



Prize Winner

Scientific Inquiry

Year 3-4

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Can we grow plants using recycled water from washing machine?



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1. Introduction

Every time we wash our clothes, we use a lot of water that goes to waste. Some people say that they recycle it to water their plants and vegetables. Can we really do this? Nowadays, it seems that laundry soaps for our washing machines are much better and less polluting than before. I have read this here:

- 1) <https://www.choice.com.au/home-and-living/laundry-and-cleaning/laundry-detergents/buying-guides/laundry-detergents>
- 2) <https://www.choice.com.au/home-and-living/laundry-and-cleaning/washing-machines/articles/using-greywater>

However, using these laundry soaps for watering the plants may still not be good. I wanted to understand with an experiment if we can really re-use the water from our washing machines to water the plants, so I made an experiment to help me find out the answer.

These are my questions and hypotheses I wanted to test:

Question 1

- 1- Can plants germinate and grow if we water them with recycled water from the washing machines?

Hypothesis 1

- 2- Using recycled water from the washing machine will not make the plants germinate and grow well because of the chemicals from the laundry soap.

Questions 2

- 1- Would it be better if we use an eco-friendly soap instead of a normal laundry soap?

Hypothesis 2:

- 2- Using a normal laundry soap will have a worse effect on the plant in comparison to the eco-friendly soap.

2. How I have prepared my experiment (material and methods)

a) Experiment treatments

To test my experiment hypotheses, I have prepared three different treatments:

- 1) **Control**: where I am watering the plants with just tap water.
- 2) **Normal soap**: watering with recycled water from washing machine where a normal commercial laundry soap was used.
- 3) **Eco-friendly soap**: watering with recycled water from washing machine where a commercial eco-friendly laundry soap was used.

The plant that I have chosen for this experiment is the dwarf pea because it grows in winter and it grows fast (8-10 weeks before harvest).

On June 7th, I have first sown the seeds in 3 small pots for each treatment group (2 seeds in each pot, for a total of 18 seeds, fig 1). After the seeds have germinated and grown a bit, on June 21st I have transferred the plants to bigger pots and kept only one plant per pot (the biggest of each group, fig 2). As it's winter, I have kept my plants in a small green house.

To see which treatment was the best for growing plants, I have cut the plants after 6 weeks and dried them in the oven at 50 degrees Celsius for 24 hours (my dad is a soil scientist, he helped me with this).

I went to my dad's laboratory to weigh the plants using a special scale that have 3 decimal points precision (fig 3).



Figure 1



Figure 2



Figure 3

b) Soap concentration in the recycled water

For the Treatment 2 (normal soap) I have chosen the Fab brand (fig 4) and for the eco-friendly soap (treatment 3) I have chosen the Earth-choice brand (fig 5). Both soaps were available at my local supermarket, Foodland.



Figure 4

Figure 5

I had to prepare the soapy water for the experiment, so I needed to know the concentration of soap in the water coming out of the washing machine.

The first thing to know was how much water comes out of a washing machine on a regular cycle. To do that, I used buckets to collect the water coming out of my washing machine that was set for a regular load. The result was 72.5L (which is about 72.5Kg, it's a lot of water!).

After this, I needed to know how much soap (in grams) we use for a load of clothes.

In both the normal and the eco-friendly soaps, the instructions said to use 50ml for a regular load. I have used my kitchen scale to measure how many grams of normal and eco-friendly soaps are it 50ml (fig 6).



Figure 6



Figure 7



Figure 8

50ml of the normal laundry soap weighted 65g and 50ml of eco-friendly soap weighted 56g. The concentration of soap coming from the washing machine was calculated like this (my dad helped me with these calculations):

Soap concentration % = Amount of soap for normal wash cycle (g) / total water used by the washing machine during the wash cycle (g) X 100

The concentration of the normal soap was:

Normal soap conc. = 65g/72500 x 100 = 0.09%

And the concentration of the eco-friendly soap was:

Eco-friendly soap conc. = 56g/72500 x 100 = 0.08%

That means there is not a lot of soap in the water from the washing machine.

Using the soap concentrations, I have prepared two buckets of 15L of water. In one I have mixed 13g of normal laundry soap and in the other one I have mixed 12g of eco-friendly soap (fig 7).

After this I have put the water in plastic bottles that I have used to water the plants (fig 8).

c) Soil pH

To see if the soaps were bad for the soil, I have measured the soil pH (it tells me how alkaline or acid the soil is) before I have started the experiment and at the end.

I went to Bunnings where I have bought a pH measuring kit and a pH meter.

With the pH measuring kit I had to mix the soil with special chemicals that reacted with the soil showing different colours (fig 9). I have used a colour chart to see what pH the soil was.

The soil pH meter is a special tool that tells you the pH after you inserted the rod in the soil (fig 10).

The soil pH before the experiments was:

1) pH from soil kit = 6.5-7

2) pH from pH-meter = 6.4



Figure 9



Figure 10

3. Results

After 4 days from sowing, on June 11th the seeds started to germinate and emerge from the pots in the treatments 1 and 3 (water and eco-friendly soap, fig 11).

The seeds in the treatment 2 (normal soaps) took another 2 days to emerge and only 3 out of 6 seeds came out (fig 12). All 6 seeds emerged in the pots of treatments 1 and 3 (fig 12, 13).

On June 21st, I have transferred the plants into bigger pots (fig 2). On that day, I could see that the plants in treatment 1 were the biggest and healthiest. The plants in treatment 3 also looked big and healthy, while the plants in treatment 2 (normal soap) were smaller (fig 14).



Figure 11



Figure 12



Figure 13



Figure 14

However, after a few days the plants in treatment 2 started to catch up and by the time I harvested I could not see any difference between the treatments (figs 15 and 16).

