FACTivity

This FACTivity was adapted from the "Roots - Why So Fine?" lesson plan produced by the University of Northern Iowa Tallgrass Prairie Center. To learn more, visit https://tallgrassprairiecenter.org/sites/default/files/lesson_plans/why_so_fine.pdf.

Time Needed

One class period

Materials

- Electronic kitchen scale
- Clock or timer
- Sugar, finely ground coffee, cocoa powder, or similar item
- Measuring cup or tablespoon

Materials (per student or group of students)

- 3 6-inch pieces of ½ inch, twisted rope (hemp or cotton)
- 3 plastic cups with water
- 3 pencils
- 3 binder clips
- Plastic sandwich bag
- Permanent marker
- Why So Fine? Graphic Organizer

In this FACTivity, you will use every-day materials to explore how root size impacts the exchange of materials between roots and their surrounding environment.

FACTivity **Background**

As you read in the “Cream of the Crop” article, the tallgrass prairie ecosystem provides many ecosystem services. For instance, the deep and dense root system of native prairie plants slows water runoff and helps preserve soil and nutrients. The roots of these prairie plants provide structure for the soil. The roots also absorb water and exchange material with the soil.

Many of the tallgrass prairie plants are **perennial**. These root systems are working all year, even though you might only see the aboveground grasses growing during the warmer months. The life cycle of perennial plants is different than many crops grown in similar areas, which are **annuals**.

Much of the exchange between roots and soil occurs at the root tips where many very small roots are found, called “root hairs” (figure 17). The root hairs increase the surface area of root systems, enabling plants to exchange more water and nutrients.

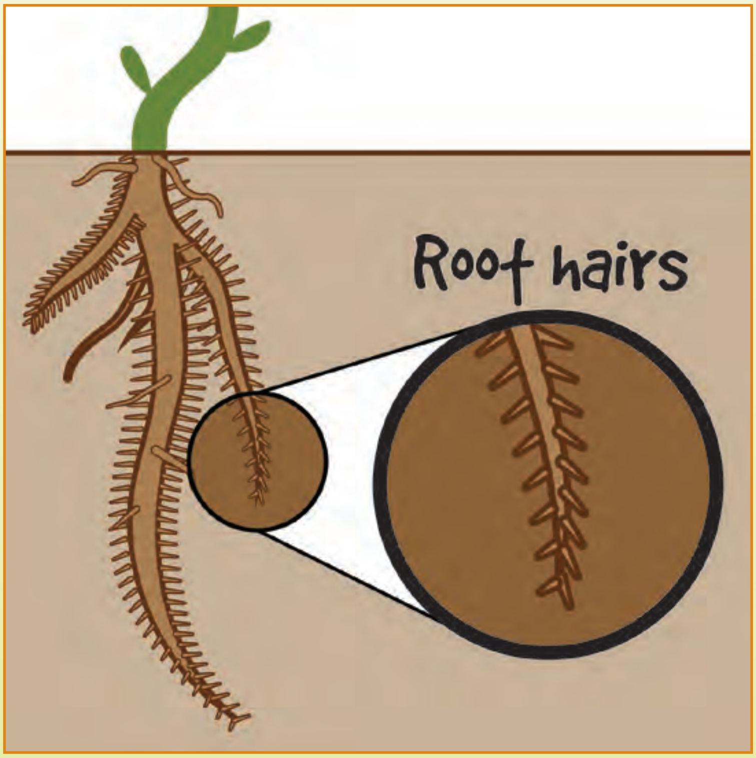

Figure 17. Root hairs are the very small, hair-like roots that grow on the larger roots. Root hairs increase the surface area through which plants can take up nutrients and water with the soil.

Illustration by Stephanie Pfeiffer.

FACTivity **Methods**

Begin by discussing the ecosystem services provided by the native tallgrass prairie ecosystem, like how roots slow water and soil runoff. Images of prairie root systems can be found at: https://www.tallgrassprairiecenter.org/curriculum_images. What do you notice about these roots?

Your teacher will provide each student or group of students with the ropes, plastic cups, pencils, binder clips, plastic sandwich bag, permanent markers, and copies of the "Why So Fine? Graphic Organizer."

Using a permanent marker, label one cup "Thick," one "Medium," and one "Fine."

Fill each cup with the same amount of water. Cups should be filled at least halfway with water.

The three pieces of rope will be made into models of three types of roots or root structures (figure 18). One piece will stay completely twisted to represent a thick root. Another piece should be unraveled half of its length, leaving a few medium strands of rope. The last piece should be unraveled over half its length and separated into many fine strands.

