**VDOE Sample Science Performance Assessment**

Lesson Topic: Soil

Course: Third Grade Science

## **Content Standards:**

Science (2018)

3.6 The student will investigate and understand that soil is important in ecosystems. Key ideas include

1. soil, with its different components, is important to organisms; and
2. soil provides support and nutrients necessary for plant growth.

Mathematics

3.15 The student will

1. collect, organize, and represent data in pictographs or bar graphs; and
2. read and interpret data represented in pictographs and bar graphs.

Computer Science

3.1 The student will construct sets of step-by-step instructions (algorithms), both independently and collaboratively

a) using sequencing;

c) using events.

English

3.8 The student will write in a variety of forms to include narrative, descriptive, opinion, and expository.

a) Engage in writing as a process.

f) Elaborate writing by including supporting details.

## Portrait of a Graduate Attributes Assessed:

Critical & Creative Thinking Descriptors

● Engages in problem solving, inquiry, and design of innovative solutions to overcome obstacles to improve outcomes

● Uses information in novel and creative ways to strengthen comprehension and deepen awareness

● Evaluates ideas and information sources for validity, relevance, and impact

Communication

* Providing feedback in order to effectively communicate results of an investigation

Civic Responsibility

* Practicing traits of a responsible member of society.

Collaboration

* Work effectively with classmates while conducting an investigation

## **Scientific and Engineering Practices**

3.1 The student will demonstrate an understanding of scientific and engineering practices by

1. asking questions and defining problems

* ask questions that can be investigated and predict reasonable outcomes
* ask questions about what would happen if a variable is changed

1. planning and carrying out investigations

* with guidance, plan and conduct investigations
* use appropriate methods and/or tools for collecting data
* measure length and/or mass in metric and U.S. Customary units using proper units

1. interpreting, analyzing, and evaluating data

* organize and represent data in pictographs or bar graphs
* read, interpret, and analyze data represented in pictographs and bar graphs

1. constructing and critiquing conclusions and explanations

* use evidence (measurements, observations, patterns) to construct or support an explanation

1. obtaining, evaluating, and communicating information

* read and comprehend reading-level appropriate texts and/or other reliable media
* communicate scientific information , design ideas, and/or solutions with others

## Performance Task:

Background: Your class has decided to have a garden in your school yard. Before actually starting the garden, you have decided to test some different soil samples before you plant seeds in your garden.

Challenge: Design and conduct an investigation that determines the type of soil that will be best for your garden. You will need to prepare a written report explaining your investigation plan. You will need to write in clear, complete sentences. You should correctly use scientific terms where appropriate for conveying your ideas.

### Possible teaching scenarios:

There are different ways that you can handle this performance assessment in your classroom. Scenarios include:

Scenario 1: You can have the whole class explore different soil combinations. Every student, or team of students, picks a different makeup of the soil sample and all of the students plant the same seeds. As a group the students decide on how they want to water the plants, and where the plants are placed so that all the containers receive approximately the same amount of light. Every student or team has one growing container that they monitor and record data.

Scenario 2: Every student, or team of students, can design their own experiment, comparing two different soil combinations with the same seeds. In this scenario, each student or team would have to have at least two (2) containers to show the comparison. Again, students decide on the amount of water and the amount of light for the plants. In this case, students can make this decision and use it for their containers. The whole class does not have to reach consensus since the class will not be comparing their data to each other.

To make this assessment even more relevant, it is possible, for a small fee, to get a soil analysis from the soil department at VA Tech. For information on how you can receive an analysis of your school yard soil, go to https://www.soiltest.vt.edu. Sampling kits are available at your local extension office. To find the extension office that serves your community, go to https://ext.vt.edu/offices.html.

Possible categories in the common rubric include asking questions and defining problems; planning and carrying out investigations; interpreting, analyzing, and evaluating data; constructing and critiquing conclusions and explanations; and obtaining, evaluating, and communicating information. The categories will depend on the amount of support provided in any given category.

