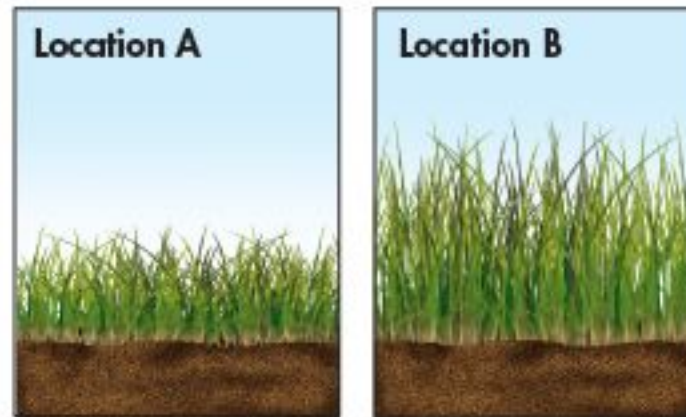


1.1 Designing a Controlled Experiment

Observation and Question

- Observation: Marsh grass grows taller in some locations than others.

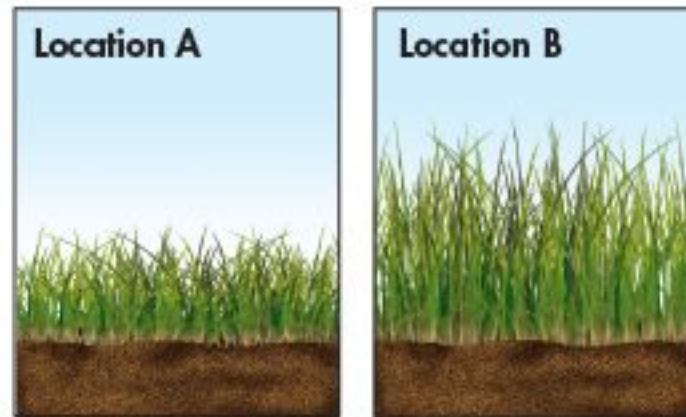
What question might you ask in response to this observation?



Students, write your response!

Observation and Question

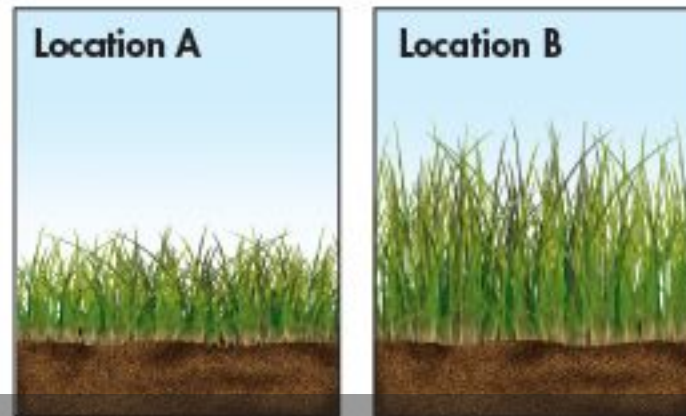
- Observation: Marsh grass grows taller in some locations than others.
- **Question: Why do marsh grasses grow to different heights in different locations?**



Research and Hypothesis

- Research: Grass growth is limited by environmental factors, such as temperature, sunlight, water, or nutrients.

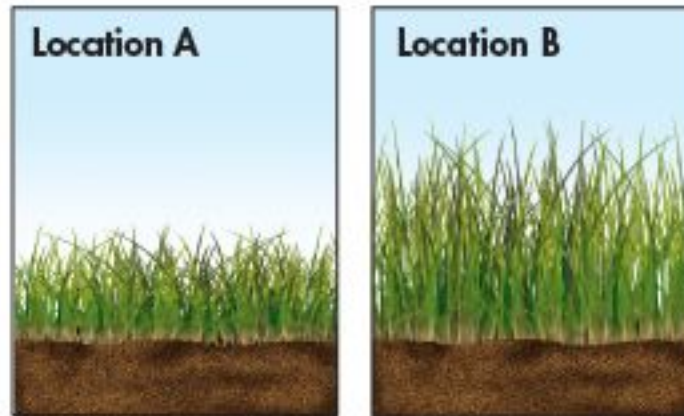
What is a testable hypothesis that you might form based on the research presented?