Figure 18. Each of your three pieces of rope should be different. One should represent a thick root, one should represent a few medium-sized roots, and one should represent many fine roots.
Illustration by Stephanie Pfeiffer.

Using the scale provided by your teacher, weigh each of your ropes. Record the weight of each in the appropriate spot on your graphic organizer.

Which root structure will absorb more water? Why? Write your answers to these questions in the appropriate spots on your graphic organizer.

Start the experiment by first attaching the thick rope to the binder clip, then threading the pencil through the metal arms, then placing the rope and clip together next to the appropriate cup of water (figure 19). Repeat this step with each of the other root structure models.

Put each of the root structure models into the appropriate cups, allowing them to rest in the water. Let sit for 10 minutes.

Your teacher will come around after the 10 minutes to help you measure the weight of each model root structure using the electronic kitchen scale. Record the weights of each model root structure in the appropriate spot on your graphic organizer.

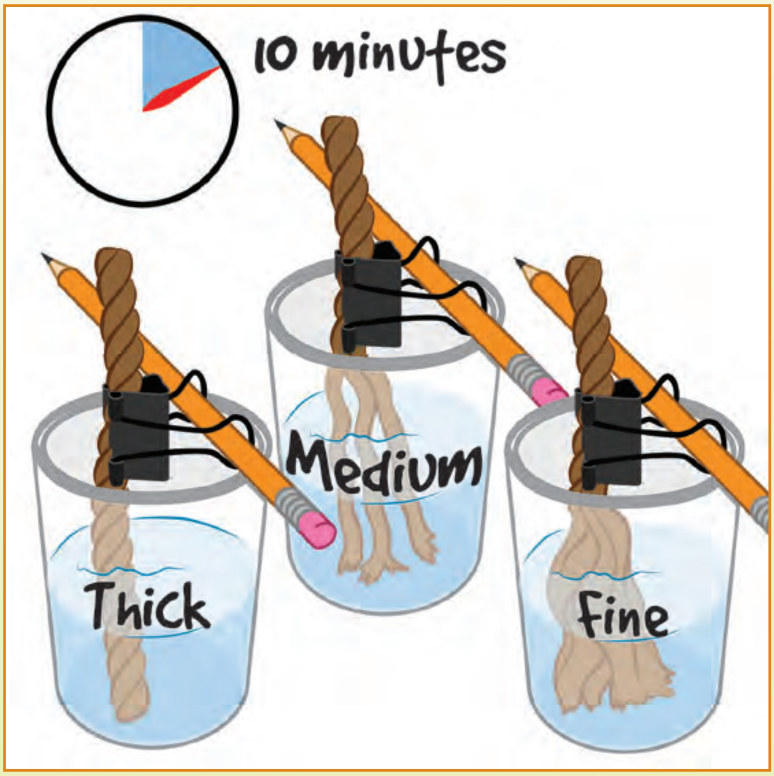

Figure 19. Each piece of rope should be clipped into a different binder clip, and a pencil should be slipped through the metal arms of binder clip.
Illustrations by Stephanie Pfeiffer.

Your teacher will also fill your plastic sandwich bag with sugar, finely ground coffee, cocoa powder, or a similar item. This material represents nutrients that can be exchanged with the roots.

One at a time, take each model root structure, place it in the bag. Close the bag and shake the bag for 10 seconds (figure 20).

Once all three have been individually shaken in the bags, look at the model root structures and rank them based on how much material is attached to the rope. Number one should be the root with the most nutrients and number three should be the root with the least nutrients. The more material attached, the more "nutrients" the model root structure could exchange with the soil.

Record these rankings on the appropriate spot on the graphic organizer.

Figure 20. Place each piece of rope individually into the bag and shake for 10 seconds. Remove the rope and place it on the table until each rope has been shaken and compared to one another.

Illustration by Stephanie Pfeiffer.

As a class, discuss the results of the experiment. Were your predictions accurate? Why or why not? What did you learn about roots and root structure from this experiment? Why is root structure so important to a plant?

Why So Fine? Graphic Organizer

Complete this graphic organizer as prompted in the Methods section of the FACTivity.

WEIGHT BEFORE		
Thick	Medium	Fine

Which root structure will absorb more water? Why?

WEIGHT AFTER		
Thick	Medium	Fine

Which root structures absorbed the most nutrients?
Rank the root structures 1-3, with 1 being the best and 3 the worst.

1. _________________ 2. __________________ 3.______________________

Were your predictions accurate? Why or why not?
What did you learn about roots and root structure from this experiment?
Why is root structure so important to a plant?
