Investigating Mass Change in a Plant

In this investigation, you will collect data on the growth and development of a plant from seed to final plant. The length of the growth phase will depend on the type of plant you grow and the growing system you grow it in. You will use data collected before, during and after the growing cycle to explain how plants obtain and use matter and energy to grow, move and live.

**Materials:**

|  |  |  |
| --- | --- | --- |
| * Electronic balance * Plant seeds * Soil/growth medium * Growth container | * water * sunny window or growth station * Graduated cylinder | * Watering container * Tape |

**Procedure:**

1. Investigation Set-Up
2. Weigh 4 seeds and calculate the average mass per seed - record your data in **Table 1**.
3. Weigh and record, in **Table 2**, the mass of the container for the seeds, the mass of the container plus dry soil and calculate the mass of the soil.
4. Plant the seeds
5. You will be keeping records of the mass of water you add to your seeds on a regular basis while the seeds grow and become plants. Select a container to be used as your watering device and record its mass. The mass of the container can be written on a piece of masking tape and taped to the container.
6. Measure and record the volume of the water you will add to the planted seeds, weigh the water in the watering container before pouring it onto the seeds.
7. Weigh the mass of the growing system with water. This should equal the sum of the mass of the seeds, soil, growing container and water.
8. Set a watering schedule - you will record mass measurements of the growing container before watering, the added water before watering and the growing container after the addition of the water.
9. Your teacher will provide instructions on how and when you will predict the outcome of this investigation.

II. Ongoing Observations and Data Collection

1. As your plant is growing, continue to make regular observations of the physical changes in your plant and water your plant. Record your data and observations about plant growth in **Table 3**.
2. The growing period is done when at least 2 sets of leaves are open and well developed. Depending on the plant species studied and the growth conditions this may be 2-3 weeks.

III. Post-Growth Phase - Final Data Collection and Analysis

1. At the end of the growing period, you will collect final mass data for all components of the growing system. Do not add water to the growing system prior to collecting data.
2. Weigh the complete growing system, including plants and soil, and record the mass in **Table 4**.
3. Collect the Plant Fresh Mass Data, then remove the soil from the container and dry before recording the soil mass data in **Table 4**. The soil should be in the same condition as when you collected soil mass data at the start of the investigation.
4. Weigh and record the mass of the empty growing container after removing soil in **Table 4** - the container should be in the same condition as when you collected the container data at the start of the investigation.
5. Plant Fresh Mass Data
   1. Gently remove your plant from the soil, taking care to keep the roots attached to the stem.
   2. Remove as much soil from the plant as possible. This can be done by gently rinsing the roots in water and completely drying the rinsed plant with paper towels.
   3. Weigh the plant and record the mass in **Table 5**.
   4. Repeat for each surviving plant.
   5. Calculate the total mass for all plants and the average mass of the surviving plants.
6. Plant Dry Mass Data
   1. Calculated: follow the instruction in **Table 5**.
   2. Actual (Optional): Follow the instructions provided by your teacher.
7. Share your group data as directed by your teacher. Collect Class Data in **Table 6**.

**Data:**

**BEFORE**

**Table 1**: Starting Seed Mass:

|  |  |
| --- | --- |
|  | Mass (grams) |
| Mass of 4 seeds |  |
| Average mass per seed |  |

**Table 2:** Growing System Measurements:

|  |  |  |
| --- | --- | --- |
|  | **Mass (grams)** | **Sketch of growing system at the start of the investigation** |
| Growing Container |  |  |
| Container + Dry soil |  |
| Calculated Dry Soil mass |  |

**DURING**

**Table 3:** Mass data and observations

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Date** | **Growing System BEFORE watering (grams)** | **Growing System AFTER**  **watering (grams)** | **Water Mass (grams)** | **Observations** |
| (Set Up Day) |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| **Total mass of water added** | |  |  | |

**AFTER**

**Table 4**: Growing container mass

|  |  |  |
| --- | --- | --- |
|  | **Mass (grams)** | **Sketch of growing system at the end of the investigation** |
| Complete Growing System |  |  |
| Growing Container alone |  |
| Dry soil alone |  |
|  | |

**Change in soil mass:**  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

AFTER soil mass BEFORE soil mass

**Table 5:** Plant Fresh Mass

|  |  |  |
| --- | --- | --- |
|  | **Mass (grams)** | **Calculating Plant Dry Mass** |
| Plant 1 |  | According to literature, plants, on the average, are **90%** water by mass.   1. Multiply total plant fresh mass by percent water to get the water mass 2. Calculate the total plant dry mass in grams by subtracting the water mass from total fresh mass 3. Calculate the average per plant dry mass by dividing by the number of surviving plants |
| Plant 2 |  |
| Plant 3 |  |
| Plant 4 |  |
| Total all plants |  | Calculated Total Dry mass: |
| Average |  | Calculated Per Plant Dry mass: |