Students, write your response!

Research and Hypothesis

- Research: Grass growth is limited by environmental factors, such as temperature, sunlight, water, or nutrients.
- **Hypothesis: IF marsh grass is lacking nitrogen, THEN the marsh grass will not grow taller.**

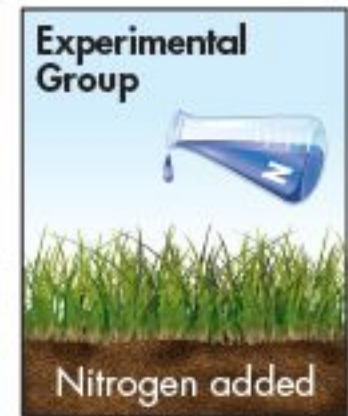


Designing Controlled Experiments

- Testing a scientific hypothesis often involves designing an experiment that keeps track of **variables**, various factors that can change.
- Whenever possible, a hypothesis should be tested by an experiment in which only **one** variable is changed.
- All other variables should be kept unchanged, or **controlled**.
- This type of experiment is called a **controlled** experiment.

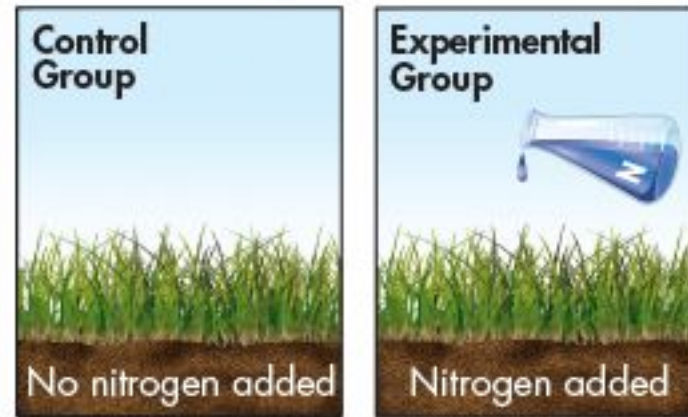
Experimental and Control Groups

- Typically, an experiment is divided into experimental and control groups.
- The **experimental** group receives the variable (treatment) in the experiment.
- The **control** group does NOT receive the variable (treatment) in the experiment. This group serves as a comparison group.



Experimental and Control Groups

- The experimental and control group are exposed to the same conditions except for **one** independent variable. All other variables are controlled.



What one condition is different between these 2 groups?

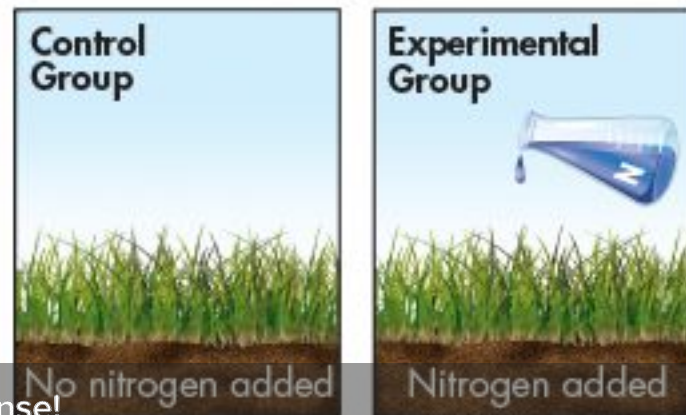


Students, write your response!

Variables

- The factors that can change in the experiment are called **variables**.
- The **independent** (manipulated) variable is purposely changed.

What is the independent variable in this experiment?

