

Does Juice Affect Earthworms' Burrowing Time?

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Nico Holtzman



Abstract

Does juice affect earthworms' burrowing time? Orange juice and lemonade are and have been popular liquids in the United States for decades, even dating back to the 1600's (Tatro, 2018). Yet most people don't know how harmful these elements can be, specifically lemonade, which kills plants, and causes harm to animals (*Can Dogs Drink Lemonade?*, n.d.). However, today we wonder if the effects of it can influence a worm's burrowing time. Through this research, we can find if lemonade or orange juice is good for humans. To begin the experiment, we tested a worm's reaction when doused in Orange Juice and Lemonade. Once doused, we put the worm in a cup full of dirt to see how long it takes to burrow. Using a stopwatch, we timed how long it took to burrow, then logged it on our chart. Lastly, we repeated that for many other worms. We found out that water makes an earthworm burrow the fastest, yet we also found out that orange juice makes an earthworm take the longest to burrow, proving our hypothesis to be correct. As for the experiment, it was difficult to test the worms because when we would wrap them in the paper towel with the liquid soaked in it, the worm would wiggle around in the paper towel and escape. Overall, according to our data, orange juice causes the longest burrowing time, and water causes the fastest, meaning orange juice and lemonade aren't as good for our bodies when not used as directed.

Introduction

Do the different juices affect Earthworms burrowing time? Lemonade and orange juice give humans a more refreshing taste than water, often drinking them in replace of water for breakfast, lunch or dinner. Because of this, we wanted to test the effects of them to see if they could cause harm to us humans. Yet, which one affects earthworms behavior the most? We have

been using these drinks for decades, not knowing their effects. Therefore, if one affects the earthworms more than the others, it could be harmful to us if used the wrong way.

Our chemicals are orange juice and lemonade. Lemonade was created in 1630. It started to be sold in Paris soon afterwards (Tatro, 2018). On the other hand, orange juice was created in the late 1920's (Snelling, 2014). It originated in Florida and is now a worldwide liquid. In the beginning it was more of a luxury and not many people had it. A main brand for both lemonade and orange juice is Minute Maid. In lemonade the main ingredients are sugar, water, and lemonade juice. Comparingly, orange juice is made up of many acids including citric, malic, and ascorbic. Yet, orange juice contains more vitamins and minerals than lemonade, however lemonade contains concentrations of iron and phosphorus (Mazmany, 2020). All in all, lemonade and orange juice made up a variety of drinks available to us at the table.

Lemonade and orange juice can be highly dangerous liquids, if used the wrong way. They may not be dangerous to us, but they are to crops, and other animals. It is even stated that if animals, such as dogs digest too much lemons, they could start throwing up and having diarrhea from the sugar and acids (*Can Dogs Drink Lemonade?*, n.d.). Earthworms could also release waste called castings if they digest too much organic matter, such as lemonade (*Earthworms*, n.d.). However, humans would be more dangerous to test because if we were soaked in lemonade, we can't burrow, so there'd be nothing to test. Earthworms relate to humans through the spine and the ventral nerve cord in the worm. Both connect the brain and body, and help with signal exchange through the body (Lal, 2018). Earthworms also need oxygen, like us, yet they use it in a different way. Unlike us, earthworms don't have lungs, and instead they breathe

through their skin (*Earthworm*, n.d.). Therefore, earthworms and humans differ, but they have a lot in common as well.

As for the lemonade and orange juice, they mostly get into the soil through spills, or watering plants with them. However, when people water plants with juices, it's not for the plant's health. It is even stated that watering a plant with pure lemonade will "...kill your plant almost immediately" (Shoop & Blackstone, 2022). Then, if the lemonade gets into the soil, then it could become an underground murderer, if it gets into the plant's roots. Lemonade, and orange juice could destroy crops, and then people would be out of food. If the lemonade somehow found a way to our crops, the nation could fall, and many would be left without their dinners. Overall, lemonade specifically, but also orange juice, are dangerous products and could hurt us and the environment.

We think water will cause the fastest burrowing time rather than orange juice and lemonade, and the orange juice will be the slowest burrowing time. I think this is because water doesn't have sugar and the other two liquids do. In Minute Maid lemonade there are 29 grams of sugar (*Lemonade - Lemonade & Fruit Drinks*, n.d.). For Minute Maid orange juice there are 24 grams of sugar (*Premium Original Orange Juice - OJ Products*, n.d.). As for the orange juice, it may be the longest reaction time because the worm might not like the pulp, and might not be able to get it off. This would cause it to squirm around until it gets the pulp off, causing it to take more time. According to our hypothesis, in water there are zero sugars, meaning it should create the fastest burrowing time, yet the orange juice will cause the longest burrowing time.

Methods

First of all, we gathered all the materials including a cup with soil in it, many worms, a tray to keep your things on, a cup of water, Minute Maid orange juice, as well as Minute Maid lemonade, paper towels, a stopwatch, an eye dropper, and a tweezers. Then, we soaked a paper towel in one of our chosen liquids. Following this, we wrapped a worm in the soaked paper towel, and timed for one minute. Next, we took the worm out of the paper towel after one minute, and we placed the worm in the dirt cup. As soon as we did this, we started the stopwatch and timed how long it took for the worm to burrow. After the worm burrowed, we removed the worm from the cup, and grabbed a new worm. We tested five worms for each liquid. After we tested five for the first liquid, we threw away the paper towel, and grabbed a new one. Soon after, we soaked the new paper towel in a different liquid, and repeated the steps for five different worms. After testing those five worms, we switched the paper towel out again for the third liquid and repeated the process. Finally, we recorded the results, and made a graph and data table based on the data in Google Sheets. After making the graph we conducted a t-test based on the data. The t-test showed how accurate our data was. Finally, we turned all our data into this essay, before we shared it with you.