## Lesson Overview and Preparation:

| **Safety and Preparation** | **Lesson Information** |
| --- | --- |
| BEFORE:  Resources Needed:  • Student direction page  • Experimental design pages  • Save milk cartons and trays-cut off the top of the milk cartons prior to experiment. Poke a few small holes in the bottom of the carton.  • Small cup to measure soil  • Chart paper  • Fast growing seeds. Some possibilities include:  Sweet alyssum  Marigold  Cosmos  Radish  Basil  Chives  Cilantro  Dill   * Soil components (rock, clay, silt, sand and humus)   Premixes of the soil components  • Graduated cylinders and  water  • Written Report (one per  student) | Teacher considerations before the assessment begins:  Have students determine what they have learned, or what they need to learn, about each soil component and what they would like to test about the growing of plants. That may include having students investigate how the different components hold water.  Questions to Consider:  “What are the different types of soil?”  “What roles does soil play in supporting plant growth?”  “Which soil component was able to hold the least water?”  “Are some soils better for some plants?  “When seeds germinate what part of the plant grows first?”  “What are the main functions of the roots?”  “What mixture of soil components is the best for germinating seeds?”  Make a decision on how you would like the class to do this assessment  When making soil samples, students are tempted to put the soil components in layers. So the students might want a layer of rock, and then a layer of clay, etc. Students should plant their seeds in a mixture of the components that are being tested. For example, if the students want to test a mixture of sand and humus, that mixture should be made ahead of time, and the separate components should not layered in the milk carton.  This assessment should be done during the teaching of the soil standard so that students understand the content. This assessment will take some time since it will take a while for the seeds to germinate and grow. |
| DURING:  Supporting students with the task  You may need to answer questions students have about the prompt to ensure that each student understands what s/he is being tasked to do.  Anticipated timeline: 1.5-3 weeks depending on the type of seed used in the experiment  Tips for growing plants from seed in the classroom:  Students should plant multiple seeds per container (depending on the container, 3 seeds may be best)  Make sure soil is moist (not wet)  Place containers in a sunny location. | Teacher: “What do we need to know before we design this investigation? Talk with your shoulder partner and then we will share.” List student ideas on chart paper. Depending on the scenario selected, students should come to consensus about how many seeds should be in each container, when the containers will be watered, how much water they will receive, where the containers should be placed, what data will be collected, the procedure that will be followed for planting the seeds and caring for the plants.  Each student or team of students should work on the question that they want to answer (within the constraints that the teacher has set), make a prediction, and determine the supplies they need.  As students are working, display the available materials they can use for the experiment.  Upon teacher approval of the procedures, each student/team will use the materials indicated in their procedures to carry out the investigation.  Students will collect data and record their data.  Students will measure growth to the nearest centimeter  Student teams can present their data to the class. After the presentations, students should be able to write a statement about what should go in the school yard garden based on the evidence presented from the class. |
| AFTER:  Reflecting with students after the  Task | Reflection Questions to Consider and Discuss:  Students revisit the essential questions:  Why is soil important to all living things?  How do soil types affect plant growth?  What roles does soil play in supporting plant growth? |

## Accessibility:

### Accommodations/Modifications

Students are given strips of paper that indicate each step of procedures; student placed these in the appropriate order. Teacher checks order before student glues them on the paper.

Give students sentence stems to help complete their written report.

Students complete modified student sheet to design investigation.

### Extensions:

Students measure plant growth to the nearest millimeter.

Students create a Plus-Minus-Interesting chart for the soil mixtures and results.

Writing prompt: Write what you think the following quite means “Man has only a thin layer of soil between himself and starvation.”

## Soil Investigation

Big Question: Which soil mixture and which plants will grow the best in your schoolyard?

Background

Your class has decided to grow a garden in your school yard. Before you start the work outside, you decide to test some different soil mixtures and plants to determine what would be best for your school yard garden.

