

The Effect of Pesticide on Plant Development

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Rational/Question

I want to investigate how pesticides affect the development and growth of plants.

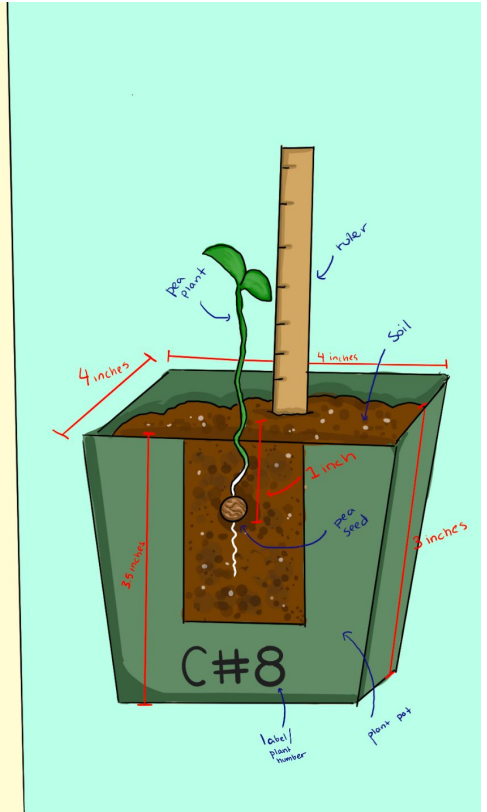
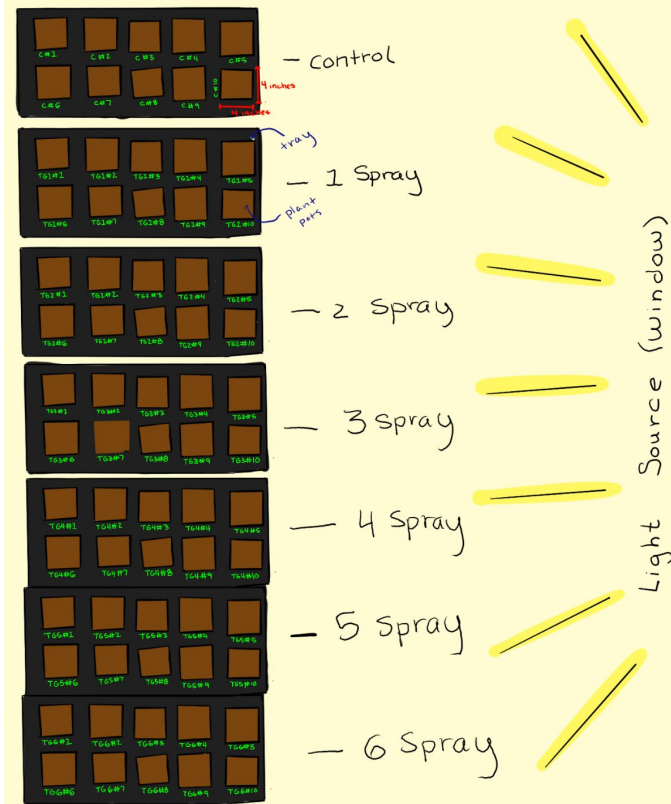
I have a garden at my house and we like to experiment with growing different fruit and vegetables - for example, tomatoes or peppers. However, we don't use pesticides on our crops, so sometimes we will find that all of our tomatoes or other crops were taken out by weeds and plant pests. Therefore, I want to see if using pesticide is a solution to this problem that won't harm our crop. This information could also be used by farmers and other people growing plants because it could give them information about whether using pesticide is a better alternative, or whether it is more harmful. Especially now, more than ever, with the growing global population, farmers are pushing to produce as much crop as they can leading them to use pesticides. I want to see if this would be beneficial or if it would cause more damage to the crop.

