



CHARLOTTE  
COUNTRY DAY  
SCHOOL

# The Fruits of their Labor: The Power of Growing Food Crops in Science Labs

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Charlotte Country Day School

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## Lab Background

- **Grade 8 Environmental Science course**
- **Currently drives scientific method, measurement, lab design, and data table/graphing skills, but has other possibilities**
- **Challenges students to feed our growing population by:**
  - **1. Increasing growth Rate**
  - **2. Improving total yield**



## Learning Outcome Goals

- Scientific Process
- Experimental design
- Controlling variables
- Data table and graph design
  - Slope/Rate of best fit line
- Simple/Concise procedures
- Commitment to long-term research/study
  - Test, Fail, Redesign, Retest
- *Growing food!*





## Learning Outcome Goals

- **Creating relevant, meaningful, indelible experiences**
  - meaningful student engagement
  - persistent inquiry
  - thoughtful deliberation
- **Student-selected variables and unique lines of inquiry create optimal ambiguity and natural student differentiation.**
- **UbD Performance Task demonstrating Transfer**
- **Standard Consideration**
  - **NGSS MS-ETS1-4 Engineering Design**

## Timeline

Lessons / Activities / Worktime	Duration (45-minute periods)
Introduction, Background, & Practice Planting	1 day
Primary Planning Brainstorm	1 day
<i>Scientific Method Review</i>	1-2 days
<i>Excel Data Table &amp; Graphing Pretest, Lesson, Practice, Practical</i>	4 days
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<i>Graphing Design activity</i>	1 day
Secondary Planning Brainstorm w/ Data Table/Graph Design	2 days
Lab Setup & Seed Planting	1 day
Checkpoint 1 (at roughly 14 days from latest planting)	1 day
Checkpoint 2 ( at roughly 28 days from first planting)	1 day
Harvest	3-6 months

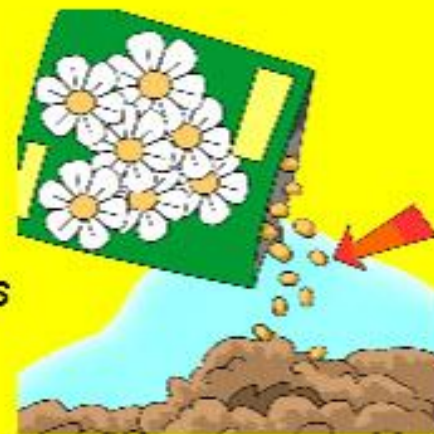


# Planting Seeds and Growing Tips

**Planting Instructions:** while seeds contain initial nutrition to get them started (cotyledons), they must grow quickly and develop leaves to begin photosynthesizing and produce their own chemical energy

### Required:

- growing medium
- water
- sunlight
- *Read the seed packet for specifics*



### Example:

*Asclepias syriaca (Common Milkweed)*

1. *Keep seed packet in a cool dry location before planting (cold treatment)*
2. *Scatter seeds 1/3 inch deep in warm (70F), thoroughly-soaked soil in full sun.*
3. *Germination in 7-10 days*
4. *Keep soil moist in seedling stage*

**Let's practice!**

# Introduction





## Timeline considerations

- Consider mid-September planting.
- Trays safely allow for 1-week holiday breaks.
- Final harvest cutoff is in mid-March or prior to Spring Break.
- Expect to doubling days to harvest in less than ideal growth locations.
- Greenhouse space, if present, can complement this timeline



# Lab Introduction Worksheets

1. Increasing growth rate
2. Improving total yield

Date: \_\_\_\_\_ (due 9/20/17:ish)      Section: \_\_\_\_\_      Name: \_\_\_\_\_

**Crop Laboratory  
Worksheet 1**

Ideas for How to Maximize Crop Growth Rate & Yield:

Crop Plant Chosen:

Chosen Growth Plan: *What will maximize the yield of your crop?*

Drawing of experiment set up:

Hypothesis:

Materials List:

8SciUnit2Sem1

Independent Variable \_\_\_\_\_      Date \_\_\_\_\_ (due 9/28/17)      Section: \_\_\_\_\_      Name: \_\_\_\_\_

Crop: \_\_\_\_\_      Group Members: \_\_\_\_\_

Teacher Approval: \_\_\_\_\_

**Crop Laboratory  
Worksheet 2**

Question: *What factors will maximize crop yield?*

Hypothesis:      If: \_\_\_\_\_  
                                 Then: \_\_\_\_\_

Variables:

Independent Variable - \_\_\_\_\_

Dependent Variable - \_\_\_\_\_

Drawing of experiment set up:  
(Label control and experimental groups if applicable)

Materials:  
Due Dates:  
Person(s) responsible:

8SciUnit2Sem1



## Supplies

- Potting soil can be reused.
- Gratnell F1 trays ([http://www.gratnellsusa.com/index.php?page=F1\\_trays](http://www.gratnellsusa.com/index.php?page=F1_trays))
- Misco Flare 7-inch self-watering pots or more cost-effective **planting pots**
- **Seeds:** Radish, Carrot, Beet, soybean, Okra, pepper, strawberry, (*plan ahead or use Amazon*)
- Hallway windows, classroom windows, stairway windows with South-facing **exposure**
- Greenhouse?



