Grey is the Way: Can Plants Grow in Greywater

Background:

Greywater is the wastewater that comes from household appliances, including dishwashers and washing machines. Greywater can contain things like food particles, soap, dust, or hair but it does not contain human wastes like urine or feces. Between dishes and laundry, the average household can make around 5,000 gallons of greywater per year.

Tucson is in the Sonoran desert which gets very little water, so it is important to conserve what we can. While it may not be safe for human consumption, greywater can potentially be reused for other things, such as watering plants. In fact, around seventy percent of residential water is used for outdoor landscaping. Since there is minimal water in Tucson, greywater might be able to be reused to help plants grow while conserving water.

For this experiment, I tested whether plants could grow when watered with greywater instead of fresh tap water. I replicated two types of greywater, Dish Water that contained Dawn dish soap and mashed potato food particles, and Laundry Water that contained laundry detergent and fabric softener. I made each type of greywater considering the realistic proportions of the components in dish water or laundry water. I used the greywaters and also fresh tap water to water mung bean seeds then observed if they germinated and grew.

Question:

Can greywater be used to successfully grow plants?

Hypothesis:

I hypothesize that if I use greywater to water plants, then they will grow just as well as plants grown with fresh tap water, because greywater usually contains diluted soap that plants can tolerate, and it may also contain additional nutrients that can help plants grow.

Materials:

- 1.5 empty cardboard 18-egg carton
- 27 mung bean seeds
- 2 bins
- 1 bowl
- 1 measuring cup
- Dawn dish soap
- Mashed potatoes
- Fabric softener
- Powdered laundry detergent
- Tap water
- Potting soil
- Tablespoon
- 10mL syringe

Procedure:

1. Prepare two types of greywater:
   1.1. Greywater 1: Dish Water
      a) Pour 16 cups of water into a bin
      b) Add one tablespoon of dawn
      c) Add in one cup of mashed potatoes
      d) Mix the ingredients and label as dishwater
   1.2. Greywater 2: Laundry Water
      a) Pour 16 cups of water into a bin
      b) Add ¼ cups of laundry detergent
      c) Add ¼ cups of fabric softener
      d) Mix the ingredients and label as laundry water
2. Prepare fresh tap water by pouring 8 cups of water into a bowl, and label as tap water
3. Pre-soak seeds (to soften the seed coat):
      a) Soak 9 mung bean seeds in one cup of fresh tap water for 12 hours
4. Prepare planting soil:
      a) Scoop one tablespoon of potting soil into each of 9 compartments of an empty cardboard 18-egg carton

Procedure Continued:

5. Plant mung bean seeds:
    a) Drain the soaked mung bean seeds
    b) Poke a small hole, approximately half a centimeter, into the soil of each compartment
    c) Place a drained mung bean seed into each hole and cover with soil
    d) Label three compartments “Dish Water”, three compartments “Laundry Water”, and three compartments “Tap Water”
6. Water the mung bean seeds:
    a) For the seeds labeled “Dish Water”, add 2.5mL Dish Water onto the seed in each compartment using a 10mL syringe
    b) For the seeds labeled “Laundry Water”, add 2.5mL Laundry Water onto the seed in each compartment using a 10mL syringe
    c) For the seeds labeled “Tap Water”, add 2.5mL fresh tap water onto the seed in each compartment using a 10mL syringe
    d) Place the egg carton on a window sill so that the seeds get sunlight
    e) Repeat watering the seeds with the correct water every 12 hours for two weeks
7. Record growth results:
    a) Observe each compartment
    b) Record whether the mung bean seed germinated, grew, or didn’t grow
    c) Compare germination and growth between water types
8. Repeat Trials
    a) Repeat steps 1 through 7 two more times for a total of 3 trials and 9 mung bean seeds total for each type of water

Trial 1:

Time: 2 weeks Beginning: November 17 Ending: December 1

Variables:

- Independent –Water type used to grow plants
(Dish Water, Laundry Water, Fresh Tap Water)
- Dependent – Mung bean seed germination and growth
- Controls – Type of seed planted, type and amount of soil, amount of water added, temperature of environment, number of waterings, timing of waterings

Results of Trial 1 experiment were:

Two mung bean seeds growing with fresh water germinated. Three mung bean seeds growing with the dish water germinated. None of the mung beans growing with the laundry water germinated.

Observations/ thoughts from my experiment:

I noticed that the dish water and laundry water sank into the soil quicker than the fresh water did. I also noticed that mold grew in the soil watered with dish water. The mung beans growing with fresh water grew the fastest.