**Actual Plant Dry Mass (Optional)**

|  |  |
| --- | --- |
|  | **Mass (grams)** |
| Plant 1 |  |
| Plant 2 |  |
| Plant 3 |  |
| Plant 4 |  |
| Total all plants |  |
| Average |  |

**Change in Plant Mass:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_\_\_

Final Average Plant Mass Average Seed Mass

**Analysis:**

Record your macroscopic-scale observations below. Use drawings and/or words.

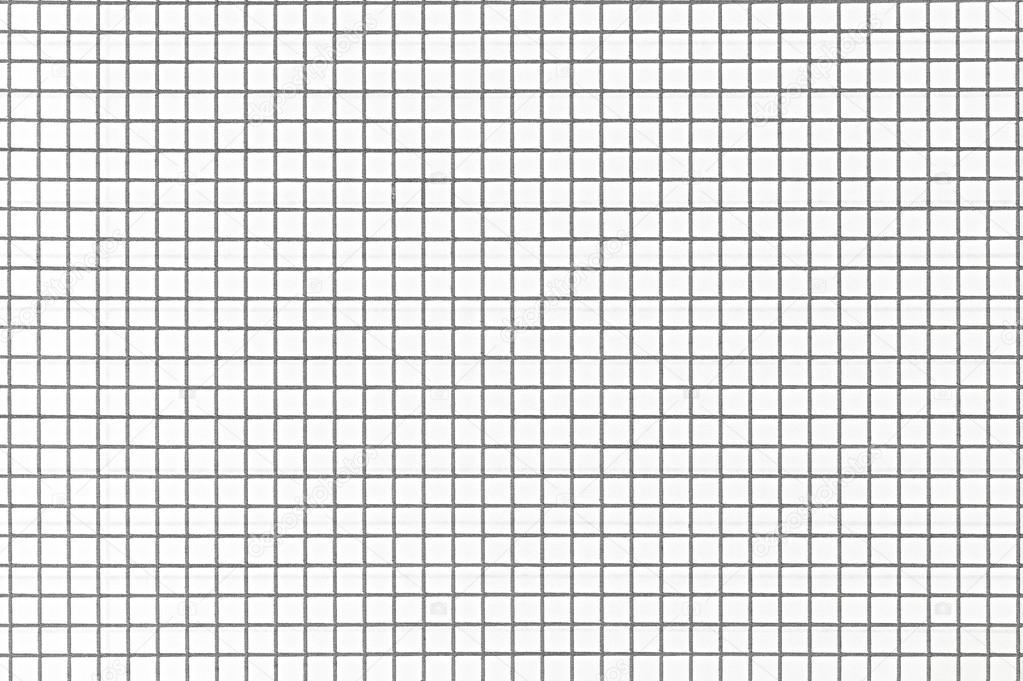
Reflection questions

* How much have your plants grown?
* Which is larger, the roots or the stems/leaves?
* What colors are the leaves, stems and roots?
* Has the soil changed in any way? How?

**Table 6: Class Data**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Group #** | **Initial Mass Soil**  **(g)** | **Final Mass Soil**  **(g)** | **Change in Soil Mass (g)** | **Initial Ave Seed Mass (g)** | **Final Ave Plant Mass**  **(g)** | **Change in Plant Mass (g)** |
| 1 |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |
| 4 |  |  |  |  |  |  |
| 5 |  |  |  |  |  |  |
| 6 |  |  |  |  |  |  |
| 7 |  |  |  |  |  |  |
| 8 |  |  |  |  |  |  |
| **Average change in weight =** | | |  |  |  |  |

**Graph: Average change in Mass for Plants and Soil**



**Analysis:**

Revisiting your hypothesis

1. Does the data support your predictions about mass? Explain.
   1. Change in soil mass: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. Change in plant mass: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   3. Change in everything in the container: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. A significant amount of water was added to the soil over the course of the growing phase. Based on your knowledge of the water cycle and plant structure, what is a reasonable explanation for your observation of the relationship between the total mass of water added to the system and the final mass of the plant?

|  |  |
| --- | --- |
| Claim: | |
| Evidence: | Reasoning: |

Patterns in the Class Data

1. What patterns do you see in the class mass data? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. What is a possible, science-based explanation for the patterns you observe? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Questions you now have about plants

As a result of this investigation, what questions do you have about plants?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_