## Examples of Student Independent Variables

- Color of Light
- Type of Light (LED)
- Type of fertilizer
- Volume of fertilizer - *smells*
- Organic vs. non-organic soils
- Plant hormones
- Over the counter drugs
- Presence of earthworms
- Delivery method of water
- Hydroponic vs soil medium
- Nutritional supplements
- Minerals (Iron, Copper...)
- Energy drinks - *smells*
- Type of water purification
- Temperature of water
- Type of water (bottled, aquarium, etc.)
- Temperature of soil
- Temperature of air

# Setup



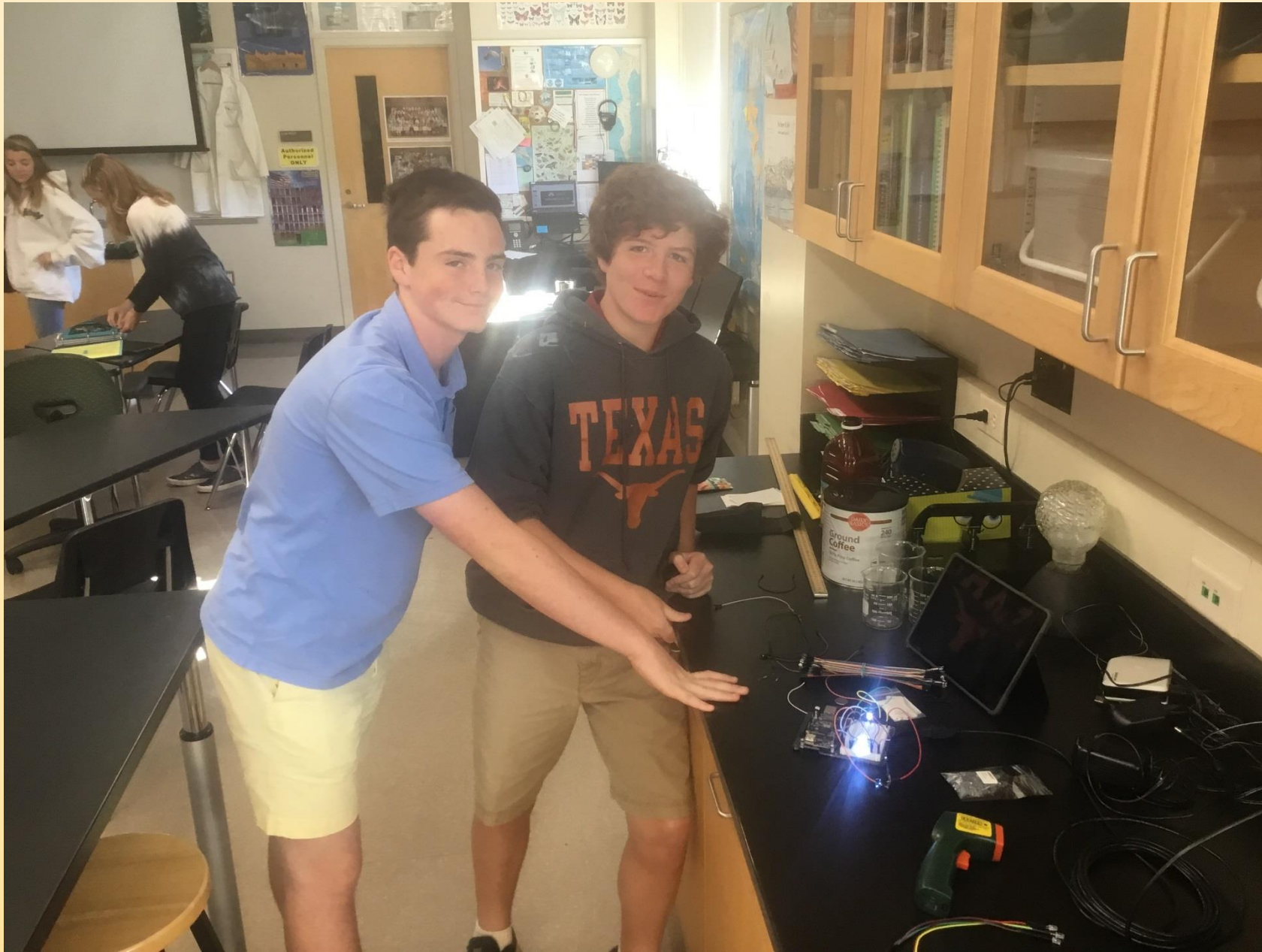
# Setup



# Setup



# Setup



# Setup





## Early Data Collection



# Checkpoint 1

Section: \_\_\_\_ Crop: \_\_\_\_\_ Date: \_\_\_\_\_  
- 1 point

Group Member Names:

