

Agri-science Resources  
for High School Sciences

PowerSeeds



**Biology**

Science

Grade 10-12

Biology Lab

Teams of 2 or 3

### DESCRIPTION

There are many different types of plants in the world. Most common plants are angiosperms. Plants have the ability to grow through very hard structures. Although they appear fragile to humans, they are actually very powerful organisms. This lab will demonstrate the just how powerful plants really are.

### READINESS ACTIVITIES

Students should:

- review the parts of a plant
- read about the process of germination

### LEARNING OUTCOMES

Students will:

- review the two major angiosperm classes
- examine the factors needed for seeds to germinate

### MATERIALS

- Grass seeds
- Corn seeds
- Pea seeds
- Lettuce seeds
- Plaster of Paris
- Cement mix
- Spackling paste
- Spackling knife
- Fine-point permanent marker
- Paper towel
- Trowel
- Newspaper
- Metric ruler
- Seed-starting mix
- 40 clear plastic cups (9cm tall, 6 cm wide)



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## Introduction

**Angiosperms** (Division Anthophyta) make up most of the plants on the Earth. Plants such as trees, flowers, fruits, vegetables, and field crops all belong to this division. Altogether, there are about 235,000 species of Angiosperms. The division Anthophyta includes two classes; The monocotyledones (**monocots**) and the dicotyledones (**dicots**).

## Monocots and Dicots

The two groups are very similar, except for a few distinguishing characteristics.

- Dicots:
- flower parts are usually found in four or fives
  - pollen is **tricolpate** meaning it has three pores
  - they have two **cotyledons** which are food leaves in their seeds
  - the leaf venation is usually netlike
  - the primary **vascular bundles** or transport tissues of the stem are found in a ring
  - secondary growth with **vascular cambium** is commonly present
  - examples are trees, shrubs and herbs

- Monocots:
- flower parts usually found in threes
  - pollen is monocolpate with only one pore
  - they have only one cotyledon
  - the leaf venation is usually parallel
  - the primary vascular bundles in the stem have a complex arrangement
  - secondary growth with vascular cambium is absent
  - examples are grasses, flowers and palms



Plants are able to break up rock into smaller pieces. This is demonstrated by plants which can grow in sidewalk cracks. This lab will test just how powerful these seeds are. A seeds ability to break through solid covering material of varying thickness and strengths will be tested in this lab. Monocot and Dicot seeds will be compared, as well as the size of the seed itself.

## Procedure

1. Because there are many containers, students can work in groups of two or three. Each group is responsible to bring their own seeds. About 81 seeds of each type is necessary. The corn and pea seeds must be soaked in water the night before planting.
2. Using the permanent marker, label nine containers with GRASS. Print the letters near the bottom of the container. Now label nine containers with LETTUCE, nine with CORN, and nine with PEA.
3. Now draw a line around the outside of each labeled container 6 cm up from the bottom.
4. Select three containers of each seed type (3 Grass, 3 Lettuce, 3 Corn, 3 Pea = 12). Label each container with PLASTER OF PARIS just below the seed type. Now select three more containers of each seed type and label them SPACKLING PASTE. Finally, label the remaining containers SAND MIX. Now you should have a total of 36 containers. Separate the containers first by seed type and then by covering material (should have 12 groups of 3).



5. Take one container marked **PLASTER OF PARIS** for each seed category and draw a line 0.5 cm above the 6 cm line. Take another container marked **PLASTER OF PARIS** for each seed category and draw a line 1.0 cm above the 6 cm line. Take the last four containers marked **PLASTER OF PARIS** and draw a line 1.5 cm above the 6 cm line.
6. Repeat this entire procedure for the containers marked **SPACKLING PASTE**. Finally do the same for the containers marked **SAND MIX**. Now all the containers should be different by seed type, material, or height of line.
7. Spread out the newspaper to avoid making a mess. Now fill each container with seed starting mix up to the 6 cm line.
8. Plant nine seeds of the proper type in each marked container. Use an X-shaped pattern across the container. Plant the corn and pea seeds about 2 cm deep. The grass and lettuce seeds need to be planted just under the surface.
9. Water the contents of each container.
10. Now mix the covering materials according to the directions. Use the remaining containers to mix them in.
11. Now use the spackling knife to cover the planted seeds with the appropriate material. Fill the containers to the height of the line above the 6 cm line. Work quickly because some of these coverings harden very quickly. Make sure everything is covered and the materials touch the walls of every container.
12. Set the containers aside for a few days. Then examine each container's surface for cracks. Take a look at the starting mix to look for root growth. Record all observations for five days in the following table.



Table 1. Observations of seed growth containers over a five day period

	Plaster of Paris	Spackling Paste	Sand Mix
Day 3			
Day 4			
Day 5			
Day 6			
Day 7			
Day 8			

## Questions

1. Which seeds broke through 0.5 cm plaster of Paris? What about 1.0 cm? 1.5 cm?
2. Which seeds broke through 0.5 cm of spackling paste? 1.0 cm? 1.5 cm?
3. Which seeds broke through the sand mix at the three heights?
4. Which seeds showed the greatest amount of root growth?
5. Which seeds showed the least seed growth?
6. Are dicotyledonous seedlings stronger than monocotyledonous seedlings? Justify this answer.
7. The larger the seed, the more powerful the seedling. Is this generalization true or false? Explain.



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## Glossary of Terms

<b>Angiosperms</b>	plants that produce enclosed seeds
<b>cotyledon</b>	a seed leaf that stores food for the germinating seedling. It is the first photosynthetic organ of a young seedling
<b>Dicots</b>	an angiosperm whose seeds have two cotyledons or seed leaves. Most angiosperms are dicots
<b>monocolpate</b>	pollen of a plant with only one pore
<b>Monocots</b>	an angiosperm whose seeds have only one cotyledon or seed leaf
<b>phloem</b>	the tissue that conducts food and other dissolved materials throughout the body of a vascular plant
<b>tricolpate</b>	pollen of a plant that has three pores
<b>vascular bundles</b>	a structure within a stem containing parallel strands of xylem and phloem
<b>vascular cambium</b>	the meristematic layer of cells that causes growth in width of a stem or root
<b>xylem</b>	the tissue that conducts water and minerals from the roots upward through the plant and helps to support the plant



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## Notes

- Make sure the containers are watered thoroughly before applying the covering. This is the only source of water the seeds will have for a number of days. In the meantime, too much water could be just as bad.
- It is important that the students be as accurate as possible when applying the covering. There is only half a centimeter to work with, so too much or too little could affect the results.
- Timing is very important. It would be a good idea to try to plant everything on a Friday. This will allow a growth period over the weekend and then five consecutive days to record results.
- It would be good if all the setting up could be done in one day. However, if time does not permit, then the amount of coverings or seeds can be cut back or the lab can be done in sections.
- There are a number of variations that can be used with this lab. Try using different types of coverings, or different seeds, maybe even different types of soils.

## References

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