

## Does caffeine affect plant growth?

### Abstract/Summary of Research:

Caffeine is helpful for people to go faster and is often healthy for the body. This is specific in coffee. It has been found to benefit the heart, skin, liver, and reduce the risk of cancer, diabetes, stroke, Parkinson's, Alzheimer's, and so much more. It also helps with better sleep, increased memory, and hair growth in balding people. The question, which is still being researched by scientists, is if caffeine can benefit people in so many different ways, can it benefit plants as well? I'll carry this out by having 4 experimental groups, each one using a different form of caffeine but one. I'll be using caffeinated tea/herbs, coffee, caffeine anhydrous, and water to see the different effects on each plant.

### Background

As work days have increased, caffeine has become a staple in the western world <sup>cite</sup>. This has worked its way into the schooling system with increased pressure, the average high schooler spending as much as 17.5 hours a week outside of school completing homework [Source 5](#) and they have often taken on jobs, leading to caffeine feeling like a necessity. Plants are an excellent model to test how caffeine affects physiological systems and compare to humans. Unlike humans, it is easier to test this in plants since we can control their environment.

Caffeine affects our brain's sleep chemical receptors [Source 3](#). The sleep chemical (adenosine) is replaced in those receptors by caffeine, which is what allows people to stay up for longer periods of time. After a while, your brain goes overtime to create receptors for the adenosine so your body can get the information that you're tired. This is when the caffeine "wears off" and often times we ingest more. The more caffeine we intake, the more receptors our body makes. In result, when we stop taking caffeine in whatever form, our body feels addicted to it. We see the side effects such as headaches, tiredness, and depressed moods, and identify them as withdrawal symptoms. These symptoms occur when you stop ingesting caffeine because the body works overtime in creating adenosine for the extra receptors. This is also linked to why people feel they build up a tolerance after a long time of drinking coffee.

That can lead to the unsafe side of caffeine because the more you take, the more it takes to keep you alert and for the caffeine to have an effect. Overstimulation from caffeine can result in high blood pressure, increased heart rate, and contribute to insomnia and anxiety.

So is caffeine good for plants? That's the question because while it can sometimes be bad for people, it is also related to the overuse of caffeine which seems to be a constant theme for humans. Many people say that they use coffee grounds in their garden, and it helps, while there are also sources that say caffeine doesn't, or that the reason coffee works is because of other things like potassium and phosphorus, which have been found to help plant growth. I will take three different types of caffeine ingested by people on a daily basis, and experiment to see what helps plants grow, and in the end, compare what might be helping the plant's growth.

The final piece of my research that will take part in comparing results at the end of the project is looking at the amount of caffeine in each product.

## Significance & Broader Impacts

This is beneficial for people with gardens. It is a large topic of whether coffee works to help plants grow, but I want to see if other sources of caffeine will work. If other sources of caffeine work, it could make it even easier to grow plants at faster rates, which could benefit people from a small situation of a family garden, to a large case of a farm that sells produce as profit.

## Question and Hypotheses

**Question:** How does caffeine affect plant growth?

**Null Hypothesis:** Caffeine will not affect plant growth in any form (tea/coffee/pills)

**Hypothesis 1:** Caffeine will help the plant grow faster.

**Hypothesis 2:** Caffeine will make the plant grow slower.

## Methods

Cress

20/experimental group (4 experimental groups-80 plants)

- Control Group: regular soil?
- Experimental 1: Coffee grounds
- Experimental 2: Caffeine pills
- Experimental 3: Black tea

Data Collection System

- Monday, Wednesday, Friday
- How much the plant has grown (height-centimeters, Mondays and Fridays)
- Width of the stem
- Root growth (length)

## Analysis Tables

[https://docs.google.com/spreadsheets/d/15gnj8Gf3i3xst1ofC\\_cLqjm-ZFsSHlfrFCwxJ88jEVE/edit#gid=0](https://docs.google.com/spreadsheets/d/15gnj8Gf3i3xst1ofC_cLqjm-ZFsSHlfrFCwxJ88jEVE/edit#gid=0)

## Timeline

- How long it takes your plants to grow
  - 3-6 weeks (fully grown)
- Do you need to construct where you will put your plants?
  - Yes, cardboard box lined with plastic wrap
- What will affect the growth?
  - Water-yes (that's what we're testing-plain water vs water with caffeine assistance)
  - Light-no (if they're all under the same lighting)
  - Temperature-no (they aren't outside so they shouldn't freeze)

## Materials & Budget:

Items	Cost	Where will you get them?
Planters	Egg Cartons	Home
Cress	?	Online
Coffee Grounds	\$5-\$10	Grocery Store (anyone has leftover?)
Black Tea	\$10-\$15	Grocery Store
Caffeine Pills	\$10-\$20	Amazon

### Sources:

Source 1:

<https://www.caffeineinformer.com/top-10-caffeine-health-benefits>

Source 2:

<https://www.bodybuilding.com/fun/8-popular-caffeine-sources-and-how-they-differ>

Source 3:

<https://www.youtube.com/watch?v=foLf5Bi9qXs>

Source 4:

<https://www.coffeeandhealth.org/topic-overview/sources-of-caffeine/>

Source 5:

<https://www.usnews.com/news/articles/2014/02/27/students-spend-more-time-on-homework-but-teachers-say-its-worth-it>

Source 6:

<https://www.thekitchn.com/everything-you-need-to-know-about-growing-basil-221272>