Grade: \_\_\_\_\_ / 15 points

## Crop Lab Check Point #1 Questions

1. Identify the following variables and groups in your experiment: - 4 points

Independent Variable = \_\_\_\_\_

Dependent Variable = \_\_\_\_\_

Control Group = \_\_\_\_\_

Experimental Group (s) = \_\_\_\_\_

2. State the hypothesis for your experiment. -1 point

3. Name all the controlled variables in your experiment. Identify a minimum of three controlled variables. -3 points

4. Why is it important to have controlled variables? - 1 point

5. Identify some errors, human or experimental, that are present in your experiment. - 2 points

6. If there are errors in your lab, what is your group going to do to fix those errors? Be specific. -1 point

7. Are there any changes needed in the structure of your data table? If so, make those changes now and update your Excel data tables and graph. The Excel app file (Ex: 8Sci5CropLabGroup3) must be updated through October 18<sup>th</sup> and shared with your teacher through the app. - 3 points

## Long-term Data Collection



## Long-term Data Collection



# Long-term Data Collection



# Checkpoint 2

Section: \_\_\_\_\_ Crop: \_\_\_\_\_ Date: \_\_\_\_\_ Name \_\_\_\_\_

Group Member Names:

Grade: \_\_\_\_\_ / 15 points

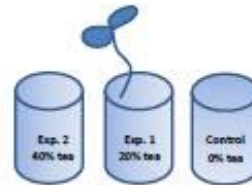
## Crop Lab Check Point #2 Questions

- Identify the following variables and groups in your experiment: - 2 points  
 Independent Variable = \_\_\_\_\_  
 Dependent Variable = \_\_\_\_\_  
 Control Group = \_\_\_\_\_  
 Experimental Group (s) = \_\_\_\_\_
- Identify some errors, human or experimental, that are present in your experiment and you believe are *confounding* the relationship between your independent and dependent variables. - 2 points
- If there are errors in your lab, what is your group going to do to fix those errors? Be specific. - 1 point
- Based on your current crop lab data, do you need to replant and start over? Why? - 2 points
- Are there any changes needed in the structure of your data table? If so, make those changes now and update your Excel data tables and graph. The Excel app file (Ex: *BSci5CropLabGroup3*) must be updated through **November XX** and shared with your teacher through the app.

## Analyzing Crop Lab Data

- Assume the hypothesis below and draw preliminary conclusions from each set of data. Is the hypothesis being supported or not supported? Is the lab in error and need to be restarted? Why

If the percent of compost tea in the watering mix increases, then the radish plants will grow taller.



#1 preliminary explanation: - 1 point  
(Supported, Not Supported) (Restart or Continue)

Why?



#2 preliminary explanation: - 1 point  
(Supported, Not Supported) (Restart or Continue)

Why?



#3 preliminary explanation: - 1 point  
(Supported, Not Supported) (Restart or Continue)

Why?



#4 preliminary explanation: - 1 point  
(Supported, Not Supported) (Restart or Continue)

Why?



#5 preliminary explanation: - 1 point  
(Supported, Not Supported) (Restart or Continue)

Why?

	Avg. Height of 40 % tea (cm)	Avg. Height of 20 % tea (cm)	Avg. Height of Control (cm)
Week 1	0	0	0
Week 2	4	2	2
Week 3	7	3	3
Week 4	9	4	4

#6 preliminary explanation: - 1 point  
(Supported, Not Supported) (Restart or Continue)

Why?

