How is germination rate calculated?

Mr. González

Do Now (5 min.)

- List the major topics you have included in your germination lab report.

How is germination rate calculated?

Do Now (5 min.)

- Major topics included in your germination lab report:
  - Anatomy of a seed,
  - Germination process,
  - Hydroponics,
  - Basil plant,
  - ???

How is germination rate calculated?

HW

- Continue your germination lab report.
- Submit the following chapters of your lab report next class:
  - Title page,
  - Problem,
  - Introduction/Background Information
  - Hypothesis
  - Safety,
  - Materials,
  - Procedures, and
  - Bibliography.

How is germination rate calculated?

Objectives

- I can calculate the real germination rate.
- I can describe what “error” is.
- I can calculate a 5% margin of error for the hypothesis.

Procedures to Monitor the Germination Process

- Once you add the seeds to the sponges and the sponges to the trays…
- Keep sponges moist on a daily basis.
- Once most (>70%) of your seedlings have germinated you should take the black plastic bag off and make sure the plantlings get good light.
- Feed your plants nutrients.
- Once they're about 4 inches tall they're ready for your AEMs.

How is germination rate calculated?

5) Place your sponges in the grid leaving an empty space in between each sponge.

How is germination rate calculated?

Germination Rate Calculation

- Create the following table in your journals.

Day	Sprouts	Seed Total	Hyp. Rate %	5% error	Real Rate %	Support Y / N
6						
7						
8						
9						
10						

How is germination rate calculated?

Germination Rate Calculation

- Calculate the germination rate after 6, 7, 8, 9, and 10 days.
- The germination rate can be calculated by?
- Hint:
  - How many sprouts do you see?
  - How many total seeds were placed in the tray?

Germination Rate Calculation

- What mathematical expression can you use to calculate the rate?
  - Sprouts you see / total seeds in tray

Germination Rate Calculation

- What mathematical expression can you use to calculate the rate?

Sprouts you see

---

total seeds in tray

How is germination rate calculated?

Define Possible Outcomes

- Define a sprouting Outcome.
- Possible outcomes need to be defined at the start of an experiment.
- These outcomes will form the basis of your observations and events.
- For the purposes of this project, we should define sprouting as the moment one hypocotyl is observable from the sponge.

Possible Outcomes

- How many possible outcomes are there?

Germination Rate Calculation

- How often will you calculate the rate?

Day	Sprouts	Seed Total	Hyp. Rate %	5% error	Real Rate %	Support Y / N
6						
7						
8						
9						
10						

How is germination rate calculated?

Germination Rate Calculation

- Take out your hypothesis tables and predict the rates if you haven't already.
- Rewrite them on this new table.

Day	Sprouts	Seed Total	Hyp. Rate %	5% error	Real Rate %	Support Y / N
6						
7						
8						
9						
10						

How is germination rate calculated?

What is a Margin of Error?

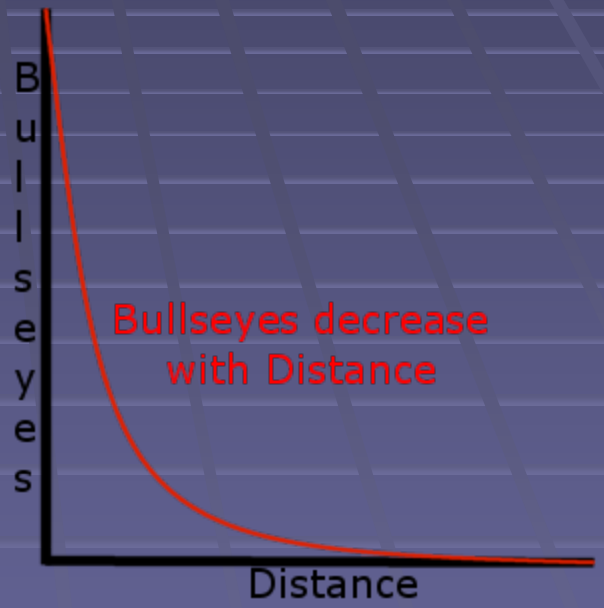
- Variation exists in nature.
- Nothing is ever predicted perfectly.
- No two events are ever perfectly the same.
- We can allow ourselves a “margin of error.”

What is a Margin of Error?

- Can you give examples of when you've used a margin of error or when you could use a margin of error?
- How much error do you think is reasonable after which it becomes ridiculous?

Bullseye

http://image.shutterstock.com/display_pic_with_logo/72655/72655,1231297063,2/stock-photo-shot-up-target-with-bulls-eye-22884709.jpg



http://technologymarketers.com/StatingTheObvious/files/2011/12/bullseyes-over-distance.png

How is germination rate calculated?

What is a Margin of Error?

- Typically, statisticians allow a maximum error of 5%.
- In other words, if you’re data or prediction is 95% close to the truth or better, it is considered “good.”
- Obviously, the higher the better = 99%.
- To get there, you need a lot of data, observations, and very strict **procedures**.

Calculating Error Margin

- Calculate the 5% error by multiplying your hypothetical rate by .05 and then +/- from the hypothetical rate.

Day	Sprouts	Seed Total	Hyp. Rate %	5% error	Real Rate %	Support Y / N
6			10			
7			25			
8			50			
9			75			
10			90			

How is germination rate calculated?