Hypothesis

I believe that if I change the amount of pesticide I spray on plants, it will affect their growth, and that the plants that were not sprayed with pesticide will grow and mature faster. Pesticide is a chemical with high toxins in it that could possibly mess up the DNA of the cell, or any other important organelles. In order for a plant to grow, it needs to undergo the process of mitosis. And in the process of mitosis, one of the first steps is the interphase. This is when the cell is doubling its DNA in the nucleus in order to make the chromosomes. If there were any complications that the pesticide caused to the cell's DNA, the plant would not be able to undergo mitosis. Therefore, the plant would not be able to grow, leading me to believe that the plant that was not sprayed with pesticide would grow taller and much faster.

Materials

- 70 4x4 pots with a depths of 3.5 inches
- 7 heavy duty plastic potting trays 10.94” W x 21.44 L x 2.44” D
- 70 pea seeds
- Round up
- Sharpie
- Pencil
- 3 sets of gloves
- 2 spray bottles (that spray 3 ml in one spray)
- Soil
- Tape
- Drop cloth or tarp
- Trash bag



Variables

variable	how it will be controlled	why it needs to be controlled
the amount of sunlight the plants receive	I will be keeping the plants in a room with controlled lighting and I will make sure that they receive equal amounts of sunlight at the same time of day and for the same amount of time	plants need sunlight in order to perform the process of photosynthesis, in which they are able to make food for themselves, which will help with their development and growth so the plants need to get equal sunlight so they have an equal opportunity to receive sunlight that they can use to make glucose
the soil that is used to pot the plants	I will control this by one bag of soil and using the same brand and bag with the name level of nutrients for all of my plants.	this needs to be controlled because different soils have minerals in them causing for different effects on the plant, for example phosphorus which is helpful in plant development and cell division, so making sure each plant has same soil is important
water intake	I will measure out a set amount of water and only water them on days when I have arranged for them to receive water and all the plants will receive water at the same time, and they will get the same amount, i will water them every other day and I will use the same spray bottle to spray 3 mls on each plant	water is a important element is photosynthesis of plants; it helps them make food, glucose, and helps them grow and develop so making sure each plant had the same amount of water will make sure they all have the same water intake
type of plant	I will only be test this on pea plants, and I will use the same seeds from the same packages to make sure they are all the same type of pea plant	different plant may grow or develop at different speeds, and some might not have the same reaction to the pesticide so making sure the plants are the same is important
amount of time the plants are left to grow	I will leave all the plants to grow for 8 days and then dig them up so they can't continue to develop	This is important to control because plants take time to grow and the longer the time the have the more they mature so making sure all of them are allowed to grow for the same amount of time is important
type of light the plant receives	I will grow all my plants near a window so they can all recieve natural sunlight and I will only be having them be exposed to that type of light	different lights can be easier for plants to collect and use to perform photosynthesis (for example red and blue light are easy for the chloroplasts of a plant to take in, meanwhile green lights are harder) so making sure all the plants are exposed to the same type of light is important.

Procedure

1. Gather all materials.
2. Take out 70 plant pot containers and separate them into groups of ten (this should leave you with 7 groups with ten containers in each group).
3. Label each group with a sharpie based on the group number, and the number they are in the group, TG1#1 (test group 1 spray #1), TG2#2, TG3#3, etc. until you have all the pots labeled.
4. Take out your plastic trays and label them on the side with tape; take out a piece of tape and place it on the side of the tray.
5. Label one of the trays "control group"
6. Label the next tray "test group 1 spray", the next "test group 2 spray", and after that "test group 3 spray." Continue until "test group 6 spray"
7. Next, take all containers outside and fill each with around 3 inches of soil (do not press soil down, lightly scoop it into each).
8. Place all your pots down on the ground with each group in a single row (it should end up being a 10x7 reangle of pots)
9. Next, take out your hose and set it to "shower."
10. Turn the hose on and sprinkle the water on the pots from about 4 feet away, move the hose swiftly and quickly over the pots not stay in the same spot for too long.
11. Your pots should have water draining from the holes at the bottom and should be very saturated with water, once you achieve this turn the hose off and let the pots drain for 1 minute.
12. Because of the watering, some of your pots have lost soil, or the soil has compressed down, so survey your pots and top you pots off with soil for any that need it so all your pot still have 3 inches of soil in them
13. Once you have topped off your pots, repeat step 10.
14. Repeat step 10-12 until all pots look uniform and have the same amount of soil.
15. After you have watered your pots leave them to sit for 30 minutes .
16. Once 30 minutes has passed, sort all your pots into their trays (all the control pots, labeled C#1, C#2, etc. Go in the control group tray, and all the pots labeled TG1 #, go in the tray labeled "test group one spray"
17. Once all of the pots have been sorted into their trays, take the control tray and set it aside.
18. With the 6 trays you are left with, spread them out so they are about one foot away from each other