## Long-term Data Collection



## Long-term Data Collection

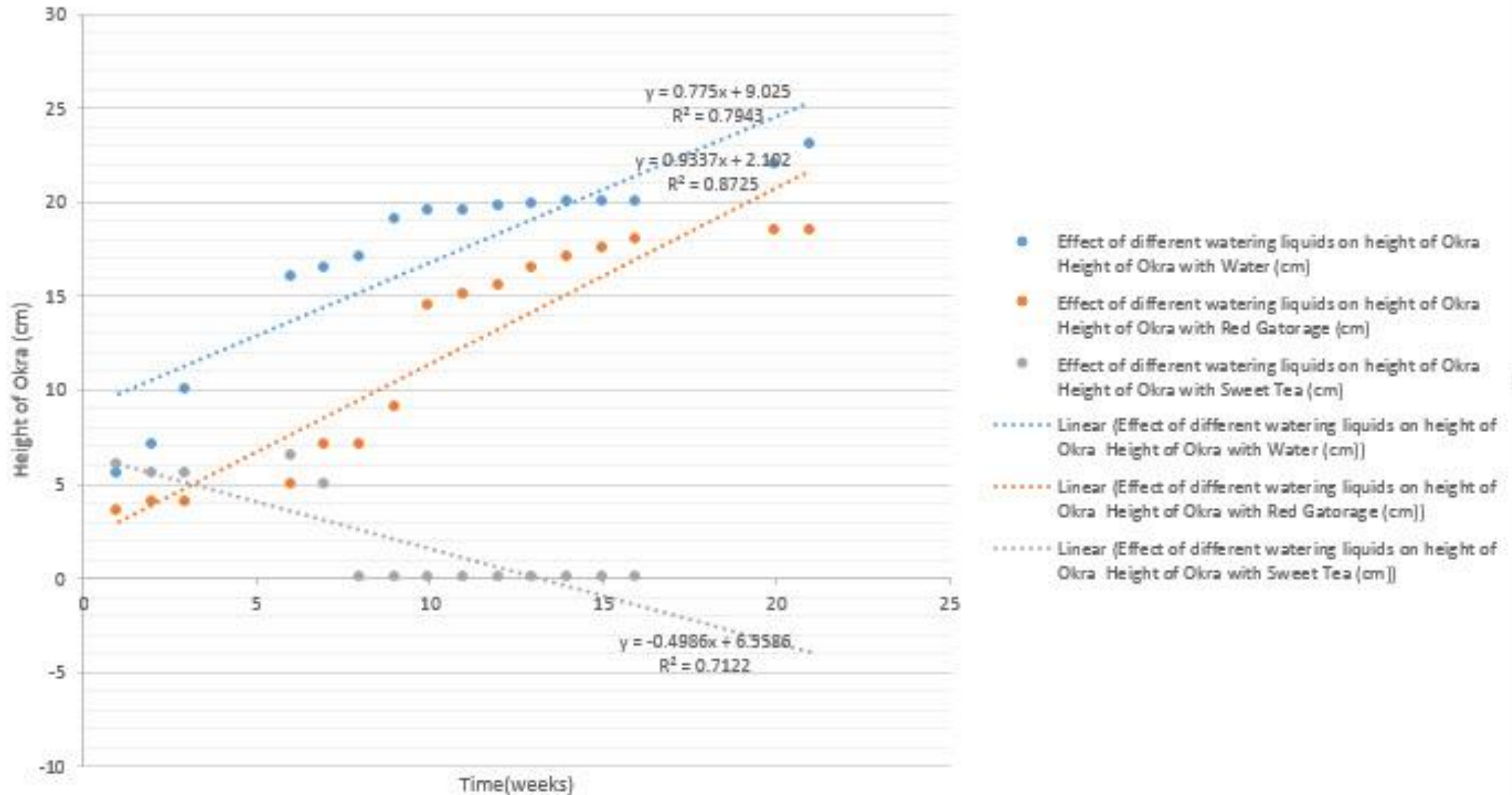




# Results



## Height of Okra with Different Liquids