Germination Rate Calculation

- To calculate 5% of 10% you convert 5% to a decimal:

  = 0.05
- You then multiply 0.05 by 10 and you get:

  = 0.5%
- Subtract and add 0.5% to 10% and you get an interval that gives you a little more room to get your hypothesis right:

  = 9.5% - 10.5%
- Put this in the 5% “error margin” column next to your hypothesis of 10.

Germination Rate Calculation

- Calculate the 5% error interval for the example below.

Day	Sprouts	Seed Total	Hyp. Rate %	5% error	Real Rate %	Support Y / N
6		117	10	9.5-10.5		
7		117	25			
8		117	50			
9		117	75			
10		117	90			

How is germination rate calculated?

Germination Rate Calculation

- Error intervals.
- Notice how the lower value is written to the left of the hyphen. Why?

Day	Sprouts	Seed Total	Hyp. Rate %	5% error	Real Rate %	Support Y / N
6		117	10	9.5-10.5		
7		117	25	23.75-26.25		
8		117	50	47.5-52.5		
9		117	75	71.25-78.75		
10		117	90	85.5-94.5		

How is germination rate calculated?

Day 6 Scenario

- Calculate the real germination rate if 26 seeds germinated in the example below.

Day	Sprouts	Seed Total	Hyp. Rate %	5% error	Real Rate %	Support Y / N
6	26	117	10	9.5-10.5		
7	39	117	25	23.75-26.25		
8	47	117	50	47.5-52.5		
9	78	117	75	71.25-78.75		
10	94	117	90	85.5-94.5		

How is germination rate calculated?

Day 6 Scenario

- In this case, was the hypothesis supported by the data?

Day	Sprouts	Seed Total	Hyp. Rate %	5% error	Real Rate %	Support Y / N
6	26	117	10	9.5-10.5	22.2	
7	39	117	25	23.75-26.25	33.3	
8	59	117	50	47.5-52.5	50.4	
9	89	117	75	71.25-78.75	76.1	
10	94	117	90	85.5-94.5	80.3	

How is germination rate calculated?

Germination Rate Calculation

- In this case, was the hypothesis supported by the data?

Day	Sprouts	Seed Total	Hyp. Rate %	5% error	Real Rate %	Support Y / N
6	26	117	10	9.5-10.5	22.2	N
7	39	117	25	23.75-26.25	33.3	N
8	59	117	50	47.5-52.5	50.4	Y
9	89	117	75	71.25-78.75	76.1	Y
10	94	117	90	85.5-94.5	80.3	N

How is germination rate calculated?

Next Activity

- What should go in the background information of the germination lab report?

- You will now go over each others' lab report drafts and grade them up to now.
- Grade them based on your knowledge of what needs to be in a lab report.

How is germination rate calculated?

Materials

- Air conditioner (weather) sealer sponge 1 ¼ inches x 1 ¼ inches x 42 inches.
- Scissors
- Permanent Markers
- Ruler
- Grids
- Germinating trays
- Waterproofing plastic (optional)
- Seeds
- Paper for seeds
- Water
- Watering can or bottle
- Black plastic garbage bag to cover seeds.
- Tray cover
- Nutrients
- E.C. Meter (Hanna Combo Sensor)
- pH meter
- RO/DI water
- Spray bottle
- Calibrating solutions
- pH storage solution
- pH down and up solution

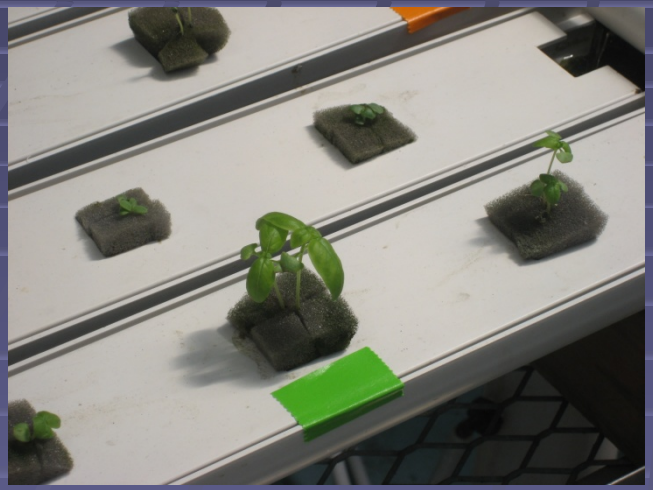
How is germination rate calculated?

Procedures

- Place the tray in the desired location. Fill up the tray about half way with water.
- Place grid in water and spray the sponges until they are soaked.
- Cover your sponges with the black plastic sheet.
- Place the tray cover over your seedlings to retain moisture.
- After the seeds have germinated prepare a light nutrient solution about 900 $\mu S/cm^3$.
- Monitor growth every day. Spray sponges daily if necessary.
- Once your seedlings are about 3-5 inches long and have strong roots you may transfer them to you grow bed.

How is germination rate calculated?

Products of Hydroponically Germinated Seeds.



How is germination rate calculated?

HW

- Continue your germination lab report.
- Submit the following chapters of your lab report next class:
  - Title page,
  - Problem,
  - Introduction/Background Information
  - Hypothesis
  - Safety,
  - Materials,
  - Procedures, and
  - Bibliography.

How is germination rate calculated?