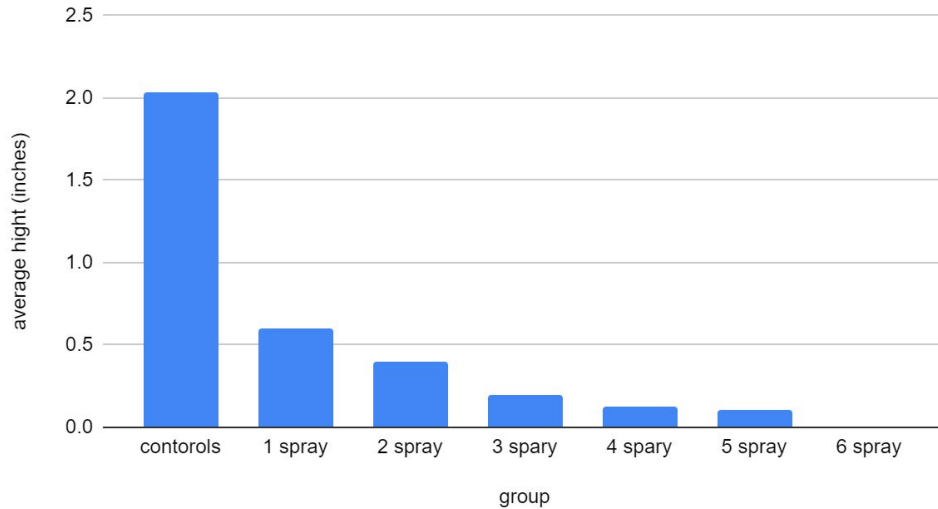


19. Next, put on gloves, (for safety reasons, this is important because you are going to be handling chemicals, and make sure you are outside for this part)
20. Transfer your “RoundUP” solution into your spray bottle, and shake rapidly for 5 seconds.
21. Then you can start to spray your pots, each of the pots in each tray will get the amount that you have written on the label (example: “test group 3 sprays” will receive 3 sprays of Roundup, about 9 mls. (each spray should be approx. 3 ml).
22. Once you have sprayed all of your pots with pesticide, leave them to sit outside for 30 minutes.
23. When 30 minutes have passed take all your trays (including your control) inside and place them near a window, in the same room, without direct sunlight on any of them, and set your thermostat to 60 degrees fahrenheit)
24. Leave the pots to sit for 24 hours. Remove gloves and throw away.
25. Once 24 hours have passed, come back with a pencil sharpie and pea seeds and measuring tape. Take the Sharpie and use the measuring tape to mark the pencil at 1 inch.
26. Put on your second pair of gloves.
27. Take the pencil and push it into the soil of your control until you meet the line in the middle of the pot, and wiggle it around so it is big and off to fit the seed.
28. Place the seed in the pothole.
29. Use one of your gloved fingers to push the soil over the hole so you can no longer see the seed, and then press firmly down with one of your gloved fingers so the seed makes contact with the soil.
30. Repeat step 29 for all the pots and move from the lowest concentration of pot to the highest.
31. Leave to sit near the window for 24 hours
32. Check back the next day and record any observations you have.
33. Repeat step 32 until day 4
34. At day 4, at the 24 hour mark, take a new clean spray bottle filled with water and spray all the pots with one full spray of water (around 3mls). Continue to record any observations.
35. Every other day thereafter, take the spray bottle filled with water and spray all the pots with one full spray of water (around 3mls)
36. When the 24 hour mark of day 8 has come, move all potted plants outside and lay out a drop cloth or tarp.
37. Put on a pair of gloves.
38. Starting with the control group, removing the seeds/plants from each of the pots by dumping out the soil one by one.
39. After you have removed the seed/plant, measure the plant from seed to the top of the stem (make sure you are not measuring the root, and your plant's stem is straight and not bent)
40. Repeat steps 38 and 39 for each group of plants and record the data into table.
41. Once you have measured all the plants properly, dispose of all the pots, soil, tarps and gloves into the trash bag.