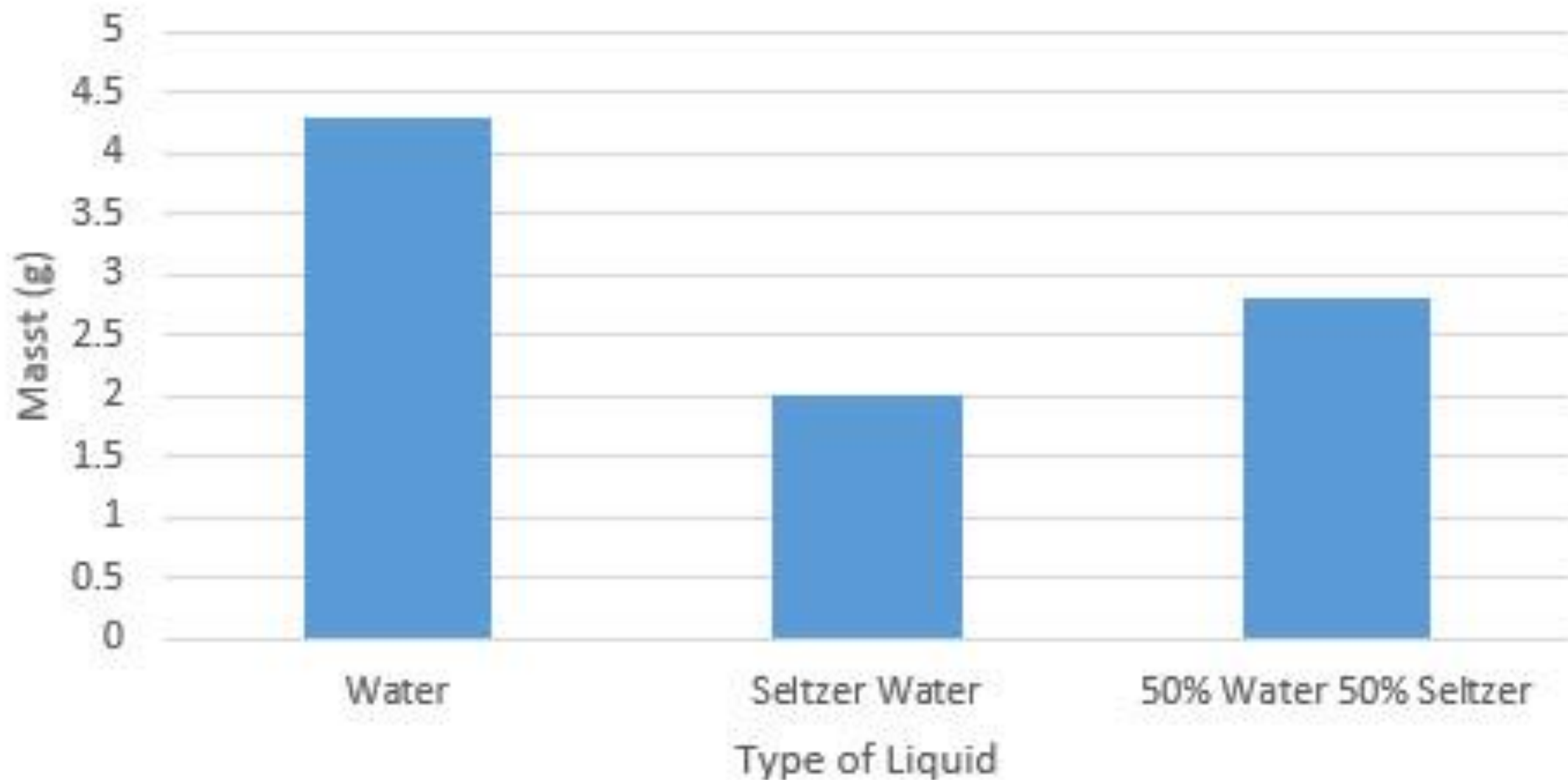
## Eating Results



# Results



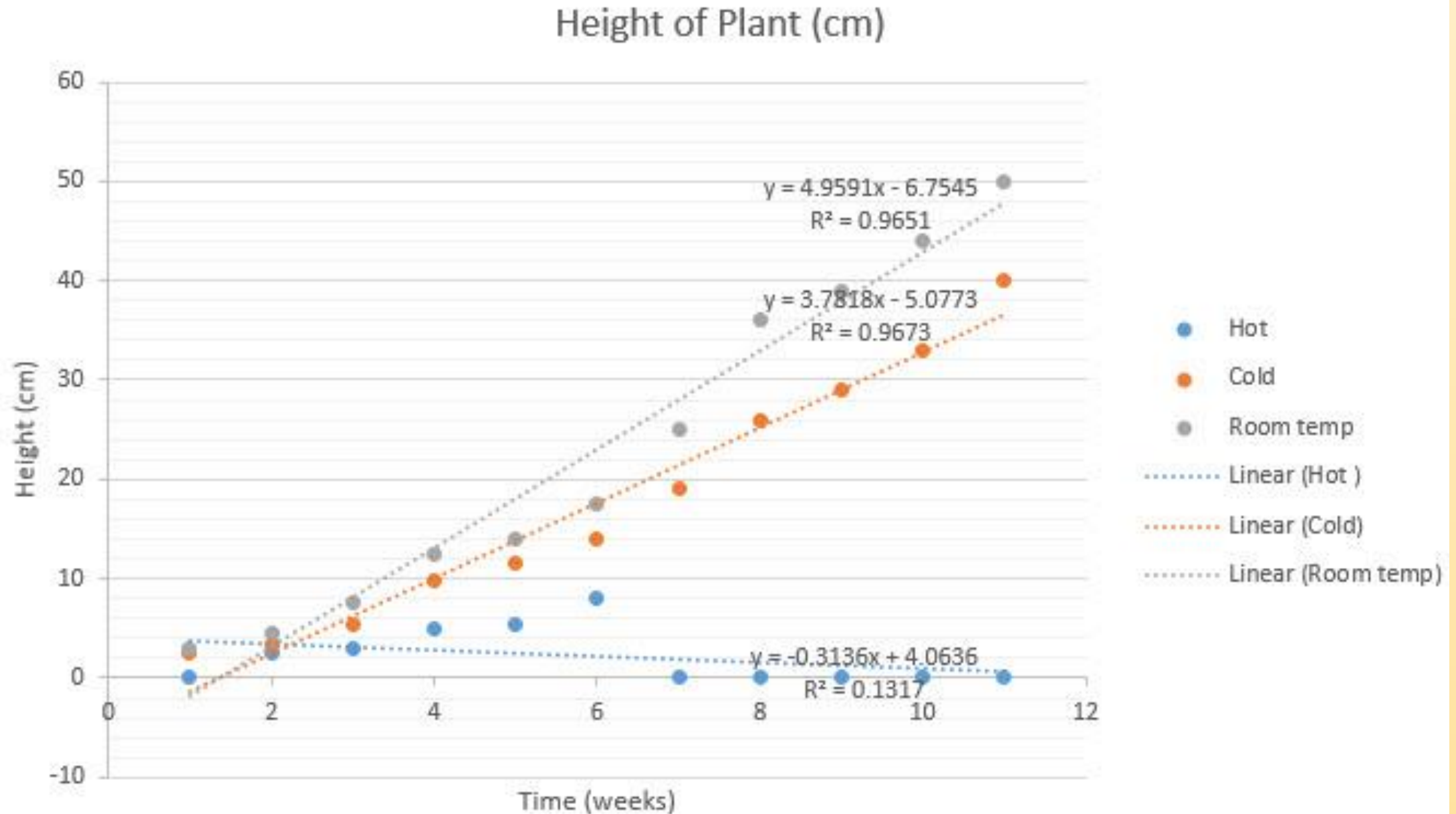
### The Effect of Type of Liquid on Weight (g)