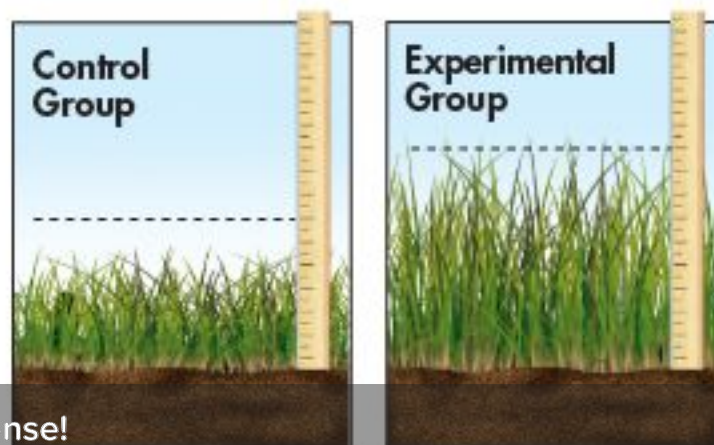


Students, write your response!

Variables

- The **dependent** (responding) variable is observed/measured during the experiment.
- The dependent variable changes in response to the independent variable.
- The dependent variable **DEPENDS** on the independent variable.

What is the dependent variable in this experiment?

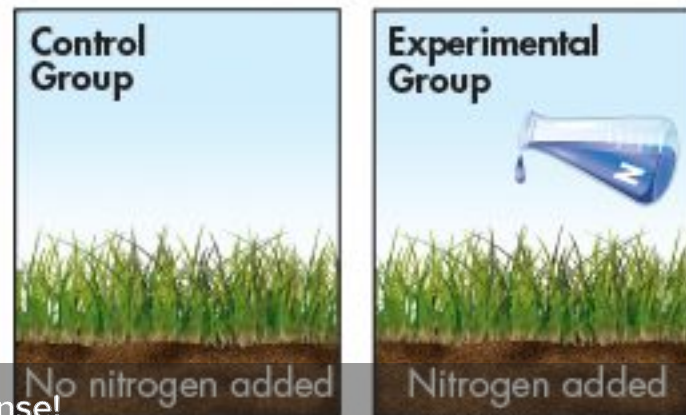


Students, write your response!

Variables

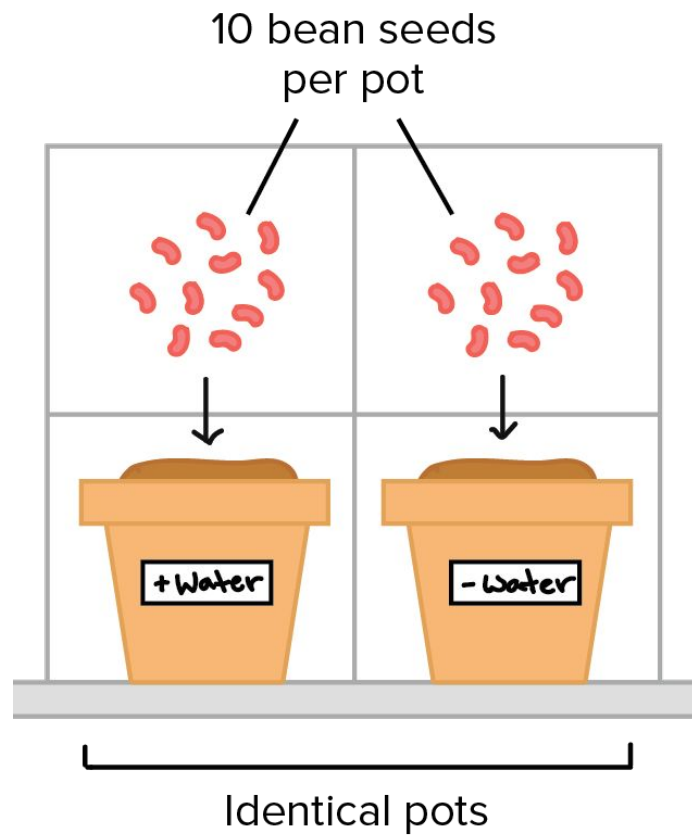
- The **controlled** variable(s) remain unchanged (constant) during the experiment. These variables will be the same between the experimental and control groups.

