Waffle Gardens

Sustaining Life in the Desert

Activity Time:

Long duration – 4 weeks or more

Age Group:

Ages 8 and up

Indigenous peoples of the American Southwest, including the Diné (Navajo), A:shiwi (Zuni), Zia Pueblo, and Laguna Pueblo, have been using a time-tested agricultural method known as a waffle garden to successfully grow crops in the semi-arid environment for generations. This centuries-old technique integrates the cycles of the seasons and geological knowledge of the area to secure the optimal location and methods for growing food. Crops are planted in rows of square cells separated by berms of clay and soil, imitating the shape of waffles. The water pools in the sunken areas of the waffle and is directed to the plant's roots, maximizing water use in the dry climate. These agricultural techniques are still being used today, often combined with ditch irrigation, and will continue for generations to come.

Rainfall is not reliable in the American Southwest, so drought resistant plants have developed over time. Many varieties are specially adapted to the arid environment and hold cultural significance throughout the year. Corn is honored in songs and ceremonies, and squash, beans, and chili peppers have been staples for generations.

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We would love your feedback on this activity! Scan to QR code to complete a Patron Survey.

What's the Point?

Photo courtesy of the Indian Pueblo Cultural Center

- Water is critical and scarce in the Four Corners Region, requiring innovative agricultural techniques to grow adequate amounts of food for communities.
- Reflecting upon and learning about Indigenous relationships with water and the land can help us understand diverse methods of using water in dry climates.
- Ancient Indigenous agricultural techniques include science and math skills that are still effective in modern times.
- There are many ways to address water shortages in dry areas, including dry farming and the waffle garden techniques.

Kit Materials

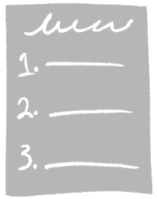
Two rectangular containers for planting

Seeds

Craft sticks

Data Sheets

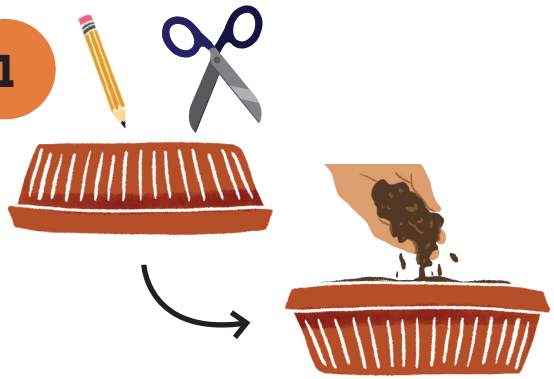
Activity Instructions



Soil

Instructions

1



Cut four holes in the bottom of the rectangular planting containers

Carefully use scissors or a pencil to cut drainage holes the size of a pea. This is important so that water can drain out of the soil and not drown the seeds. Fill both trays with soil (from your neighborhood or purchased from a garden store) to the top.

This represents the landscape of the four corners region.

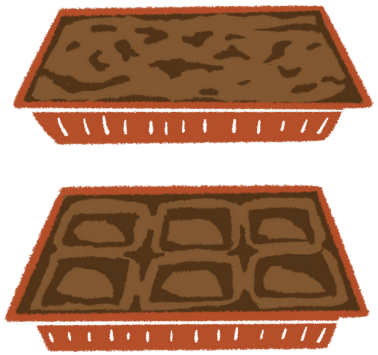
2

Water the soil in both trays.

Use the bucket or watering can to pour water into each tray until the soil is moistened enough to mold into mud.

This represents the seasonal rains.

3

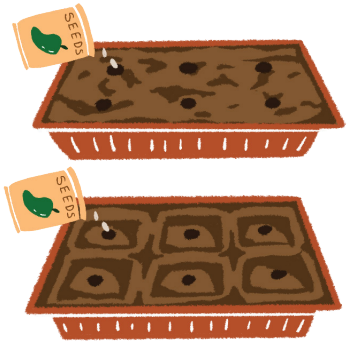


Prepare the Waffle Garden.

With a handful of moist soil, construct walls around the four edges of the tray, each about 1.5 inches (3-5 cm) tall and 1 inch (2.5 cm) thick. Continue making mud walls to form a waffle pattern of interconnecting squares, three squares filling the length of the tray and two filling the width of the tray.

The second tray will represent a waffle garden.

4

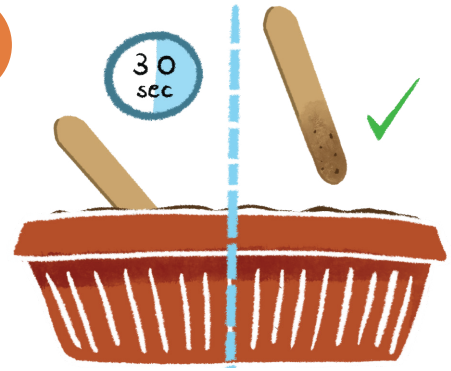


Plant your seeds.

