EDVOTEK®

# Sci-On® Biology

Revised and Updated

Sci-On™

## S-41

# Which One is The Mutant?

**See Page 3 for storage instructions.**

**EXPERIMENT OBJECTIVE:**

Students will plant Quick Plant™ seeds to compare and observe the plants as they grow to investigate the meaning of "mutant" in genetics.

## Table of Contents

**Storage:**
Store this experiment at room temperature.

## Experiment Components

This experiment is designed for 30 students working in pairs.

A Pack of Wild type QuickPlant™ Seeds (75 seeds)
B Pack of Dwarf type QuickPlant™ Seeds (75 seeds)
C Pack of Pale type QuickPlant™ Seeds (75 seeds)
D Seed gel

### REAGENTS & SUPPLIES

- 30 peat pellets
- Growth containers
- Tooth picks
- 10 rulers
- 5 magnifying glasses

## Requirements

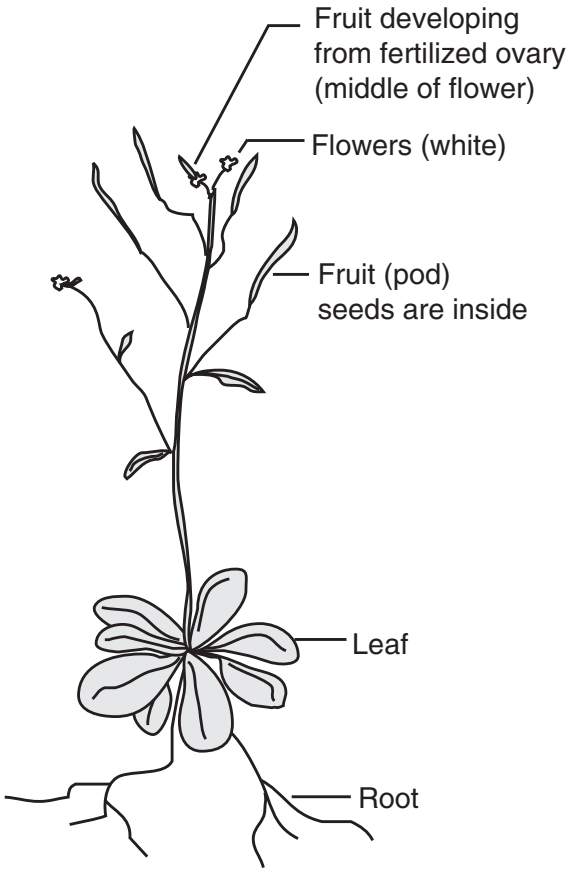
- Fluorescent plant growth lights recommended for optimal growth.

## Background Information

Quick Plants™ are plants that belong to the mustard family. Some relatives of Quick Plants™ are cabbage, broccoli, water cress and mustard. The size and short life cycle of Quick Plants™ make them a popular choice for genetics and biotechnology. Thousands of these plants can be grown in a small space in a research lab or classroom and inheritance in the plant over many generations can be studied in a relatively short time.

Quick Plants™ normally grow as a rosette of leaves out of which a tall inflorescence develops. This form of growth resembles that of cabbage. An obvious difference between the two plants is that cabbage is usually harvested before it has the opportunity to produce flowers. That is why we don't see a tall stem coming up out of the head. Cabbage has also been selected by plant breeders to produce a rosette with tightly overlapping leaves that form a head. The rosette of Quick Plants™ does not do this. The plant is self-pollinating. This means that it is not necessary for you to pollinate the plants in order that they produce seeds.

The three types of seeds supplied with the kit include normal (wild type) plants, dwarf plants whose full adult size is shorter than normal, and some plants that produce lower amounts of chlorophyll. Compared with the wild type, plants that cannot produce a normal level of chlorophyll will have some different physical features.