What are the control variables in this experiment?

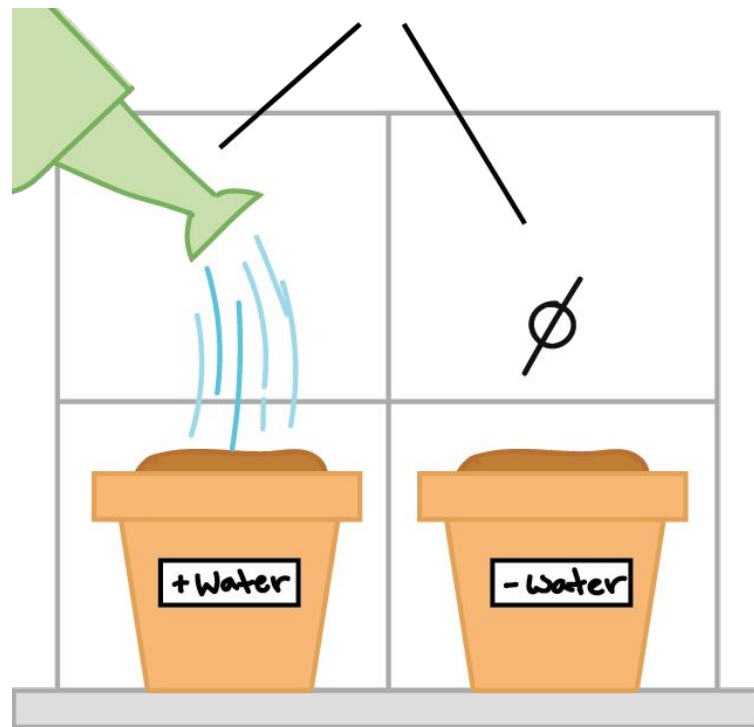


Students, write your response!

HYPOTHESIS: WATER EFFECTS THE GROWTH OF TOMATO PLANTS

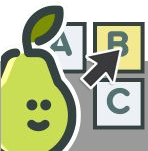


HYPOTHESIS: WATER EFFECTS THE GROWTH OF TOMATO PLANTS



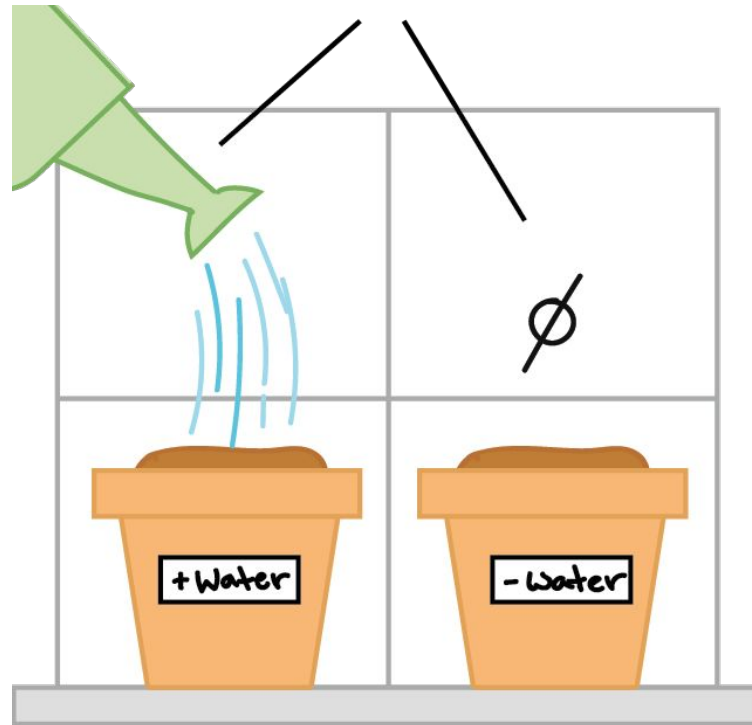
DESIGNING A CONTROLLED EXPERIMENT

Which pot is the experimental group?