# Results



# Final Student Data Excel Files

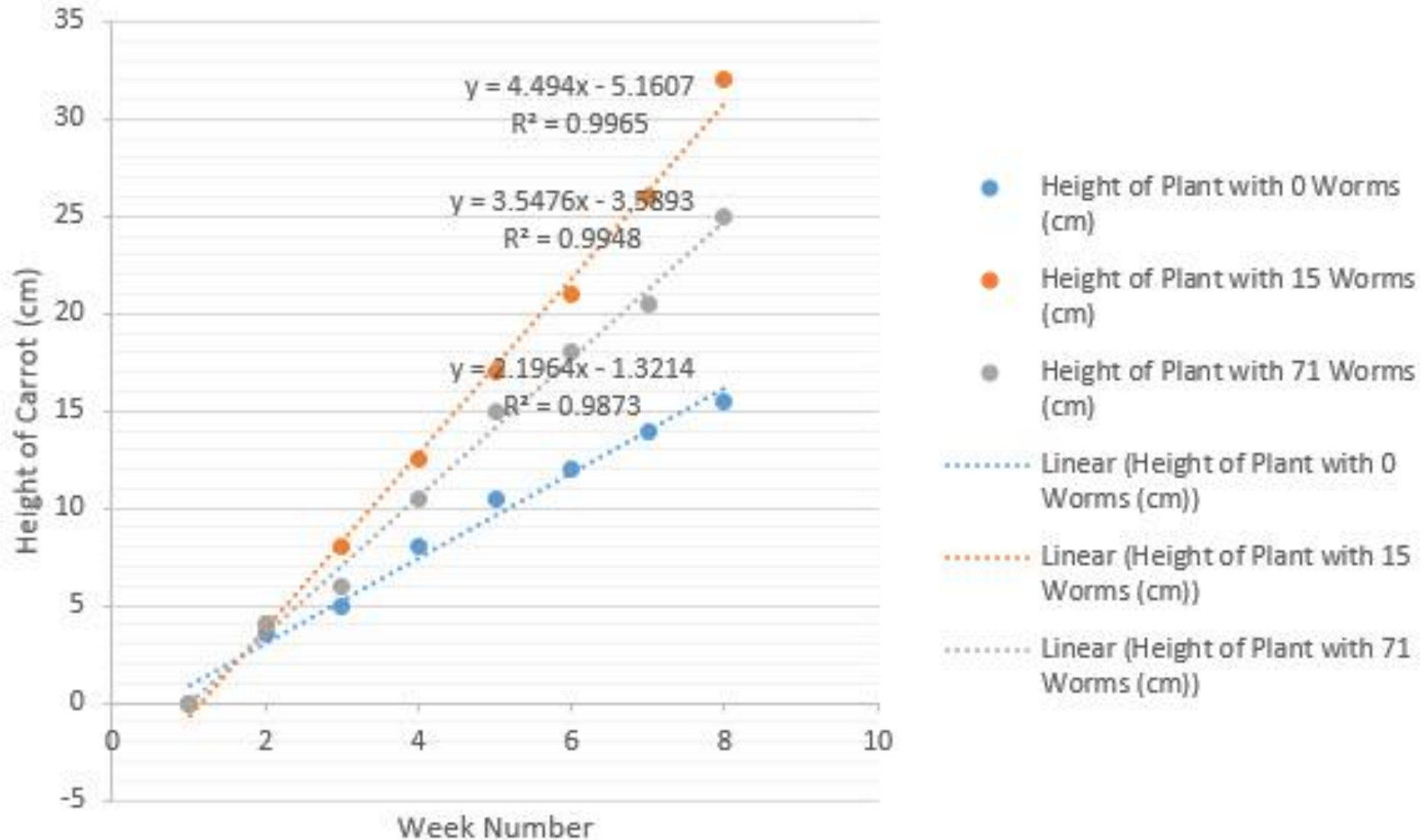


