

Topsy-Turvy Soybeans

Grade Level(s)

Middle School

Estimated Time

30 minutes

Purpose

Students will observe how plants respond to gravity by germinating soybeans in a CD case and rotating the case as they grow.

Materials

▪Links:

Website with virtual resources: www.linncoag.com -2020/21 virtual learning drop down tab- February

Iowa Ag Today Middle School

https://www.iowaagliteracy.org/page/file?path=Files%2Fwebsite%2Fiowa-ag-today%2FIALF_AT_MD_issue2-online.pdf

Instructional video [Do seeds know which direction to germinate? - YouTube](#)

Planting soybean video <https://www.youtube.com/watch?v=1Ovuawy2OYI>

▪Worksheets:

Soybean product scramble

▪Other:

4 soybeans per student

1 clear plastic CD per student

Paper towel

Permanent marker

Large binder clip (or some way to hold the CD case up)

Vocabulary

- Germination - The process of a plant emerging from a seed and beginning to grow.
- Geotropism - The growth of a plant in response to the force of gravity.

Interest Approach – Engagement

Watch the planting soybean YouTube video above to learn how soybeans are planted.

- How do the soybean seeds know which way to grow?
- Do you think the planter puts the seeds into the ground in an upright position?
- Could the soybean germinate down instead of up towards the sun?

Fun facts about soybeans:

- The soybean or bean is a species of legume native to East Asia, widely grown for its edible bean which has numerous uses.
- Soybeans are used to feed livestock, make biodiesel, and processed into many food and household products.
- Iowa is the top soybean producing state in the country.

Background - Agricultural Connections

You might not know it, but plants are able to sense their environment and respond appropriately. One of the key parameters that every plant must respond to is the direction of gravity: stems go up (opposite to the pull of gravity) and roots go down (in the same direction as the force of gravity).

By sensing the gravity, plants can turn sideways, upside down, etc. Scientists first theorized that the plant could tell by the warmth of the plant soil but now we know that they sense gravity and automatically know where down is and grow upwards. This is a crucial skill for the plant because they need to grow upwards and get their leaves out of the soil so they can reach the sunlight and grow. Even though it seems easy to understand that plants sense gravity, the actual mechanisms inside the plant roots are quite complicated. Statocytes are a kind of cell that surrounds the rootlet tips. Inside those Statocytes, the statoliths act as a motion sensor. Movements of these small bodies allow the roots to understand the direction of gravity.

Procedures

1. Watch the instructional video, link provided above.
2. Cut the paper towel or blotting paper so it fits inside the CD case.
Moisten the paper towel and lay it in the case.
3. Evenly place four soybeans on the paper towel. Orient the soybeans in at least two different directions (note the direction of bean's hilum).
4. Close the CD case so that the beans are held snugly. Tape the case shut.
5. Using a marker, number the soybeans 1,2,3,4 on the outside of the case.
6. Set the CD case in an upright position. Attach a binder clip to the bottom to help keep the case upright.
7. Keep the paper towel moist. As the seeds begin to sprout, note the direction in which the roots and stems are growing. Does the direction the seed is turned affect the direction of growth?

8. Two days after the seeds have begun to grow, rotate the CD case 90° on its side. Continue rotating the case every two days. Did rotating the case effect the growth?

9. Review with the same questions from the beginning of the lesson:

- How do the soybean seeds know which way to grow?
- Do you think the planter puts the seeds into the ground in an upright position?
- Could the soybean germinate down instead of up towards the sun?

10. Optional for fun: soybean worksheet

11. Read the Iowa Ag Today publication (link above) to learn more about plant structures.

Organization Affiliation

Original activity from Montana Ag in the Classroom.

Agriculture Literacy Outcomes

T1.3-5.e Recognize the natural resources used in agricultural practices to produce food, feed, clothing, landscaping plants, and fuel.

T4.6-8.b Describe how biological processes influence and are leveraged in agricultural production and processing.

Iowa/ Common Core Standards

5-LS2-1 Support an argument that plants get the materials they need for growth chiefly from air and water.

5-PS2-1 Support an argument that the gravitational force exerted by earth on objects is directed down.