

SEED DEPTH LAB

Determining the Best Sowing Depth

If a seed is not planted deeply enough the roots may be too close to the soil surface. This might cause the seedling to fall over. Seeds not sown deep enough may dry out and are more likely to be eaten by birds. A seed may not have enough energy to push through the soil and reach the light if it is sown too deeply.

What is the best sowing depth for a seed?

In this lab, you will determine the best depth for seed sowing. You will seek to discover if this best sowing depth is related to the size or the type of the seed.

Purpose: To determine the best sowing depth for different types of seeds.

Materials

- Seeds of various sizes, such as bean, corn, radish, basil.
- Razor blades and a scissor
- 3 Clear, 2-liter plastic soda bottles with labels removed
- Pre moistened Potting soil
- A ruler with cm markings
- Aluminum Foil
- Grease pencils in white or yellow
- Probes for punching drainage holes
- Bunsen Burner

Prediction Questions (to be completed at the time you build your columns)

1. For each column make a specific prediction about the depth where seeds will display the best results.
2. What are the external factors that may influence seed growth in this experiment? How can we control for those factors?
3. What are the intrinsic factors of seeds that may influence growth in this experiment? How can we control for those factors?

Pre-lab Questions (you will probably need to do some research to find some of these answers)

1. What is the recommended depth of sowing for each seed species?
2. What are the sources of energy for a newly germinated seed?
3. Why should you record the day of emergence for each seed?
4. What influence will sunlight have on your results

Post lab questions

1. What environmental factors do you believe influenced your results?
2. How did your results match up with your predictions?
3. What steps could you take or change this lab procedure to get better results?

Procedure

New Bottle Set Up

1. Delabel all of your clear 2 liter plastic soda bottles (scrape them under running water)
2. Take one of your bottles and measuring from the line just above where the bottle begins to curve towards the feet measure 16 cm toward the cap end. Make several marks. (the marks should be just before the bottle starts to curve towards the cap.
3. Cut off the bottom “feet” and cap dome by following the lines. Your goal is to wind up with a plastic cylinder.
4. Take your other two bottles that still have feet and using a heated probe poke several holes in the feet for drainage (See me when you are ready)
5. Measure up 20 cm from the bottom of both bottles and mark with a grease pencil in several places around the bottle. Connect the marks to make a line around the bottle.
6. Use a scissor or razorblade to cut off the tops of the bottles on the lines.
7. Label one Bottle A, Label the other Bottle B
8. Using a ruler mark both sides of the bottle into four sections 5 cm each

Old Bottle Set Up

1. Ahhh Ha!!! So you decided not to bring in your own soda bottles.... Very well then now you must pick two of the old grungy bottles and using **dry paper towels** first clean out all of the old dirt and spider webs into a garbage can. **DO NOT DUMP TRASH IN THE DIRT BIN.**
2. Only after all of the soil is removed can you use water to clean off the old marks.
3. What is that? Marks won't come off with water? You could try to use the friction of your own skin to rub off the ink that may remain
4. When both bottles are clean move on to Bottle A set up.
(Some ink marks may not come off.... I guess you'll need to figure out a way to ignore them.)

Bottle A set up

1. Starting with a footed bottle measure from the bottom heading towards the top in 4 cm increments up to the 20 cm mark.
2. On your cylinder continue marking in 4 cm increments from top to bottom
3. after you have marked your cylinder measure 2 cm up from the bottom edge make a series of six evenly spaced cuts up to the 2 cm mark.