# Results





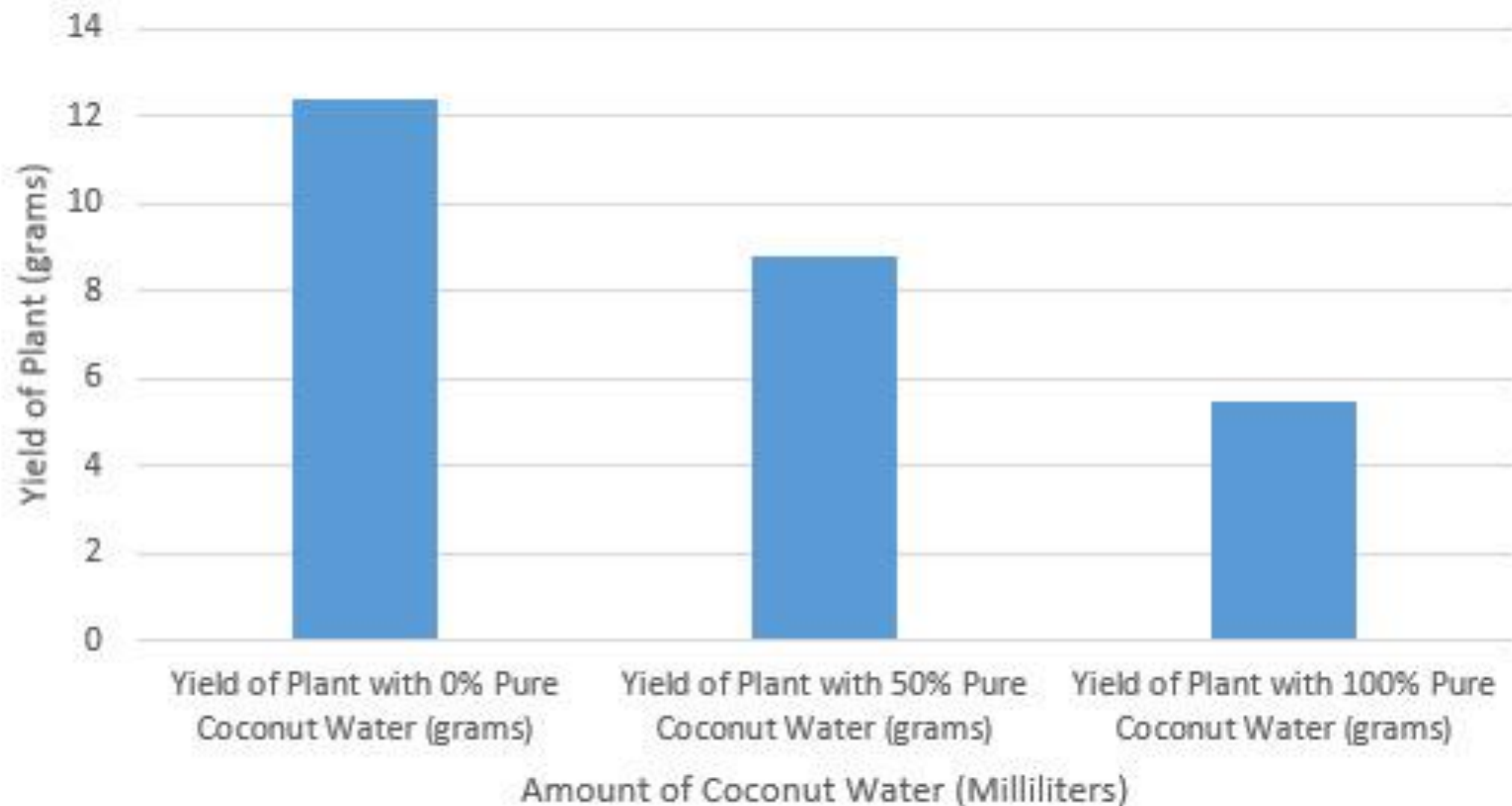
### Effect of Worm Number on Height of Carrot Plants