Challenge

Design an investigation that will test which type of soil is best for the plants in the garden. You also need to prepare a written report explaining your plan to investigate the different soil types. You will need to write in clear, complete sentences and correctly use scientific terms to make your ideas clear.

**Soil Investigation**

What question are you going to answer?

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

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

What is your prediction about what will happen?

If\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, then \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

What do you plan to change?

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

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

What will stay the same?

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

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

What soil mixtures do you plan to use on your experiment? (Circles types of soil you plan to mix together in each container).

| Mixture 1 | Mixture 2 | Mixture 3 |
| --- | --- | --- |
| Rock | Rock | Rock |
| Sand | Sand | Sand |
| Clay | Clay | Clay |
| Humus | Humus | Humus |
| Silt | Silt | Silt |

What steps will you take to complete your experiment?

**You may add more numbers, and you may include a labeled sketch/diagram of your set-up.**

| 1 |  |
| --- | --- |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |

What data will you collect?

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

Sample Data Table

Data should be taken on a regular basis such as every other day.

Mixture 1

Soil Composition:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  | 1st Observation  Day\_\_\_\_\_\_ | | 2nd Observation  Day\_\_\_\_\_\_ | | 3rd Observation  Day\_\_\_\_\_\_ | |
| --- | --- | --- | --- | --- | --- | --- |
|  | Number of Leaves | Height | Number of Leaves | Height | Number of Leaves | Height |
| Plant 1 |  |  |  |  |  |  |
| Plant 2 |  |  |  |  |  |  |
| Plant 3 |  |  |  |  |  |  |

Mixture 2

Soil Composition:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  | 1st Observation  Day\_\_\_\_\_\_ | | 2nd Observation  Day\_\_\_\_\_\_ | | 3rd Observation  Day\_\_\_\_\_\_ | |
| --- | --- | --- | --- | --- | --- | --- |
|  | Number of Leaves | Height | Number of Leaves | Height | Number of Leaves | Height |
| Plant 1 |  |  |  |  |  |  |
| Plant 2 |  |  |  |  |  |  |
| Plant 3 |  |  |  |  |  |  |

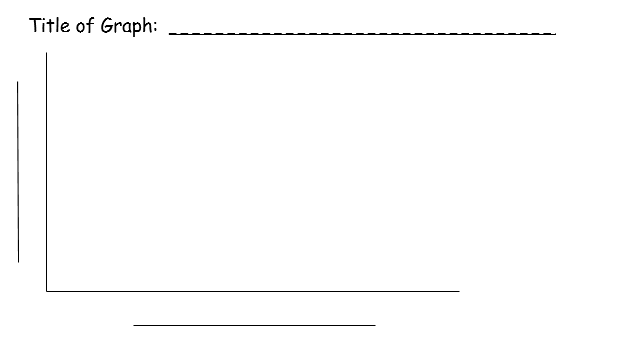
Mixture 3

Soil Composition:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  | 1st Observation  Day\_\_\_\_\_\_ | | 2nd Observation  Day\_\_\_\_\_\_ | | 3rd Observation  Day\_\_\_\_\_\_ | |
| --- | --- | --- | --- | --- | --- | --- |
|  | Number of Leaves | Height | Number of Leaves | Height | Number of Leaves | Height |
| Plant 1 |  |  |  |  |  |  |
| Plant 2 |  |  |  |  |  |  |
| Plant 3 |  |  |  |  |  |  |

Add additional data tables as needed

Using the graph below or a piece of graph paper, make a graph of the height of your plants. The number of days goes on the horizontal axis and the height of the plants goes on the vertical axis.



What does my data tell me?

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

What I would recommend for the school yard garden based on the evidence from the class experiments?