Results

According to our data, we found that water makes the worm burrow the fastest, lemonade the second fastest, and orange juice the slowest. The results concluded that the average burrowing time for water was 72.2 seconds. The average time for lemonade was 140 seconds, and finally, orange juice was 155 seconds. In our graph, you can see that the yellow represents the different worms lemonade trials, while the orange represents the different orange juice trials.

That means that the blue shows the water trials. At the far right side of our graph, you can see our averages for the three liquids, with water being the fastest, and orange juice being the slowest burrowing time.

Our variables included the independent variable being the liquids and the dependent variable being the burrowing time. Our controlled variables included the brand of the juices, being Minute Maid, the dirt cup, and the stopwatch. The T-test we did shows the percentage of how accurate our data is. Water and lemonade had a p-value of 0.077. The water and orange juice had a p-value of 0.012. The lemonade and orange juice had a p-value of 0.700. If the data is above five percent, then five percent is caused by other factors. The higher the number, the worse your data is. You want your data to be under five percent. Overall, the experiment proved to be a success, meanwhile our hypothesis was correct.

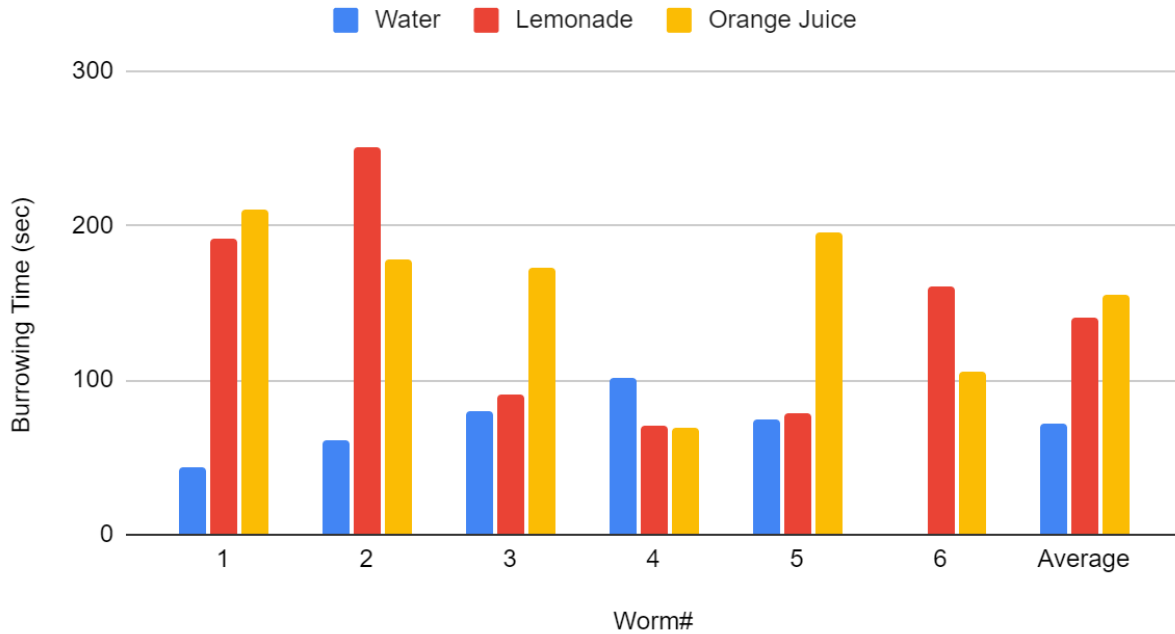
Data Table: In our data table, you can see the three different liquids, along with the worms on top of it. The averages are underneath, along with the t-test, which we tested based on the averages. Orange juice proved to be the longest burrowing time, with water being the fastest.

Table 1: Earthworms burrowing time throughout different liquids

Worm#	Water	Worm#	Lemonade	Worm#	Orange Juice
1	44	1	191	1	210
2	61	2	251	2	178
3	80	3	90	3	173
4	101	4	70	4	69
5	75	5	78	5	195
6		6	161	6	105
Average	72.2 sec	Average	140.16 sec	Average	155 sec
T-test W&L	0.0768963730	T-test W&OJ	0.0121501267	T-test L&OJ	0.7000453506

Figure 1: Different liquids affecting earthworms burrowing time.

Do different liquids affect Earthworm Burrowing Time?



Conclusion

According to our hypothesis, we predicted that orange juice would cause the longest burrowing time, and water would cause the fastest burrowing time. The results supported our hypothesis. For the burrowing time of worms, we concluded that orange juice causes the longest burrowing time, and water causes the shortest burrowing, with lemonade in the middle. The orange juice caused a significant difference in the burrowing time compared to water. However, the T-test stated that the results for orange juice and lemonade were around 70% caused by other things, and the water and lemonade were 7% caused by other things. We saw that the lemonade may have caused the worms to squirm more than the orange juice or water. This experiment showed that orange juice and lemonade are not as good for our bodies, specifically our nervous

system, if we douse ourselves in these liquids. These liquids can also harm our plants if used incorrectly.

Some limitations included that the worms kept squirming out of the paper towel when we lathered them in the liquids, as well as the soil was soaking in liquids from the other classes previous experiments. The worms also tried escaping the dirt cup numerous times. As for further experiments, we might try other liquids such as more acid liquids, or doing condiments. However, we did not do this experiment for no reason. Overall, the orange juice proved to result in the longest burrowing time, and the water to be the quickest burrowing time, proving our hypothesis to be correct.

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