



CAN WE GROW PLANTS IN MARS SOIL?

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This report presents findings from experiments conducted in Spring 2002 by three sixth grade and one 3rd grade classes in East Lansing, Michigan. It shows the kinds of data that can be collected by kids in these grades. Norm worked with the classes and has thoughts on how to structure future experiments and data reporting.

CAN WE GROW PLANTS IN MARS SOIL?

MATERIALS AND METHODS:

1. **Plants** – Wisconsin Fast Plants
2. **Containers** – Wisconsin Fast Plant growing system (Styrofoam container, each seed planted in an individual cell (1cm x 1cm x 5cm deep). Each container had 32 individual cells.
3. **Soils** – Earth soil – Greenhouse potting media with no fertilizer; Mars soil – MARS JSC-1 simulant soil from Chris McKay at NASA.
4. **Watering** – Soils were watered till water ran out the bottom before seeding. Immediately following seeding they were watered again. Watering during the experiment was through a capillary mat system that ran under the Styrofoam containers. The water reservoir was replenished weekly. If the soil surface in the cells appeared dry they were watered by hand from the top as well.
5. **Lighting** – all plants were grown under fluorescent lights with a 24 hour photoperiod.
6. **Temperature** – plants were grown in the classroom at room temperature.
7. **Scientists** – 6th graders – students were assigned to one of five scientist groups (Soil, Seed Germination, Plant Growth, Flowering, or Seed Production). There were three classes that I worked with so there were three of each scientist group. They took data approximately twice per week at the beginning of the day. 3rd graders – Each student was assigned one day to collect data using a pre-constructed data sheet.
8. **Results** – Data for the soils, Seed Germination – 6th grade, and Plant Growth – 6th grade is the average of the three 6th grade scientist groups. Data for Seed Germination – 3rd grade and Plant Growth – 3rd grade is the actual data from the class. Data for Flowering and Seed Production are from the 6th graders and are actual numbers from one scientist group that are representative of the overall data collected.

QUESTION:

Will plants grow in Mars soil?

Will plants grow the same in Mars soil as they grow in earth soil?

RESEARCH:**HYPOTHESIS:**

Each scientist group will predict how plants will grow in Mars soil compared to how they grow in earth soil.

DESIGN AN EXPERIMENT:

For our experiment we will grow Wisconsin Fast Plants in Mars soil and earth soil. We will look at many different parts of plant growth to really understand if the plants will grow in Mars soil and if their growth is different in Mars soil compared to growth in earth soil.

There are many parts of plant growth that we could study. Based on what we know about plants, we are going to study these things:

1. The soil
2. Seed germination
3. Plant growth
4. Flowering
5. Seed production

COLLECT DATA:

Each class will be divided into 5 scientist groups - Soil, Seed Germination, Plant Growth, Flowering, and Seed Production. Each group will record their specific data. Data collection will occur first thing in the morning (during contact), sometimes during science and during lunch.

EXPLAIN DATA:

Data will be combined at the end to answer the overall questions -

Will plants grow in Mars soil?

Will plants grow the same in Mars soil as they grow in earth soil?

ASK NEW QUESTIONS:

Students will be encouraged to ask the next questions for future studies.

SOIL SCIENTISTS:

Scientists that study the properties of soils to understand what they are made of and how they affect plant growth.

QUESTION:

Will Mars soil be similar to earth soil?

RESEARCH - Resources:

Articles

Web sites:

HYPOTHESIS:

Write your hypothesis for how the pH of Mars soil will compare to the pH of earth soil.

The pH of Mars soil will be higher than Earth soil.

The pH of Mars soil will be lower than Earth soil.

Write your hypothesis for how the electrical conductivity (EC) of Mars soil will compare to the EC of earth soil.

The EC of Mars soil will be higher.

The EC of Mars soil will be lower.

DESIGN YOUR EXPERIMENT:

To see if Mars soil is similar to earth soil we will do these tests:

1. Carefully describe the soils
2. Measure pH (how acidic or basic it is)
3. Measure EC (electrical conductivity – a measure of the amount of ions that conduct electricity, often a pretty good measure of the amount of salt in a soil)
4. Send a sample to the MSU soil testing lab for a complete analysis
5. We will make these measurements at the beginning of the experiment and at the end to see if they change.