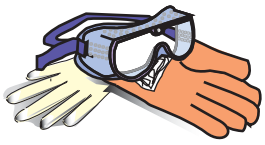
## Experiment Overview and General Instructions

### EXPERIMENT OBJECTIVE:

Students will plant Quick Plant™ seeds to compare and observe the plants as they grow to investigate the meaning of "mutant" in genetics.

### LABORATORY SAFETY

Gloves and goggles should be worn routinely as good laboratory practice.



### LABORATORY NOTEBOOK RECORDINGS:

Address and record the following in your laboratory notebook or on a separate worksheet.

**Before starting the Experiment:**

- Write a hypothesis that reflects the experiment.
- Predict experimental outcomes.

**During the Experiment:**

- Record (draw) your observations, or photograph the results.

**Following the Experiment:**

- Formulate an explanation from the results.
- Determine what could be changed in the experiment if the experiment were repeated.
- Write a hypothesis that would reflect this change.

## Student Activities

Experiment Procedure

### ACTIVITY ONE

**Each Lab Group should have the following materials:**

- Seeds
- Planting medium
- Growth containers
- Toothpick
- Ruler
- Magnifying glass

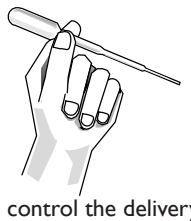
### ACTIVITY ONE

#### Preparing to Plant Quick Plant™ Seeds

1. Before actually planting the Quick Plant™ seeds, you will need to soak the round peat pellets in water for several hours, or overnight.
   - Place the peat pellets flat in the bottom of the growing containers.
   - Fill the container with water and allow the pellets to soak until fully expanded. The pellets should become approximately 1 to 1-1/2 inches (2.5 to 3.8 cm) tall.
2. Observe that Quick Plant™ seeds are dark and very small. To facilitate planting, the following has been done:
   - The wild type seed is in a material which has been formed into a pellet to make it easier to plant the seeds for germination.
   - The mutant seeds have been added to a liquid gel mixture by your instructor to facilitate even dispersal of seed.
3. Crush one of the wild type Quick Plant™ seed pellets and examine the tiny dark seed with a magnifying glass or microscope.
   - Describe what you see.
   - Make a visual comparison of the wild type seed to the mutant seed in the gel mixture.

#### Planting

4. Before planting, remove excess water from the growing container.
5. Place 2-3 seed pellets (wild type) on the surface of each moistened and expanded peat pellet. The seeds should be distributed evenly over the surface of the peat moss so the plants have room to grow. Press the seeds lightly onto surface of medium.
6. Use a transfer pipet to take up some of the gel mixture with mutant seeds. Gently squeeze the bulb and add 3-4 drops to each moistened peat pellet.
7. Replace the remaining seeds in the pipet back into the container and pass the mutant seeds to another lab group.



To control the delivery of small volumes with transfer pipets, gently squeeze the pipet stem, instead of the bulb.

## Student Activities

8. Place the lid onto the container and place the planted seeds under the lights so they are just a few inches away from the light bulbs. The seeds should germinate within 3-4 days.

   Reminder: Do not let the seeds dry out.

9. Initially, you will need to keep the seeds very moist. After seeds have germinated, remove the plastic lid.

10. Water your plants after you notice the pellet slightly drying out (the surface will turn light brown). Do not over-water!

### Observing The Plants As They Grow

11. Keep a careful record of your observations of the plants as they grow. Pay careful attention to the formation and description of leaves, flowers, fruit and seeds.

## ACTIVITY TWO

### Hunting For Mutants

As the plants germinate and grow, watch them carefully.

1. Look for signs that will tell you which of the plants are mutants. If you see a plant that you suspect might be a mutant, place a colored toothpick next to it as a marker.

2. Watch it for a few days. Is it still different enough from its neighbors to qualify as a mutant?

3. By the time three weeks have passed, you should be pretty certain about your choices. Remember that there are two different types of mutants in your population and one normal kind of plant.