Bottle B set up

1. Starting from the bottom measure up 10 cm and make a mark. Then begin marking 4 cm increments up to the 20 cm mark

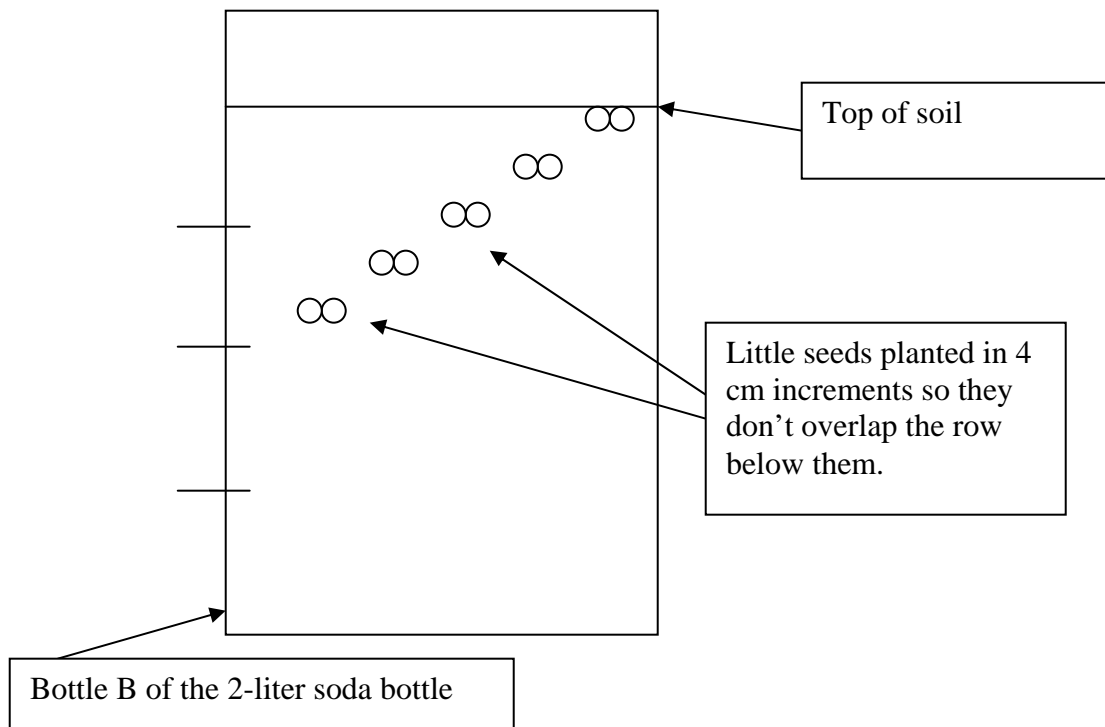
Bottle Filling Procedure

Bottle A

1. Using large seeds that have been soaked overnight to speed germination. (Beans or Peas).
2. Fill the soda bottle to the 4 cm line with moist potting soil.
3. Place two seeds next to each other on top of the potting soil and pressed against the clear wall of the soda bottle. Orient both seeds in the same direction. For example, place corn seeds with the pointed end down, and place bean seeds with the hilum facing up.
4. Press both seeds gently into the potting soil until the top of the seed is level with the soil surface.
5. Using the grease pencil circle the seeds
6. Add a 4-cm layer of potting soil, and firm gently by tapping the soda bottle on the tabletop.
7. Do not sow seeds directly above one other. The seeds should form a stair step pattern (see Figure). Repeat steps 3 to 6 until the soil surface is 4 cm from the top.
8. Now take your cylinder and alternate the tabs (the 2 cm cuts) over the top edge of the dirt filled bottle until the 2 cylinders are lined up. Use clear tape to make sure they are connected.
9. Now repeat steps 3 to 6 until the top of the last two seeds is even with the soil surface.
10. Measure the depth of each pair of seeds from the soil surface to the top of the seed. Sowing depths should be about 0, 4, 8, 12, 16, 20 cm.

Bottle B

1. Fill the bottle to the 4-cm line with moist potting soil place two seeds next to each other on top of the potting soil
2. Press them against the wall of the soda bottle. Orient both seeds in the same direction. Basil seeds have no direction.
3. Press both seeds gently into the potting soil until the top of the seed is level with the soil surface.
4. Add a 4 cm layer of potting soil, and firm gently by tapping the soda bottle on the tabletop.
5. Repeat steps 3 to 5 until the soil surface reaches the top.
6. The top of the last two seeds should be even with the soil surface.
7. Measure the depth of each pair of seeds from the soil surface to the top of the seed. Sowing depths should range from 0 cm to 12 cm.



For all Seeds

1. After sowing, cover the sides of the soda bottles with foil to exclude light.
2. On measuring days remove the foil and measure the length of each seedling's root and shoot.
3. Note how many days after planting it takes each seedling to break through the soil surface.
This is the day of emergence it is important that you keep track of this date.
4. You will need to make a data chart that can keep track of all of your data by date, bottle and depth. Your best choice is to do this in Google docs. <http://docs.google.com>
5. Graph the day of emergence by depth of sowing over time
6. Graph the seedling shoot length against the depth of sowing for each bottle

SEED DEPTH LAB REPORT

Required Graphs

- A graph of the day of emergence for each side by depth of sowing over time.
- A graph of shoot length by depth of sowing over time for each side.
- A graph of root length by depth of sowing over time for each side.
- A line graph comparing root and shoot length of the optimal seed depth from Bottle A and Bottle B

Be sure you address the following in your lab report:

- Experimental error (human or otherwise)
- Your conclusion for the best depth of sowing for small seeds and large seeds.
- A drawing of the lab apparatus used in this experiment

Lab Reports should follow the following format.

1. **Introduction:** Include a statement of the problem investigated, why the work was carried out, background of the problem including an explanation of how the problem relates to you and the world, a brief statement of the general method of approach to the problem, and expected results.