RESULTS: (averaged across 3 experiments, one per 6th grade class)

Soil parameter	Earth soil	Mars soil
Beginning pH	6.0	6.0
Beginning EC	1.8	2.0
Ending pH	6.0	6.6
Ending EC	3.5	1.2

SEED GERMINATION SCIENTISTS:

Scientists that study how seeds germinate and how environmental factors affect seed germination.

QUESTION:

Will 'Fast Plant' seeds germinate differently in Mars soil compared to earth soil?

Will they germinate at the same speed in the two soils?

Will the same number of seeds germinate in each soil?

RESEARCH - Resources:

Articles:

Web sites:

HYPOTHESIS:

Write your hypothesis for how Mars soil will affect total seed germination.

We think the seeds will not germinate as well in Mars soil.

Write your hypothesis for how Mars soil will affect how fast seeds germinate.

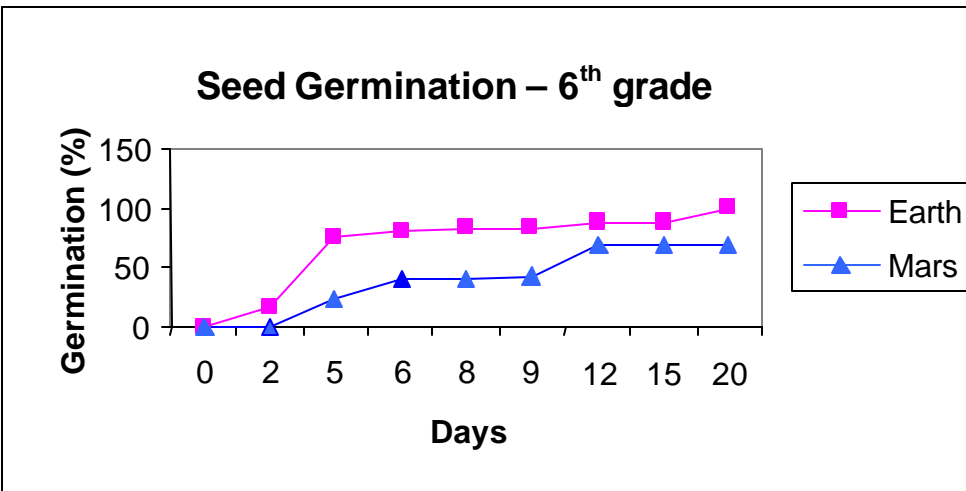
We think that seeds will germinate more slowly in Mars soil.

DESIGN YOUR EXPERIMENT:

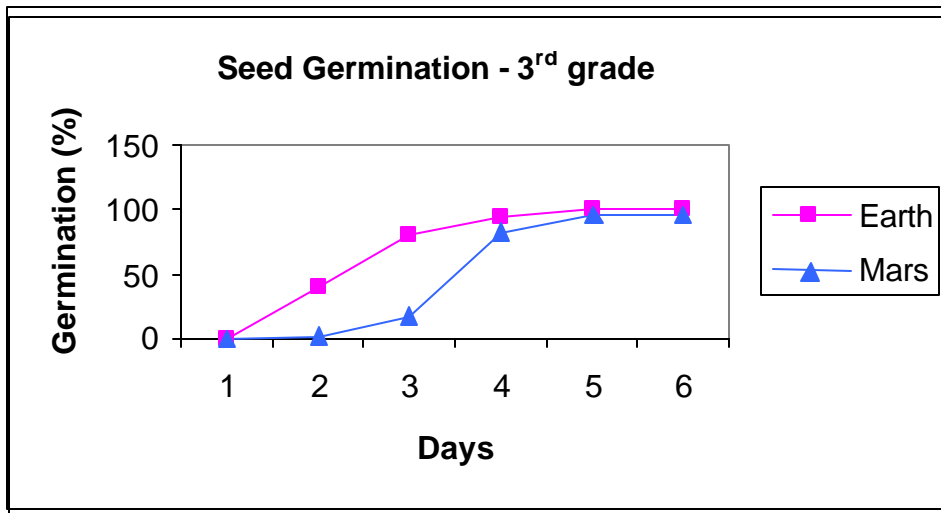
To see if 'Fast Plant' seeds will germinate differently in Mars soil compared to earth soil we will do these tests:

1. Record the number of seeds planted
2. Record when the first seed germinates
3. Record the number of seeds that germinate each day
4. Record when the last seed germinates
5. Record the total number of seeds that germinate

RESULTS: (averaged across 3 experiments, one per 6th grade class)



1. Seeds in Earth soil germinated faster than seeds in Mars soil.
2. Seeds in Earth soil had a higher germination percentage than seeds in Mars soil.
 - May be due to difference in soil moisture
3. Seeds at school germinated faster than seeds in the "Web Garden" at MSU.
 - There were differences in room temperatures



1. Seeds in Earth soil germinated faster than seeds in Mars soil, but total % germination was the same.

PLANT GROWTH SCIENTISTS:

Scientists that study how plants grow and how environmental factors affect plant growth.

QUESTION:

Will 'Fast Plants' grow differently in Mars soil compared to earth soil?

Will they grow at the same rate in the two soils?

Will they grow to the same height in the two soils?

RESEARCH - Resources:

Articles:

Web sites:

HYPOTHESIS:

Write your hypothesis for how Mars soil will affect the rate of plant growth.

We think the plants will grow slower in the Mars soil.

Write your hypothesis for how Mars soil will affect how tall plants grow.

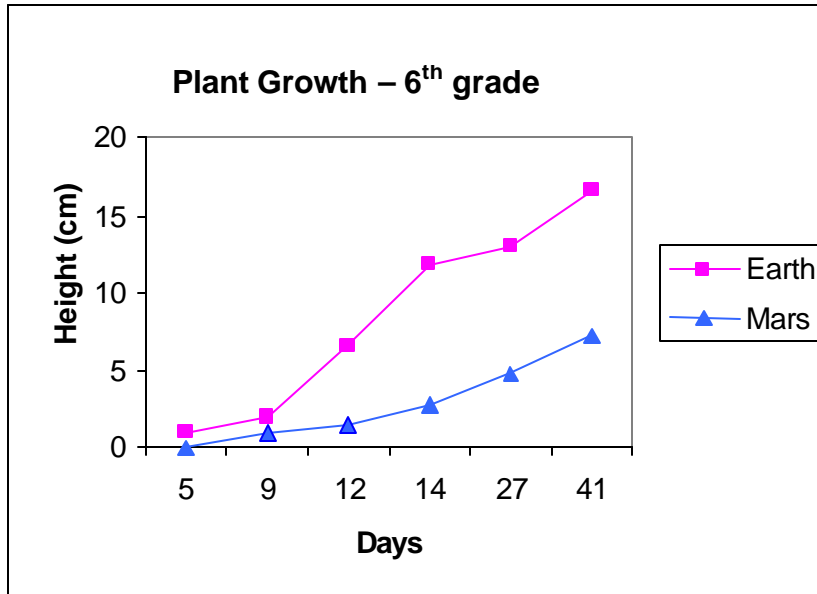
We think the plants will be shorter in the Mars soil.

DESIGN YOUR EXPERIMENT:

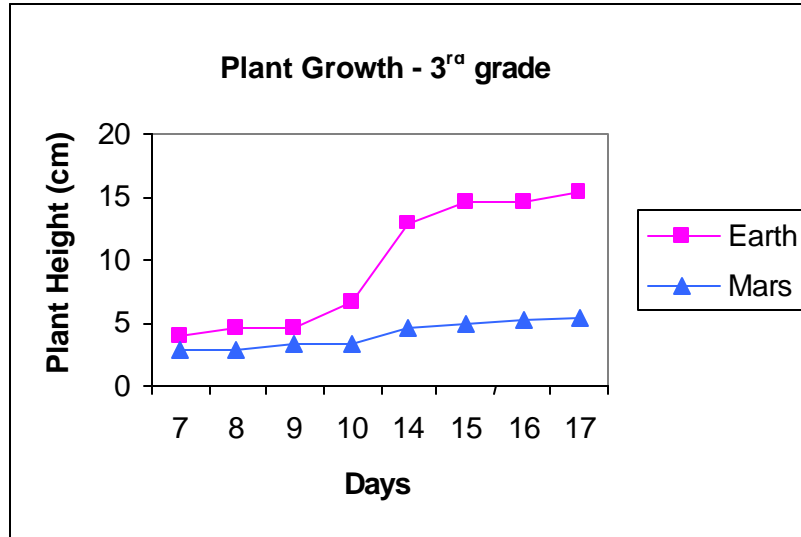
To see if 'Fast Plants' grow differently in Mars soil compared to earth soil we will do these tests:

1. Select 5 plants in Mars soil and 5 plants in earth soil to measure
2. Record the number of days till the first leaf
3. Record the number of leaves on the plants - once per week
4. Record how tall the plants are - once per week
5. Record the total plant dry weight at the end of the experiment

RESULTS: (averaged across 3 experiments, one per 6th grade class)



1. Plants in Earth soil grew faster
2. Plants in Earth soil were almost 3 times taller than plants in Mars soil.



1. Plants in Earth soil grew faster
2. Plants in Earth soil were almost 3 times taller than plants in Mars soil.

PLANT FLOWERING SCIENTISTS:

Scientists that study how plants flower and how environmental factors affect plant flowering.

QUESTION:

Will 'Fast Plants' flower differently in Mars soil compared to earth soil?

Will they flower at the same time in the two soils?

Will they produce the same number of flowers in the two soils?

RESEARCH - Resources:

Articles:

Web sites:

HYPOTHESIS:

Write your hypothesis for how Mars soil will affect when plants flower.

The plants in Mars soil will flower 1 week later than plants in Earth soil.

Mars soil will not affect when the plants flower.

Write your hypothesis for how Mars soil will affect the number of flowers produced.

Plants in Mars soil will have fewer flowers.

DESIGN YOUR EXPERIMENT:

To see if 'Fast Plants' flower differently in Mars soil compared to earth soil we will do these tests:

1. Select 5 plants in Mars soil and 5 plants in earth soil to measure
2. Record the number of days till the first flower
3. Record the number of days till the last flower
4. Record the number of flowers on the plants - twice per week

RESULTS:

Every day there were many more flowers on plants growing in Earth soil compared to plants growing in Mars soil.

The total number of flowers through day 19 were: (averaged across 3 experiments, one per 6th grade class)

Earth soil	Mars soil
113	19

SEED PRODUCTION SCIENTISTS:

Scientists that study how plants produce seeds and how environmental factors affect seed production.

QUESTION:

Will 'Fast Plants' produce seeds differently in Mars soil compared to earth soil?

Will they produce seeds at the same time in the two soils?

Will they produce the same number of seeds in the two soils?

RESEARCH - Resources:

Articles:

Web sites:

HYPOTHESIS:

Write your hypothesis for how Mars soil will affect when plants produce seeds.

Plants in Mars soil will produce seeds later than plants in Earth soil.

Write your hypothesis for how Mars soil will affect the number of seeds produced.

Plants in Mars soil will produce less seeds than plants in Earth soil.

Plants in Mars soil will produce more seeds than plants in Earth soil.

DESIGN YOUR EXPERIMENT:

To see if 'Fast Plants' produce seeds differently in Mars soil compared to earth soil we will do these tests:

1. Select 5 plants in Mars soil and 5 plants in earth soil to measure
2. Record the number of days till the first seed pod
3. Record the number of days till the last seed pod
4. Record the number of seed pods on the plants - once per week
5. Record the total number of seed pods
6. Record the total number of seeds

RESULTS:

Every day there were lots more seed pods on the plants growing in Earth soil compared to plants growing in Mars soil.

The total number of seed pods through 35 days was: (averaged across 3 experiments, one per 6th grade class)

Earth soil	Mars soil
33	10

OVERALL SUMMARY:

Plants growing in Earth soil grew much better than plants growing in Mars soil.

Plant growth	
Seed germination	2 to 6 days faster in Earth soil Slightly higher % germination in Earth soil
Plant growth	About 3 times taller in Earth soil
Flowers	5 to 6 times more flowers in Earth soil
Seed pods	3 to 4 times more seed pods in Earth soil

WHAT'S NEXT?

1. Close comparison between plants in the classroom and plants in the Web Garden.
2. Look at different temperatures.
3. Give some fertilizer to both the Earth and Mars soils.
4. Make sure that flowers are fertilized at least every other day.