In the first tray, use a craft stick or your finger to make two rows of three holes lengthwise, no more than ¼ inch (0.6 cm) deep. Drop two of the same seeds in each hole and lightly cover with soil. Do not pack down the soil.

In the second tray, make a hole in each waffle plot, no more than ¼ inch deep. Drop two of the same seeds in each hole and lightly cover with soil. Do not pack down the soil.

5



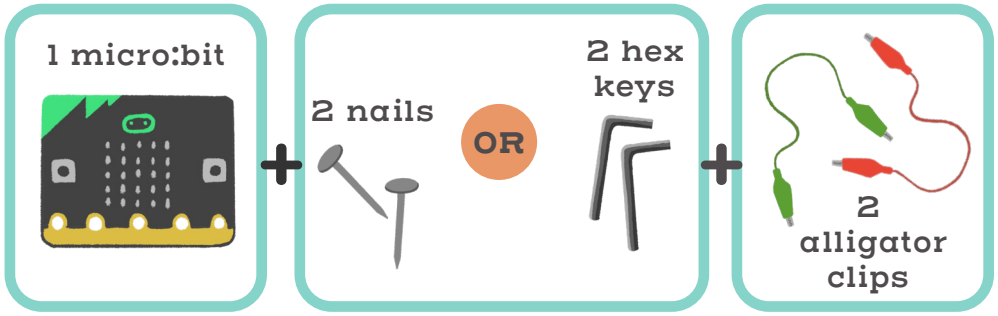
Irrigate and Test.

Twice a day for several weeks, check each tray to determine if the soil is dry enough to need water by inserting a clean, dry craft stick into the center of the trays and leave for 30 seconds. If it comes up with moist with flecks of dirt stuck to it, you do not need to water. If it comes up completely dry with dirt that crumbles right off, then it is time to water.

Record your observations on the data collection sheet to track how often you need to water the first tray compared to the waffle garden tray. You will soon find that the waffle garden retains moisture the longest.

Optional technology extension

Use:



to check the soil moisture content in each container.

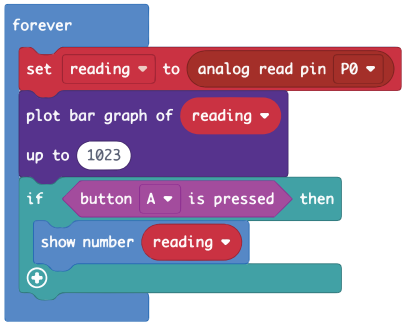
Ask your library if they have micro:bits available for check out!

You can create an electronic circuit using the nails or hex keys (**safer alternative**), alligator clips, and your micro:bit. Water will make the soil have some conductivity. To measure this, we read the voltage on Pin 0 by pressing button A, which returns a reading between 0 (**no current**) and 1023 (**maximum current**).

Very dry dirt will have a reading of around 600. Wet dirt will have a reading of around 1000. If the reading is less than 850, you need to add water so the plants have enough to grow.

Now it's time to experiment!

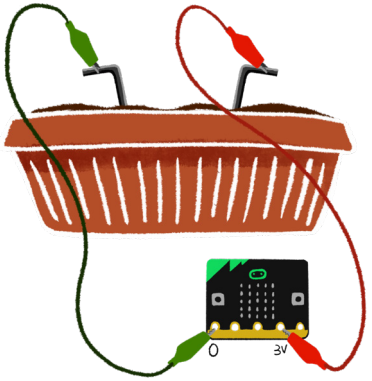
1



Create and Upload Code

Follow these instructions and upload the code to your micro:bit:
https://makecode.microbit.org/projects/soil-moisture/code

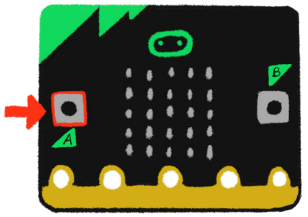
2



Set Up the micro:bit

Insert the two nails or hex keys into one container about 3 inches apart. Attach one alligator clip from the left key to Pin 0 of the micro:bit. Attach the other alligator clip from the right key to Pin 3V of the micro:bit.

3



Collect Data

Press button A to get a reading. If the reading is above 850 you do not need to water. If the reading is below 850, you need to water.

Repeat all steps on second container and record readings on data collection sheet.

Data Collection Sheet

Waffle Garden Container

Date	Craft Stick Observation	(*Optional*) Micro:bit Reading	Needs Water (Y/N)

Data Collection Sheet

Non-Waffle Garden Container

Date	Craft Stick Observation	(*Optional*) Micro:bit Reading	Needs Water (Y/N)