2. **Methods and materials:** This section tells the reader how and with what “stuff” the work was done. You should try to strike a balance between an over-detailed description of even the most trivial items and a very sketchy statement that provides insufficient information. The important guideline is that another worker of similar training and ability, following your description, should get the same results. This section should be written as a description of what you did, not as a set of instructions.

3. **Results:** Here is the real meat of a report. In this section you should **describe** the important qualitative and quantitative observations in your work. You are **not** yet drawing conclusions from your data. Data should be tabulated and/or graphed and described. One of the common errors in report-writing is to say, “The data are plotted in Fig. 1” without saying something like, “As can be seen in the graph, the rate of germination over 5 days was slow for the first three days after which a sharp rise is noted.” Be aware that tables and graphs are not self-explanatory, and must be summarized for the reader.

All graphs and tables should be numbered and provided with a title. Additional information which makes the data more comprehensible should be provided as needed.

4. **Discussion and conclusions:** This section serves two functions. First, it provides a place where the data may be fully discussed and interpreted, and second, it allows the author to delve into the realms of speculation. Here one may address questions like “why did something unexpected happen?” or “what would happen if the seeds were germinated in a higher pH solution?” or “why did the expected results not materialize?” In this section the author may (discretely) pat him- or her-self on the back, criticize other workers results, suggest improvements in methodology, etc.

5. **References:** Some papers have no references, others have 200 or more.

BOTANY SEED DEPTH LAB REPORT RUBRIC

Student Names:		Due Date:		
This analytic rubric is used to verify specific tasks performed when producing a lab report. If the task has been completed, all points are awarded. If the task is incomplete half points may be awarded. No points are awarded if the task is not complete.				
Category	Scoring Criteria	Points	Student Evaluation	Teacher Evaluation
Lab Introduction <i>15 points</i>	The question to be answered during the lab is stated.	5		
	The hypothesis is supported by facts.	5		
	A connection is made between the lab and the "real world" (how might data from this lab improve life?)	5		
Methods <i>10 points</i>	Procedures are written in paragraph form and describe what was actually done (not a list of numbered steps)	5		
	There are no "understood" procedures. (Such as: <i>water plants daily</i>)	5		
Results <i>20 points</i>	The data was stored on Google Docs (You don't get any credit for typing it all in the night before)	5		
	Your final data table is included	5		
	Measurements show proper units.	5		
	Each graph is summarized/described in words (as seen in the graph of <i>Bottle A</i> , seedlings died at...)	5		
Discussion <i>30 points</i>	Show how the essential data answers the lab questions (answered as part of the discussion not as numbered questions)	10		
	What factors contributed to picking the best seed depth for each bottle. (think about the environmental variables)	10		
	Come to a final conclusion on seed depth and size	5		
	Identify the one area of the lab most likely responsible for measurable experimental error. (Think carefully.)	5		
Presentation <i>15 points</i>	Report is printed in black ink on white paper using 12 point Times New Roman or Arial font double spaced with one inch margins on all sides with no visible corrections (Warning: this is not Word's default setting).	5		
	A diagram of the essential apparatus used in the experiment is drawn in the largest available white space on the front of the lab report.	5		
	Report is written in such a way that others could accurately duplicate the experiment.	5		
Lab Participation <i>10 points</i>	You were not cited for safety or participation violations.	10		
Section Score	Part 1 Points	100		

BOTANY SEED DEPTH REQUIRED DIAGRAMS, TABLES AND GRAPHS RUBRIC

Student Names:

Due Date:

This analytic rubric is used to verify specific tasks performed when producing a lab report. If the task has been completed, all points are awarded. If the task is incomplete half points may be awarded. No points are awarded if the task is not complete.

Category	Scoring Criteria	Points	Student Evaluation	Teacher Evaluation
Graphs 25 points	line graph of shoot length by depth of sowing over time for Bottle A (large seeds)	3		
	Bottle A Shoots graph is correctly labeled and has a key	2		
	line graph of root length by depth of sowing over time for Bottle A (large seeds)	3		
	Bottle A Roots graph is correctly labeled and has a key	2		
	a line graph of shoot length by depth of sowing over time for Bottle B (small seeds)	3		
	Bottle B shoots graph is correctly labeled and has a key	2		
	a line graph of root length by depth of sowing over time for Bottle B (small seeds)	3		
	Bottle B roots graph is correctly labeled and has a key	2		
	Line graph of best Shoot from Bottle A and B	3		
	graph is correctly labeled and has a key	2		
Section Score	Part Two Total Points	25		
Section Score	Part One Total Points	100		
	TOTAL POINTS	125		
Deadline	Reports will be accepted after the beginning of class for 3/4 credit. Papers turned after 2:17 on the due date will be mulched for use in the greenhouse and receive ¼ credit.			