# Pre-Lab Information

**Purpose** To examine how humans change the genetic makeup of a population

**Time** Approximately two 60-minute periods

**Question** How do humans change the genetic makeup of a population?

**Summary** In this lab, you will grow first-generation Brassica rapa plants. You will cross plants from this generation to ensure that the second-generation plants are better protected from herbivory. You will then grow second-generation plants. Finally, you will statistically analyze and compare data from the first-generation and second-generation plants.

# Lab Procedure

1. **Prepare for the project.** 
   1. Read through this guide before you begin, so you know the expectations for this lab.
   2. If anything is unclear to you, be sure to ask your teacher.
2. **Access the virtual lab.**
3. **Cultivate the first-generation plants.**
   1. Read the introduction and then select **Start**.
   2. Select the Brassica rapa seeds in the Materials Box to place the seeds on the soil. Repeat this step until all the seeds have been planted.
   3. Select the vermiculite in the Materials Box to put a light covering of vermiculite on the soil. Repeat this step until all the plant containers in Growing Container 1 have vermiculite. Select the **Continue** button when you are done.
   4. Select the **Add Container** button to add a second growing container.
   5. Move on to the next step.
4. **Place the containers under the light apparatus.**
   1. Drag Growing Container 1 under the light apparatus.
   2. Drag Growing Container 2 under the light apparatus.
   3. Move on to the next step.
5. **Gather data on the** **3rd, 6th, 9th, and 12th day of growth of the first-generation population.**
   1. Determine the number of trichomes for each plant in Growing Containers 1 and 2 by dragging the magnifying glass in the Materials Box over each plant.
   2. Record the number of trichomes per plant on each day in Table A.
   3. Move on to the next step.
6. **Determine which plants to cross to help plants fight herbivory.**
   1. Read the scenario below.

You and your classmates took the top 15% of plants with the highest trichome numbers. You were assigned four plants. Your goal is to determine which plant combination would be the best to cross to ensure that the second-generation plants would yield high trichome numbers.

* 1. Determine the number of trichomes for each plant assigned to you in Growing Containers 1 and 2 by dragging the magnifying glass in the Materials Box over each plant.
  2. Record the number of trichomes per plant in Table B.
  3. Identify the plant combination (two plants to cross) that would allow the second-generation population to better protect themselves from herbivory. Write the plant combination in the appropriate space in Table B.
  4. Write an explanation for your choice of plant combination in the appropriate space in Table B.
  5. Move on to the next step.

1. **Cultivate the second-generation plants.**
   1. Read the introduction to this part of the lab and then select **Start**.
   2. Select the Brassica rapa seeds in the Materials Box to place the seeds on the soil. Repeat this step until all the seeds have been planted.
   3. Select the vermiculite in the Materials Box to put a light covering of vermiculite on the soil. Repeat this step until all the plant containers in Growing Container 1 have vermiculite. Select the **Continue** button when you are done.
   4. Select the **Add Container** button to add a second growing container.
   5. Move on to the next step.
2. **Place the containers under the light apparatus.**
   1. Drag Growing Container 1 under the light apparatus.
   2. Drag Growing Container 2 under the light apparatus.
   3. Move on to the next step.
3. **Gather data on the 3rd, 6th, 9th, and 12th day of growth of the second-generation population.**
   1. Determine the number of trichomes for each plant in Growing Containers 1 and 2 by dragging the magnifying glass in the Materials Box over each plant.
   2. Record the number of trichomes per plant on each day in Table C.
   3. Move on to the next step.
4. **Consolidate data.**
   1. Consolidate the data you have gathered with your virtual classmates by selecting the **Consolidate Data** button.
   2. Once you have access to the consolidated data spreadsheet, move on to the next step.
5. **Determine the type of chart to use for data representation.**
   1. Determine which graph or chart would be best used to represent your data. Identify the type of chart and explain why the chart you have chosen is the best one to use. Write your answers in Table D.
   2. Have your teacher check your choice and explanation. After your teacher approves your data representation plan, move on to the next step.
6. **Represent data from the first-generation population.**
   1. Construct a chart in the space below Chart 1 to represent the trichome count data from the first-generation population.
   2. Using the data, determine the following:
      1. Mean
      2. Standard deviation
      3. Standard error

Write the values you obtained in Table E.