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

**Soil Investigation**

*Modified*

What question are you going to answer? **(Question)** Circle your response:

what type of soil what type of plants where to buy the seeds

how many seeds to plant how grass grows how to mix soil

What soils do you intend to use in your mixtures? Circle two or three soil components that you will use in your mixture. Check with your teacher—you may be making only one mixture.

| Mixture 1 | Mixture 2 | Mixture 3 |
| --- | --- | --- |
| Rock | Rock | Rock |
| Sand | Sand | Sand |
| Clay | Clay | Clay |
| Humus | Humus | Humus |
| Silt | Silt | Silt |

What do you think will happen?

If I use \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, then \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ seeds will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

What steps will you take to complete your experiment?

***You may include a labeled sketch/diagram of your set-up***

| 1 |  |
| --- | --- |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |

What data will you collect?

| What will you notice? | What will you measure? |
| --- | --- |
| What will you look for? Eyes to represent "looking for"  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  What will you smell? Nose to reflect smell  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  What will you feel?Hand to reflect feel.  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | What will you measure?  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

My Data:

Mixture 1

Soil Composition:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  | 1st Observation  Day\_\_\_\_\_\_ | | 2nd Observation  Day\_\_\_\_\_\_ | | 3rd Observation  Day\_\_\_\_\_\_ | |
| --- | --- | --- | --- | --- | --- | --- |
|  | Number of Leaves | Height | Number of Leaves | Height | Number of Leaves | Height |
| Plant 1 |  |  |  |  |  |  |
| Plant 2 |  |  |  |  |  |  |
| Plant 3 |  |  |  |  |  |  |

Mixture 2

Soil Composition:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

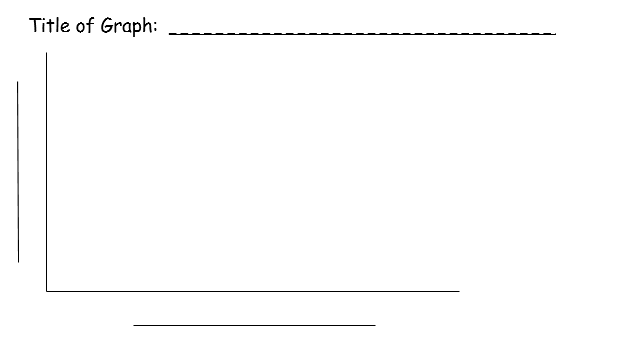
|  | 1st Observation  Day\_\_\_\_\_\_ | | 2nd Observation  Day\_\_\_\_\_\_ | | 3rd Observation  Day\_\_\_\_\_\_ | |
| --- | --- | --- | --- | --- | --- | --- |
|  | Number of Leaves | Height | Number of Leaves | Height | Number of Leaves | Height |
| Plant 1 |  |  |  |  |  |  |
| Plant 2 |  |  |  |  |  |  |
| Plant 3 |  |  |  |  |  |  |

Mixture 3

Soil Composition:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  | 1st Observation  Day\_\_\_\_\_\_ | | 2nd Observation  Day\_\_\_\_\_\_ | | 3rd Observation  Day\_\_\_\_\_\_ | |
| --- | --- | --- | --- | --- | --- | --- |
|  | Number of Leaves | Height | Number of Leaves | Height | Number of Leaves | Height |
| Plant 1 |  |  |  |  |  |  |
| Plant 2 |  |  |  |  |  |  |
| Plant 3 |  |  |  |  |  |  |

Using the graph below or a piece of graph paper, make a graph of the height of your plants. The number of days goes on the horizontal axis and the height of the plants goes on the vertical axis.



What did my data tell me about the different mixtures of soil?

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

What were the components of the soil mixture that I would recommend for the garden based on the evidence from the class experiments?

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

**Possible questions to ask after the experiment:**

1. When scientists conduct experiments, they often have additional questions that they would like to investigate. What is another question about soils that you could investigate?
2. A classmate conducted the experiment, but none of the seeds germinated. What might explain why none of the seeds germinated?