Students choose an option

HYPOTHESIS: WATER EFFECTS THE GROWTH OF TOMATO PLANTS

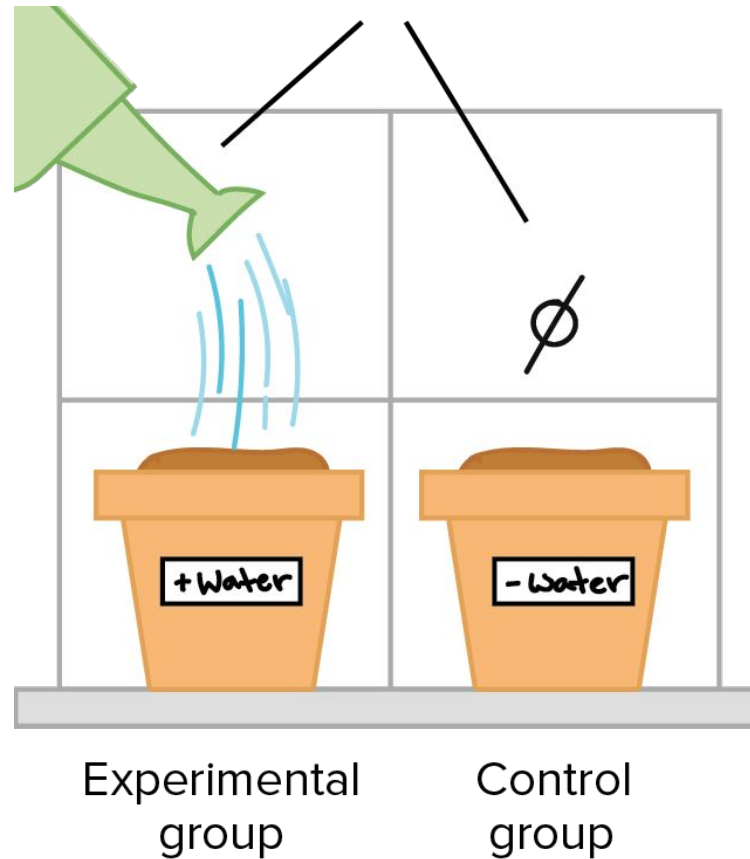


DESIGNING A CONTROLLED EXPERIMENT

Which pot is the control group?