Data

effect of pesticide on plant development



Plant Number	Height (inches)	Plant number	Height	Plant number	Height	Plant number	Height
C1	2	Tg1 1	1	Tg2 1	0.5	Tg3 1	0.2
C2	2.5	Tg1 2	0.6	Tg2 2	0.7	Tg3 2	0.2
C3	2	Tg1 3	0.5	Tg2 3	0.5	Tg3 3	0.3
C4	2	Tg1 4	0.4	Tg2 4	0.3	Tg3 4	0.1
C5	1.5	Tg1 5	0.5	Tg2 5	0.5	Tg3 5	0.5
C6	2	Tg1 6	0.3	Tg2 6	0.5	Tg3 6	0.5
C7	2	Tg1 7	0	Tg2 7	0.5	Tg3 7	0.5
C8	1.5	Tg1 8	0.6	Tg2 8	0.3	Tg3 8	0.1
C9	2.3	Tg1 9	1.5	Tg2 9	0.2	Tg3 9	0
C10	2.5	Tg1 10	1	Tg2 10	0.5	Tg3 10	0.3
average	2.03	average	0.6	average	0.4	average	0.2
Plant number	Height	Plant number	Height	Plant number	Height		
Tg5 1	0	Tg4 1	0.2	Tg6 1	0		
Tg5 2	0	Tg4 2	0.2	Tg6 2	0		
Tg5 3	0	Tg4 3	0.2	Tg6 3	0		
Tg5 4	0.1	Tg4 4	0.1	Tg6 4	0		
Tg5 5	0.2	Tg4 5	0.2	Tg6 5	0		
Tg5 6	0	Tg4 6	0.2	Tg6 6	0		
Tg5 7	0.2	Tg4 7	0	Tg6 7	0		
Tg5 8	0.2	Tg4 8	0.1	Tg6 8	0		
Tg5 9	0.2	Tg4 9	0.1	Tg6 9	0		
Tg5 10	0.2	Tg4 10	0	Tg6 10	0		
average	0.11	average	0.13	average	0		

Analysis

- This data shows that pesticide did affect the growth and development of pea plants.
- Even though the plants were left in the same conditions, for the same amount of time, none of the plants that were sprayed with pesticide grew as tall as the controls.
- RoundUp is labeled as a pesticide which affect the photosynthesis of plants causing them not to be able to create food to grow. However, this data shows that RoundUp affected more than that.
- When a seed first sprouts and sends its radical into the soil, it is relying on the cotyledons to produce energy for itself because it is underground and cannot access sunlight.
- The plants that were sprayed with pesticide had trouble growing even if they weren't relying on photosynthesis, so RoundUp also has some other effect on pea plants.
- It is possible that when RoundUp was exposed to plant tissue, it made its way, through the process of diffusion (passive or active), into the cell, and from there it impeded on the plants ability to mitotically divide causing the plant the be stunted in growth. It is also possible that it affected the plants access to nutrients causing the plants growth to be stunted. This information could be used to better understand the effects of RoundUp on the environment. For example, if you were to spray a weed or plant that you wanted to kill in your garden, and the RoundUp made contact with the soil and contaminated it, it may later impact your ability to plant something else if RoundUp remained in the soil.

Future work

If I were to conduct this experiment again I would change my method of measuring my plants. In this experiment, when it came time to measure all the plants, I decide to measure the stem of the plants and not the radical. I think if I were to do this again I would measure the radical because sprouting a root is one of the first steps in the plant cycle. I observed that the higher the concentration of pesticide, the smaller the radical appear to be. Therefore, next time, I would also take into account the radical in my measurements.