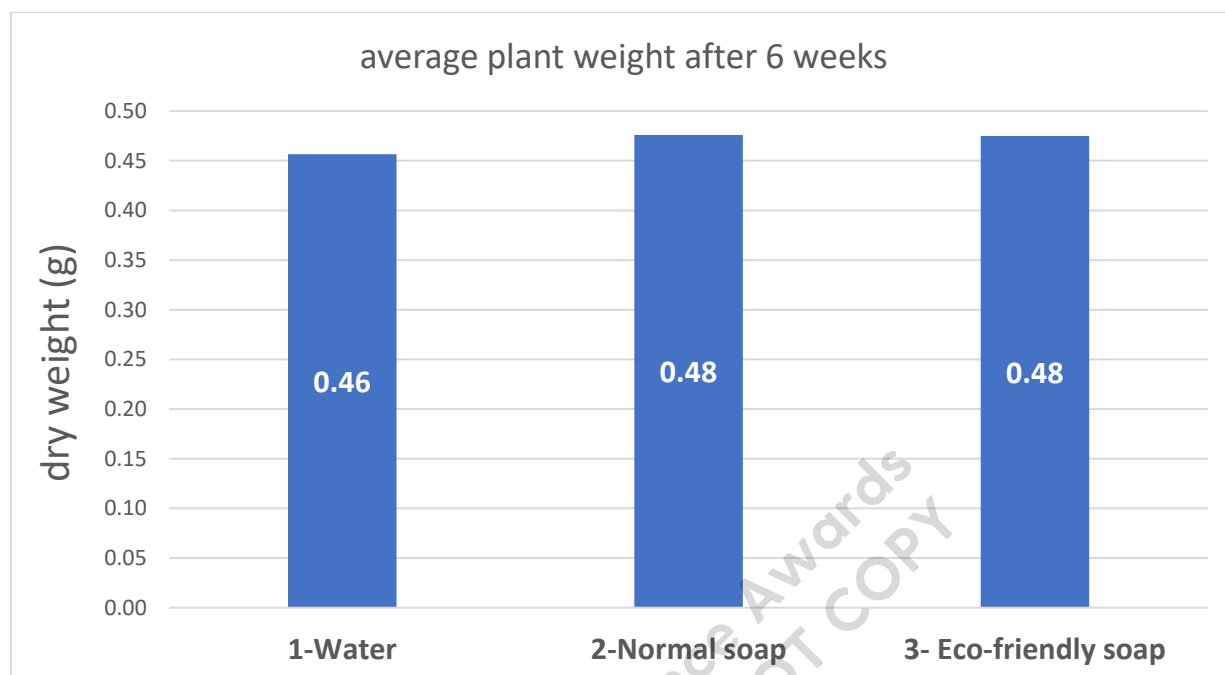


Figure 15



Figure 16

After I had cut and dried the plants in the oven, their average weight of the dry plants was 0.46g for treatment 1, and 0.48g for treatments 2 and 3.
The table below shows this results.



I have also measured the soil pH from the treatments at the end of the experiment. These are the results:

Treatment	pH kit	pH meter
T1-Water	6-6.5	6.4
T2- Normal soap	6-6.6	6.8
T3- Eco-friendly soap	6-6.7	6.6

I could not see any difference between the pH before and after the experiment when I have used the pH kit (fig 20) , but I could see it when I have used the pH meter (figs 17, 18 and 19).



Figure 17 (T1)



Figure 18 (T2)

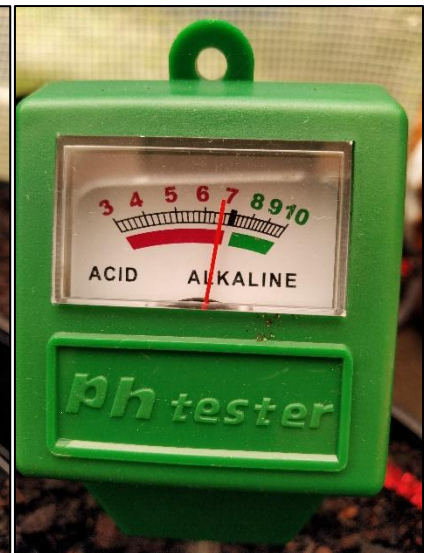


Figure 19 (T3)



Figure 20

4. Conclusions

Question 1: Can plants germinate and grow if we water them with recycle water from washing machines?

My experiment has shown that if you use recycle water with a normal laundry soap, the plant won't germinate well and will grow slowly at the beginning.

When I have used an eco-friendly soap, there were no differences with watering with just tap water.

However, after a few weeks the plant watered using recycled water with normal soap started to grow just as well as the other treatments. In fact, at the end of the experiment the plants watered with recycled water from the washing machine were a bit bigger (heavier) than the ones watered with just tap water!

When I have measured the pH at the end of the experiment (using the pH meter) the soil watered with eco-friendly soap was more alkaline than the pH at the start (from 6.4 to 6.6). The soil watered with normal soap was even more alkaline at the end of the experiment (from 6.4 to 6.8).

Question 2: Would it be better if we use an eco-friendly soap instead of a normal laundry soap?

In my experiment, when I have used the eco-friendly soap the plants germinated better than the plants where I have used a normal laundry soap. However, at the end of the experiment there were no difference between the two soaps.

In conclusion, both of my initial hypotheses were wrong. You can grow plants using recycled water from washing machines. This is good, because it means that modern soaps, even the non-eco-friendly ones, are much better than the soaps we used in the past. However, we still must be careful because the soil pH becomes more alkaline when using the recycled water and it could become too much over time. Maybe, it would be better to sometimes use the normal tap water to avoid this problem.

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