Students choose an option

HYPOTHESIS: WATER EFFECTS THE GROWTH OF TOMATO PLANTS



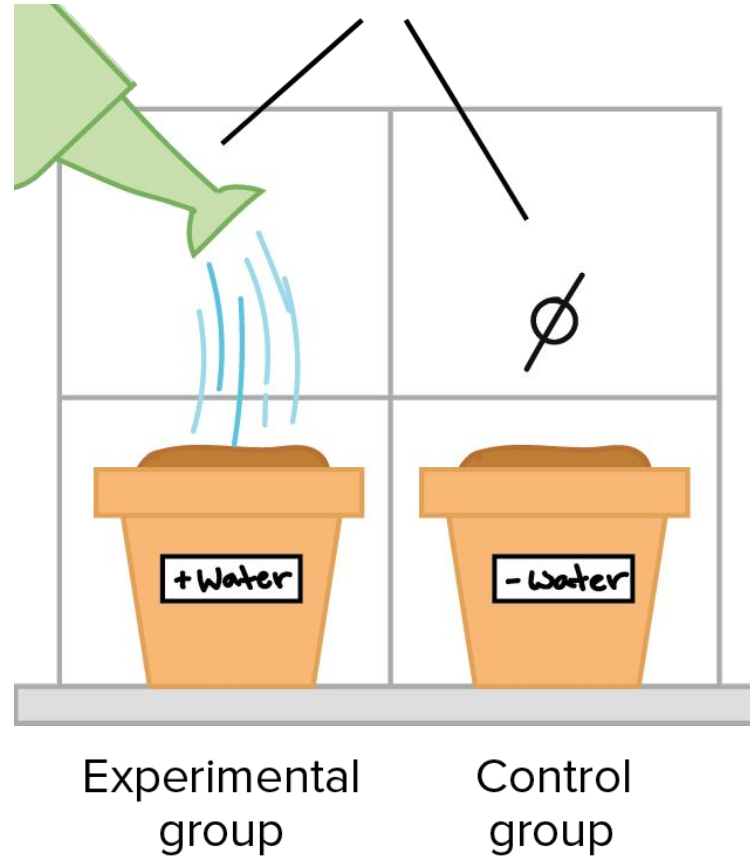
DESIGNING A CONTROLLED EXPERIMENT

Why is the control group necessary?

Students, write your response!

HYPOTHESIS:

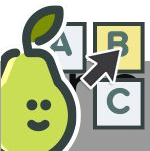
WATER EFFECTS THE GROWTH OF TOMATO PLANTS



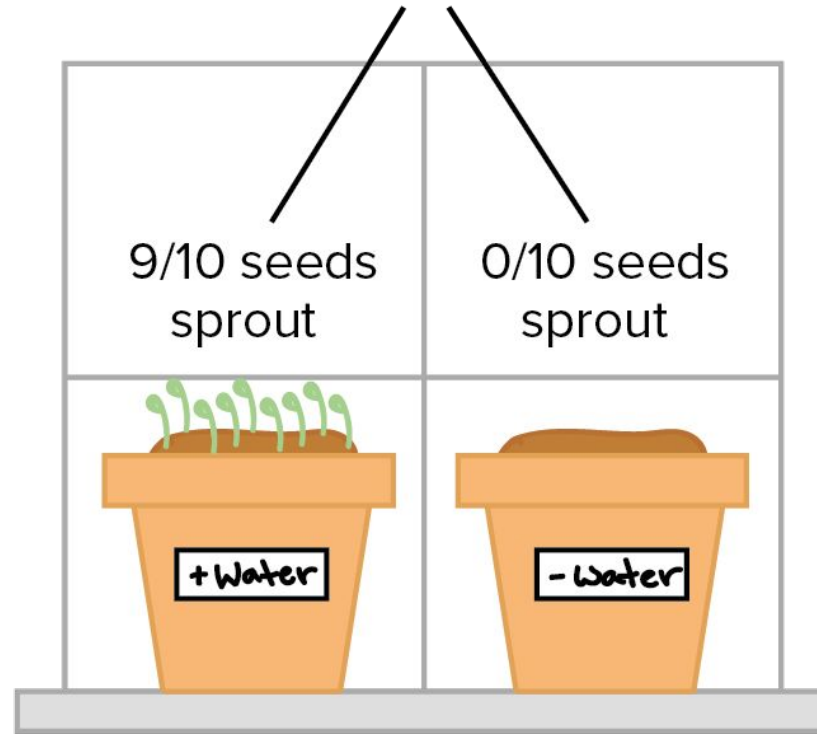
DESIGNING A CONTROLLED EXPERIMENT

What is the *independent variable*?

variable that was changed in the experimental group)