Trial 2:

Time: 2 weeks Beginning: November 18 Ending: December 2

Variables:

- Independent –Water type used to grow plants
(Dish Water, Laundry Water, Fresh Tap Water)
- Dependent – Mung bean seed germination and growth
- Controls – Type of seed planted, type and amount of soil, amount of water added, temperature of environment, number of waterings, timing of waterings

Results of Trial 2 experiment were:

Two mung beans growing with fresh water germinated. Three mung beans growing with dish water germinated. None of the mung beans growing with laundry water germinated.

Observations/ thoughts from my experiment :

I noticed that the dish water and laundry water sank into the soil quicker than the fresh water did. I also noticed that mold grew in the soil watered with dish water. The mung beans growing with fresh water grew the fastest.

Trial 3:

Time: 2 weeks Beginning: November 19 Ending: December 3

Variables:

- Independent –Water type used to grow plants (Dish Water, Laundry Water, Fresh Tap Water)
- Dependent – Mung bean seed germination and growth
- Controls – Type of seed planted, type and amount of soil, amount of water added, temperature of environment, number of waterings, timing of waterings

Results of Trial 3 experiment were:

Three of the mung beans growing with fresh water germinated. Three of the mung beans growing with dish water germinated. One of the mung beans growing with laundry water germinated.

Observations/ thoughts from my experiment :

I noticed that the dish water and laundry water sank into the soil quicker than the fresh water did. I also noticed that mold grew in the soil watered with dish water. The mung beans growing with fresh water grew the fastest.

Data Charts:

TRIAL 1

	# Germinated
Fresh Tap Water	2
Dish Water	3
Laundry Water	0

TRIAL 2

	# Germinated
Fresh Tap Water	2
Dish Water	3
Laundry Water	0

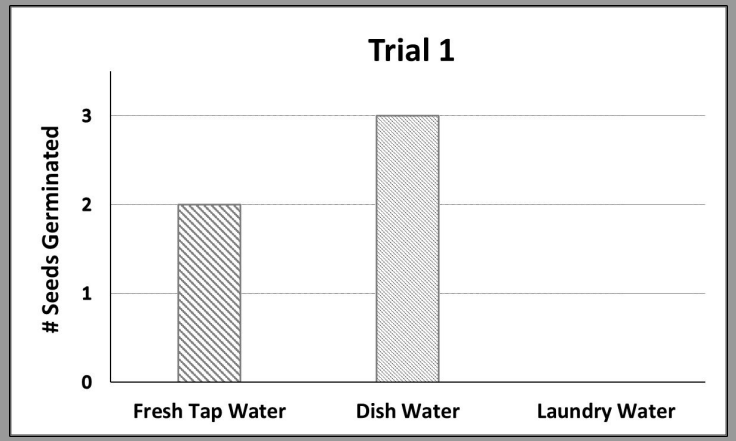
TRIAL 3

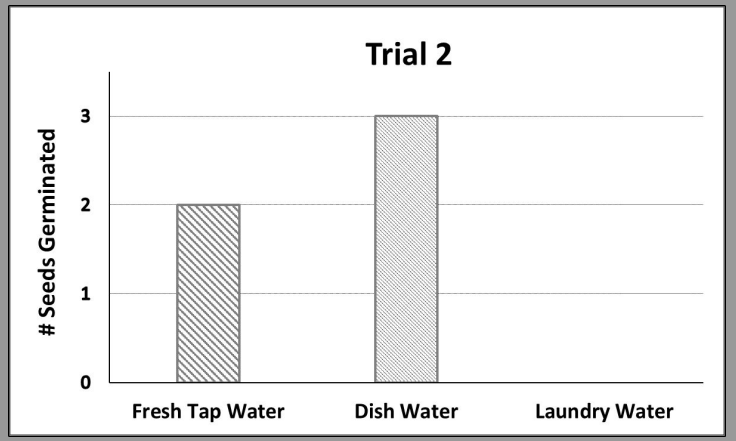
	# Germinated
Fresh Tap Water	3
Dish Water	3
Laundry Water	1