## Study Questions

1. When did you begin to notice differences between the plants?
2. Measure the sizes of the plants. Are they all the same? Which are the dwarves? What fraction of the wild type is the height of the dwarf?
3. Do they all have the same intensity of green? Can you distinguish the pale plants? Do they produce more or less chlorophyll than the wild type plants?
4. How would you define "mutant"?
5. What is a phenotype?

# Instructor's Guide

## Lesson Plan Outline

This lesson plan outline, written by a teacher, can be used as a guideline to fit your specific classroom experience.

### I. Purpose

To identify mutant strains of plants.

### II. Experiment Skills

Students will plant a population of Quick Plants™ seeds to compare and observe the plants as they grow to investigate the meaning of "mutant" in genetics.

### III. Materials

Components which are provided with this kit, and a list of additional requirements to perform this experiment are listed on page 2. Fluorescent lights are recommended for optimal growth.

### IV. Prerequisite Knowledge

Instructions included in the student handout presume that the students have had experience growing and observing EDVOTEK Quick Plants™ and that they are familiar with the "wild type" Quick Plant™ phenotype.

### V. Focusing Event

The students will have preconceived ideas about the meaning of the terms "mutant" or "mutation". The activities outlined in the kit are aimed at getting them to develop an accurate concept of what these terms mean in the context of genetics. They will learn the meaning of mutation in biology.

## Suggestions for Lesson Plan Content

1. Have students become familiar with these vocabulatory words:

| | | | |
|---|---|---|---|
| Genetic | Mutant | Mutation | Chlorophyll |
| Pale | Dwarf | Phenotype | |

2. The following are focusing points to guide classroom discussion:

   - Pass out instructions and read through them with the class. Stress the following:

     - They must take care of their plants
     - They must make sure to follow watering instructions

   - Explain about mutations and that they are changes in DNA that can be inherited. In other words, they are genetic differences. Relate these changes to possible differences between two individuals.

   - The plants grown in this experiment include normal (wild type) and mutants. The following are some suggested questions to ask the class:

     - Do you know what a mutation means?

     - Are mutant plants dangerous in any way?

     - Can the plants that are not mutants become mutants if they grow in the same container?

3. Remind students to record their observations in their notebooks.
4. Check daily that students are following correct watering procedures.
5. Check to see that they are recording observations.
6. Check to see that mutant plants have been pre-identified.
7. Have students compare their mutants with those of other students.
8. Have students do study questions.
9. Discuss study questions as a class.

## Pre-Lab Preparations

- Although very little pre-lab preparation is required for growing Quick Plants™ , there are some suggestions for maximizing growth. The most reliable growth will be insured if plants are grown under continuous fluorescent lighting, just a few inches from the lights. Allow peat moss pellets to absorb water overnight in container provided with kit. Pellets will swell to approximately two inches in height. Once pellets have been soaked, excess water should be removed from container. During the course of the experiment, water when pellets begin to look dry on the surface.

- To facilitate even dispersal of seed, add 500 µl of seed gel (component D) to each of the tubes containing the different types of Quick Plant™ seeds. The tubes will be shared among the class.

- Quick Plants™, grown in the classroom according to the directions, will normally complete their lifecycles within 5-6 weeks. This means that if you plant seeds today, you will be harvesting the next generation in 6 weeks. As the plants grow, students should be given time to observe them on a regular basis. Routine observations need not take more than a few minutes per day, but planting, measuring, and harvesting activities can be planned as complete lessons.

- The three types of plants provided in this kit can be grown individually, if preferred. In a mixed population, identifying mutant plants will be challenging for students and will illustrate that mutants are simply "genetically different" from the standard type. It is not always obvious which plants are mutants. The student's assessment of mutant plants will depend initially on their observations of the stature and the color of the plants.

## Answers to Study Questions

Most answers will vary due to different growth conditions and student interpretation.