HYPOTHESIS: WATER EFFECTS THE GROWTH OF TOMATO PLANTS



DESIGNING A CONTROLLED EXPERIMENT

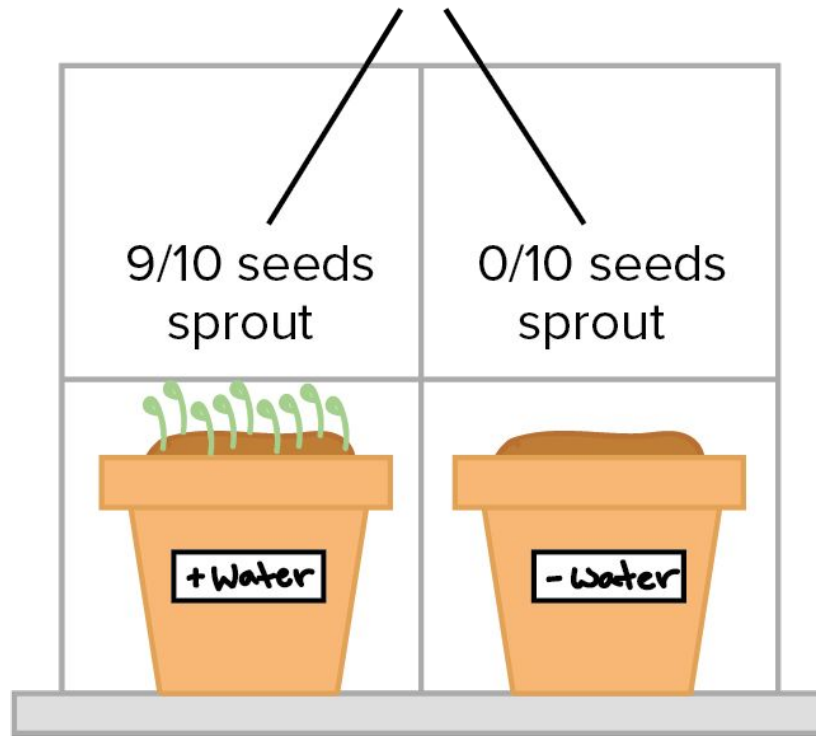
What is the dependent variable?

(the variable that changes in response to the independent variable)



HYPOTHESIS:

WATER EFFECTS THE GROWTH OF TOMATO PLANTS



DATA & ANALYSIS

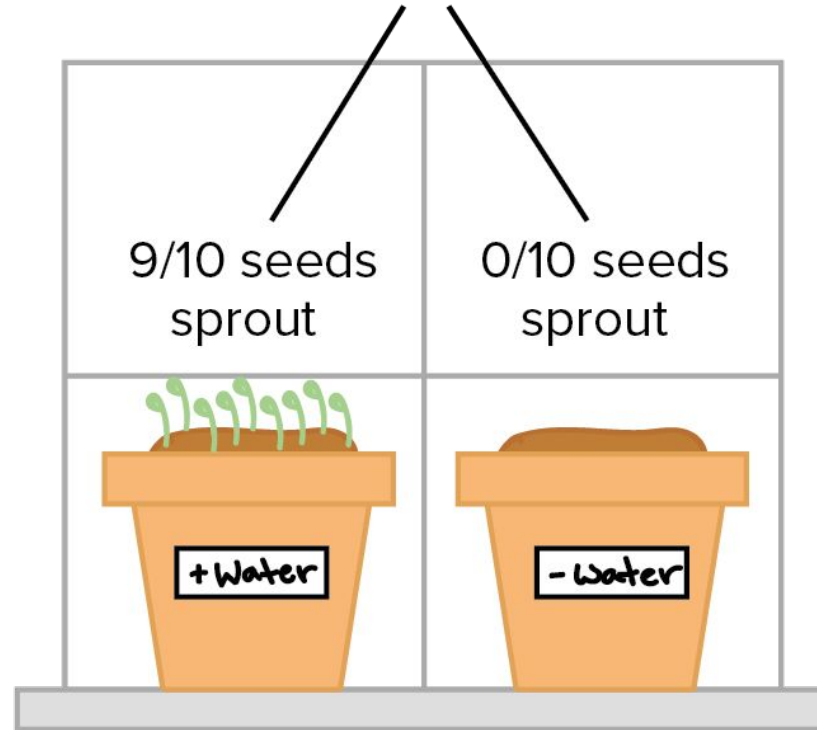
Control Group = 0/10 seeds sprout

Experimental Group = 9/10 seeds sprout

HYPOTHESIS:

WATER EFFECTS THE GROWTH OF TOMATO PLANTS

WHAT IS THE CONCLUSION?



DATA & ANALYSIS

Control Group = 0/10 seeds sprout

Experimental Group = 9/10 seeds sprout

Students, write your response.

HYPOTHESIS:

WATER EFFECTS THE GROWTH OF TOMATO PLANTS

CONCLUSION:

WATER DOES EFFECT THE GROWTH OF TOMATO PLANTS