* 1. Use the data from the previous step (Step 12b) to create error bars in your chart.
  2. Move on to the next step.

1. **Represent data from the second-generation population.**
   1. Construct a chart in the space below Chart 2 to represent the trichome count data from the second-generation population.
   2. Using the data, determine the following:
      1. Mean
      2. Standard deviation
      3. Standard error

Write the values you obtained in Table F.

* 1. Use the data from the previous step (Step 13b) to create error bars in your chart.
  2. Move on to the next step.

1. **Compare data from the two populations.**
   1. Use your statistical values to construct a graph to show the sample means of the first- and second-generation plants (to within 95 percent confidence) in the space below Chart 3. Be sure to add error bars to your chart.
   2. In Table G, compare the data of the two populations. Be sure to use your statistical analysis and to reference graphs you constructed in your comparison.
2. **Write your lab report.**
3. **Submit your Student Guide and lab report to your teacher.**

# Data and Analysis

Record your data/observations and analyses either in your lab notebook or in the spaces below.

**Table A. Trichome Count of the First-Generation Population**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Plant #** | | **Trichome Count** | | | |
| **Day 3** | **Day 6** | **Day 9** | **Day 12** |
| **Growing Container 1** | **1** |  |  |  |  |
| **2** |  |  |  |  |
| **3** |  |  |  |  |
| **4** |  |  |  |  |
| **5** |  |  |  |  |
| **6** |  |  |  |  |
|  | | | | | |
| **Growing Container 2** | **1** |  |  |  |  |
| **2** |  |  |  |  |
| **3** |  |  |  |  |
| **4** |  |  |  |  |
| **5** |  |  |  |  |
| **6** |  |  |  |  |

**Table B. Trichome Count of the Plants to Be Crossed**

|  |  |
| --- | --- |
| **Plant #** | **Trichome Count** |
| **1** |  |
| **2** |  |
| **5** |  |
| **6** |  |
| **Plant combination** |  |
| **Explanation for the plant combination** |  |

**Table C. Trichome Count of the Second-Generation Population**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Plant #** | | **Trichome Count** | | | |
| **Day 3** | **Day 6** | **Day 9** | **Day 12** |
| **Growing Container 1** | **1** |  |  |  |  |
| **2** |  |  |  |  |
| **3** |  |  |  |  |
| **4** |  |  |  |  |
| **5** |  |  |  |  |
| **6** |  |  |  |  |
|  | | | | | |
| **Growing Container 2** | **1** |  |  |  |  |
| **2** |  |  |  |  |
| **3** |  |  |  |  |
| **4** |  |  |  |  |
| **5** |  |  |  |  |
| **6** |  |  |  |  |

**Table D. Choice of Chart to Use and Explanation for the Choice**

|  |  |
| --- | --- |
| **Type of Chart** |  |
| **Explanation for Choice** |  |

**Chart 1. Trichome Count of the First-Generation Population**

|  |
| --- |
|  |

**Table E. Statistical Analysis of the Data from the First-Generation Population**

|  |  |
| --- | --- |
| **Mean** |  |
| **Standard Deviation** |  |
| **Standard Error** |  |

**Chart 2. Trichome Count of the Second-Generation Population**

|  |
| --- |
|  |

**Table F. Statistical Analysis of the Data from the Second-Generation Population**

|  |  |
| --- | --- |
| **Mean** |  |
| **Standard Deviation** |  |
| **Standard Error** |  |

**Chart 3. Sample Means of the First- and Second-Generation Populations**

|  |
| --- |
|  |

**Table G. First- and Second-Generation Data Comparison**

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| --- |
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