5


Let's Grow Cleaner
P. Mix. Trial 1
P. Mix. Trial 2
P. Mix. Trial 3
Oil Mix. Trial 1
Oil Mix Trial 2
Oil Mix Trial 3
Substances
4.5
4.5
4.5
4.75
4.75
4
4
4
4.75
4.75
0
1
2
3
4
5
Height of Plant (inches)
Day 6
Day 7
Day 8
Day 9
Day 10


Let's Grow Cleaner
S. Mix. Trial 1
S. Mix. Trial 2
S. Mix. Trial 3
Water Trial 1
Water Trial 2
Water Trial 3
Substances
3
3
3
2
2.5
2
2.875
0
1
2
3
4
5
Height of Plant (inches)
Day 1
Day 2
Day 3
Day 4
Day 5


Let's Grow Cleaner
S. Mix. Trial 1
S. Mix. Trial 2
S. Mix. Trial 3
Water Trial 1
Water Trial 2
Water Trial 3
Substances
3.75
4
4.5
3.75
1.5
3
3.25
3.5
3.25
0
1
2
3
4
5
Height of Plant (inches)
Day 6
Day 7
Day 8
Day 9
Day 10

Beginning of Experiment

Middle of Experiment

End of Experiment

Results

Overall, the plants that were being watered with the oil mixture did the best. On the other hand, the plants that were being watered with the perfume water did the worst. The plants that were being watered with the perfume mixture had an average height growth of 0 inches. The plants that were being watered with the oil mixture had an average height growth of 1 $\frac{3}{4}$ inches. The plants that were being watered with the soap mixture had an average height growth of 1 inch. And lastly, the plants that were being watered with just water had an average height growth of 1 and 2/25th inches. The plants that were being watered with the perfume water died after day 1. In trial 2, the plant that was being watered with the oil mixture died after day 5. In trial 3, the plant that was being watered with the soap mixture started dying after day 8. Lastly, in trial 3 the plant that was given just water died after day 7.

Conclusion

Our hypothesis that stated "If different types of liquid pollution (perfume, oil, and soap) are given to plants, then the plants given perfume will wither the most because of the chemicals found in perfume. We think the plants that are given just water will grow the most" was partially correct. Our hypothesis was partially correct because we were correct about the plants that were given the perfume mixture did wither the most. But we were incorrect about the plants given water growing the most because the plants that were being watered with the oil mixture grew the most. The perfume mixture made the plants wither the most because the perfume is made up of chemicals that are harmful to plants. We believe that the oil mixture made the plants grow the most because vegetable oil lacks toxins and chemicals and does not leave harmful chemicals behind that can affect plant growth and health.