## Eating Results



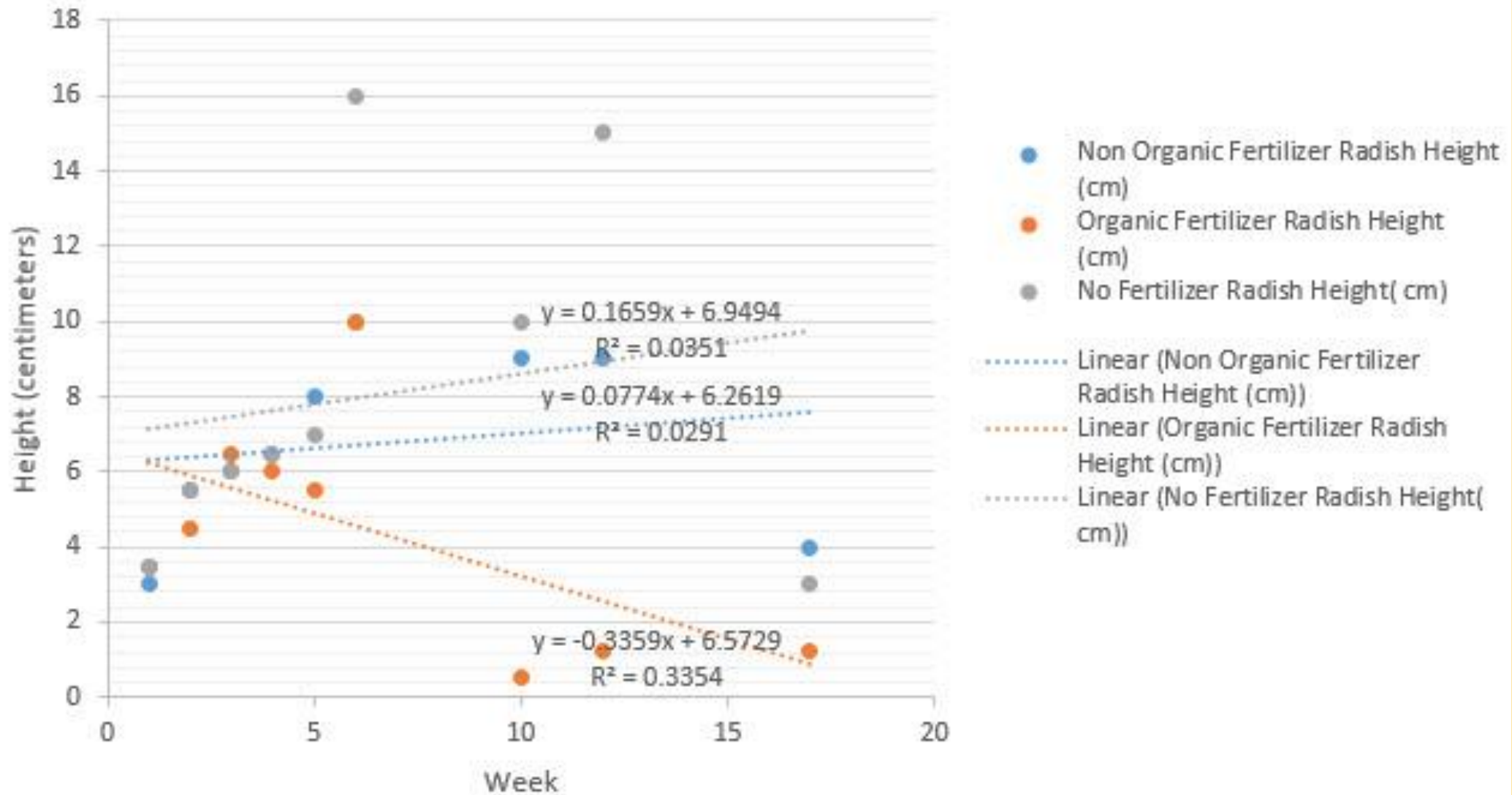
The Effect of Coconut Water on the Yield of the Plant



## Eating Results



## Effect of Different Fertilizers on Radish Height



# Final Grading Checklist

Section: \_\_\_\_\_ Date: \_\_\_\_\_ TOTAL SCORE = \_\_\_\_\_/20 Name: \_\_\_\_\_

Name: \_\_\_\_\_

Name: \_\_\_\_\_

## Crop Lab Data and Graph Grading Rubric

Due by end of class on Friday, March 15, 2018

*If you have concerns about group participation in the crop lab, an email must be sent to your teacher explaining the concern by March 11.*

*Points may be deducted.*

### Data TABLE- /6 points

Do...	Points	Teacher	Don't...
Create a table that clearly represents your data neatly and organized	1		Don't...Type the units IN the table – just type them as a heading (Excel will like you better).
include plant growth data	1		
include crop yield data	1		
Label each column and row specifically with units.	3		Don't...Write anything about the data or explain the data in this section.

### Plant Growth GRAPH – /8 points

Do...	Points	Teacher	Don't...
Create the right type of graph that clearly shows your plant growth results (data).	1		
include plant growth data	1		
Best fit lines with rates/slopes indicated	2		
include a legend if needed (and delete it if it is not needed!)	1		Don't...Worry if your graph title is too long – usually longer titles are more descriptive.
Label each axis on your graph with detailed labels that include units.	2		Don't...Show every bit of your data unless it is absolutely necessary to understand your results. Sometimes you just need to see averages in the graphs.
Title your graph with a specific and detailed title.	1		

### Crop Yield GRAPH – /6 points

Do...	Points	Teacher	Don't...
Create the right type of graph that clearly shows your crop yield results (data).	1		
include crop data	1		
include a legend if needed (and delete it if it is not needed!)	1		Don't...Worry if your graph title is too long – usually longer titles are more descriptive.
Label each axis on your graph with detailed labels that include units.	2		Don't...Show every bit of your data unless it is absolutely necessary to understand your results. Sometimes you just need to see averages in the graphs.
Title your graph with a specific and detailed title.	1		



## Lessons We Have Learned

- Overwatering & under watering
- Container sourcing & selection
- Protecting your building from water damage
- Indoor vs. outdoor growth rates
- Providing open-ended challenges and the freedom to explore and investigate

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## Impact

- Fruits of their labor – *Have they known more about any other food item they have eaten?*
- Perfect opportunity to learn to simply, revisit, and perfect sound experiments design – *Impact is often less about the chosen IV and more about the process*
- Supports campus Monarch Garden Program: <https://www.learner.org/jnorth/>
- Supports Friendship Trays - <http://friendshiptrays.org/>
- Instigated greenhouse budget for 2017-2018



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## Acknowledgements & Contact

### Collaborating Teaching Partners

Julia Walthall-Eisman, Middle School Science Teacher, Charlotte Latin School

Sarah Klingler, Grade 8 Science Teacher, Charlotte Country Day School

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# COUNTRY DAY Ready.

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