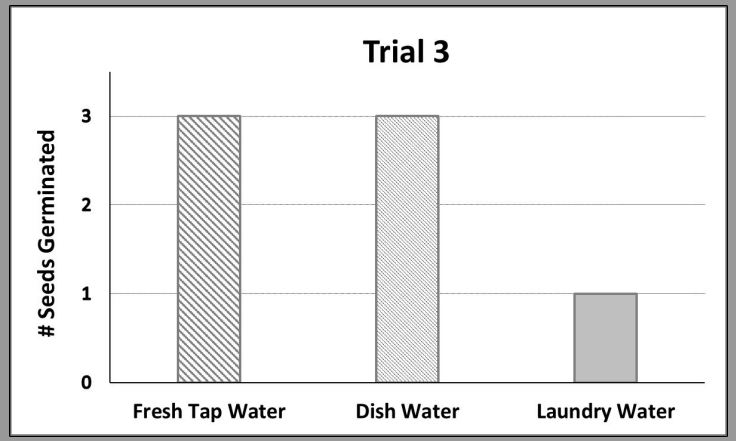
TOTAL

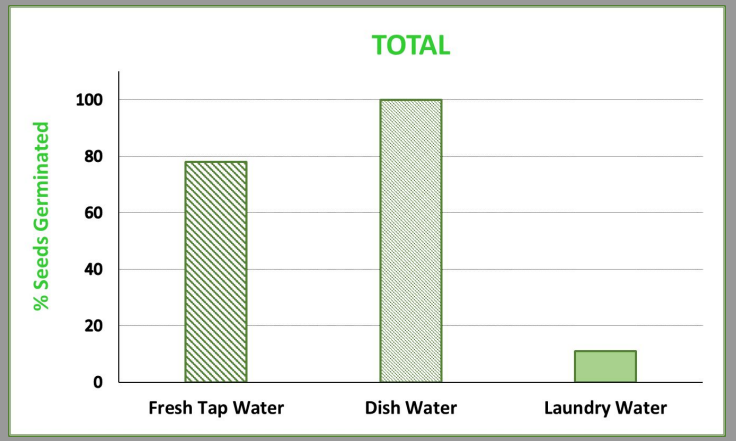
	# Germinated	% Germinated
Fresh Tap Water	7	78%
Dish Water	9	100%
Laundry Water	1	11%

Graphs:


Trial 1
Seeds Germinated
0
1
2
3
Fresh Tap Water
Dish Water
Laundry Water


Trial 2
Seeds Germinated
0
1
2
3
Fresh Tap Water
Dish Water
Laundry Water


Trial 3
Seeds Germinated
0
1
2
3
Fresh Tap Water
Dish Water
Laundry Water


TOTAL
% Seeds Germinated
0
20
40
60
80
100
Fresh Tap Water
Dish Water
Laundry Water

Closing:

In my experiment, I examined whether mung bean seeds could be grown with greywater. I used two different types of greywater, one with the contents of dish water, and one with the contents of laundry water. I then compared the growth of mung bean seeds watered with the greywaters to the growth of mung bean seeds watered with fresh tap water. I hypothesized that the mung bean growth would be the same using all three types of water.

After collecting data, I found out that seven mung beans grown with fresh water germinated in total: two in the first trial, two in the second trial, and three in the third trial. Nine mung beans grown with dish water germinated in total: three in the first trial, three in the second trial, and three in the third trial. One mung bean grown in laundry water germinated in total: zero in the first trial, zero in the second trial, and one in the third trial. One thing I noticed was that both greywaters, which contained soaps, soaked into the soil quicker than the fresh tap water, which beaded up on top of the soil for awhile. Another thing I noticed was that the dish water caused the soil to get moldy.

My results did not completely match my hypothesis, so overall, my hypothesis was invalid. While seeds watered with dish water grew as well as seeds watered with fresh tap water, seeds watered with laundry water did not grow as well. From this experiment, I concluded that greywater from cleaning dishes can be used to grow plants but laundry water most likely cannot.

Closing Continued:

After doing this experiment, I was curious about some of the things I observed that I did not expect. I did not expect mold to grow using the dishwater, and I wonder if nutrients from the mashed potatoes gave an extra benefit to the seeds. I also did not expect that the fresh tap water would not soak into the dry soil as well as the greywaters. I would be interested in exploring if adding some soap could help water soak into the dry desert dirt when watering plants in my yard. Finally, I was curious whether some eco-friendly laundry detergents might allow seeds to grow better than the normal powder detergent did in my experiment.

Reflection:

Overall, I think my experiment was not too difficult to execute and my results made sense based on the research I conducted. My experiment did a good job of showing that dish water can be reused for watering plants, but also taught me that laundry water might not be good for landscaping. I think that I gave my mung bean seeds plenty of water and soil, but if I were to do this project again, I would use soil that was not so dry, and I might plant more seeds to make sure the results were accurate. I could also use a different type of laundry detergent, because eco-friendly detergents might be better for plant growth.

Implication:

In researching my last science fair project, I learned that "...even though Earth has a lot of water, less than one percent of the water on Earth is available for human use. In Tucson we get our water from the Colorado River which is losing water due to droughts, climate change, and an overuse of water." With that same idea in mind, in this project, I found that greywater can be reused to water plants so that we can save more clean water for other uses. If people started using their grey dish water to water plants rather than discarding it, we would not only be saving water, but we would also be helping plants grow.

Citations:

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- Veroutsos, E., & Morgan, K. (2025, September 18). *Which seeds sprout and grow the quickest?* BackyardBoss. https://www.backyardboss.net/fast-growing-seeds/
- Nolan, T. (2024, June 18). *Salt-tolerant plants that will survive in road-salt-laced soil*. Savvy Gardening. https://savvygardening.com/salt-tolerant-plants/