

1.3 Investigate

How Does the Amount of Starch Vary Between Rice Varieties?

You learned in the last section that different rices have different traits. The size of the grain is one trait. Another trait of rice is how much **starch** it contains. Starch is a type of complex sugar, known as a **carbohydrate**, produced by plants. Plants use energy from the sun, water, and carbon dioxide from the atmosphere to produce sugars in a process called **photosynthesis**. Some of the sugars plants make are used for growth and to support their life systems. The rest of the sugars is stored as starch in the seeds or roots of the plants.

When humans and other animals eat plants, they consume the starch the plants produced. After the starch is eaten, the carbohydrates are digested, or broken down, in a form that the animal's body can use as energy. Starch from grains is a very important source of nutrition for people all over the world. Among the cereals, rice is the most important grain. Rice is the main food for more than half the world's population. Asia, where most people live, produces and consumes most of the world's rice. In addition to starch, rice is a good source of minerals, vitamins, and some proteins. All these compounds are essential for humans. Different kinds of rices have different amounts of these nutrients. Rice is easy to cook, easy to store, and is inexpensive and filling. It is also easy to digest. However, rice is not a complete food. For a healthy, balanced diet, rice needs to be consumed with meat or fish and vegetables.

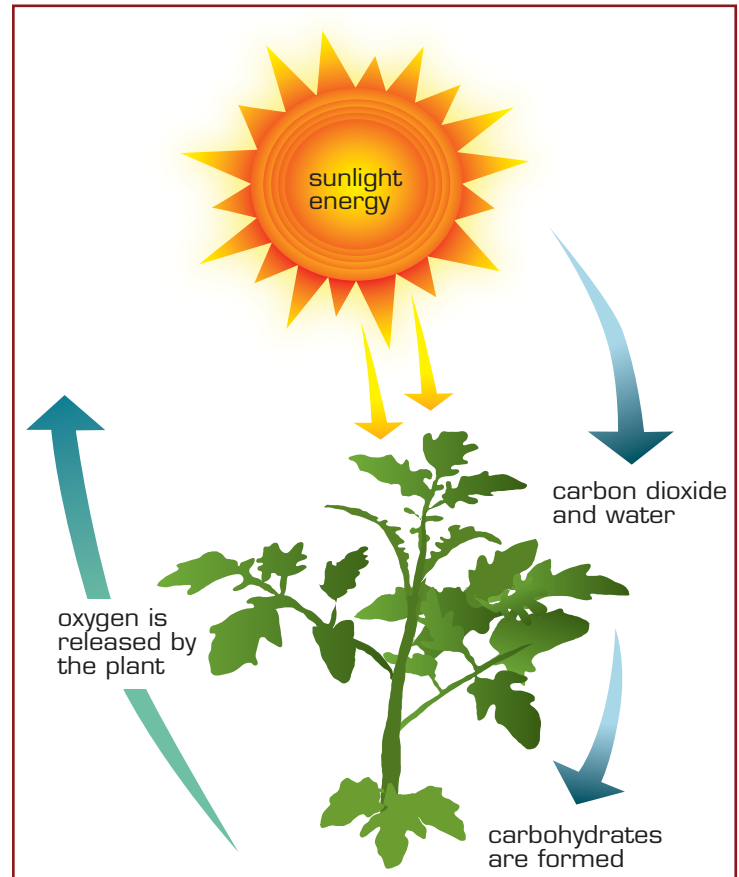
Today, millions of people in some areas of the world suffer from **malnutrition**. Because rice is the main food for most of the world's people, scientists want to find a rice variety that will grow in many different areas and that has the best possible nutritional value. If such a rice variety can be found, it will help improve the lives of many children and adults.

starch: a tasteless, odorless carbohydrate found in foods.

carbohydrate: a complex sugar.

photosynthesis: to put together using light for energy.

malnutrition: a condition resulting from not enough food or lack of the proper food.



Demonstration

Your teacher will first demonstrate how to test for starch in two samples of unknown substances. You cannot observe starch directly, so your teacher will use iodine to test the samples. Iodine is a chemical that reacts with starch and reveals its presence.

Observe

As you watch the demonstration, answer the following questions. Be prepared to discuss your answers with the group.

1. What happens when iodine mixes with a substance containing starch? Record on a piece of paper the changes you notice in the substance.
2. What happens when iodine mixes with a substance that does not contain starch? Record any changes you notice.



Stop and Think

1. How could you use iodine to measure the amount of starch in a rice sample?
2. Make a prediction about the effect of iodine on two different rice samples.
3. Why is measuring the amount of starch in different rice varieties important in addressing the *Big Challenge*?

amylose: a carbohydrate

amylopectin: a carbohydrate.

Rice contains two different types of starch: **amylose** and **amylopectin**. Amylose starch reacts with iodine to form a blue/purple color. Amylopectin does not react with iodine. Other methods are used to test rice for amylopectin. The amount of amylose and amylopectin influence the texture of rice. Rice grains rich in amylose remain firm and separate when cooked. Rice with lots of amylopectin becomes soft and sticky when cooked. Some people prefer one type of rice over another.



Do not eat any of the samples you use in your investigation. Iodine can stain hands or clothing.

Demonstration

Your teacher will now demonstrate how to measure the starch content of two different varieties of rice: Rice A and Rice B. After your teacher mixes iodine with each of the rice powders, examine the color of each of the powders. In the table on your *Amount of Starch Data* page, record the color of each paste. Use the following terms to describe the colors: *brown*, *medium blue*, or *dark blue*.

Amount of Starch		
1.3		
Name: _____ Date: _____		
Use the space in the table below to record the results of the starch demonstration.		
Sample	Color	Presence of starch
Rice A		
Rice B		
Estimate of the amount of starch in each sample of rice.		

Analyze your Data

- What color is the Rice-A paste? What does the color indicate? In the table on your data page, record whether or not you think the Rice-A paste has starch.
- What color is the Rice-B paste? Record in the table whether or not you think the Rice-B paste has starch.
- If you think the samples contain starch, use the colors you observed in the demonstration to estimate the amount of starch. You will not be able to tell exactly how much starch the rice contains, but you can estimate whether it has a little or a lot of starch.

In your group, discuss what each group member observed in the demonstrations. Come to an agreement on whether or not both rice samples contain starch. If they do contain starch, agree on which rice contains the most starch.

Communicate Your Results

You will meet with the class to discuss your results. Present your group’s conclusion on whether or not the rice powders have starch and how much starch they contain. Use the following questions to guide your discussion:

- How did your group come to an agreement of whether or not each of the rice samples contains starch?
- How did your group come to the most accurate conclusion on how much starch each rice sample contains?
- Now that you have the most accurate data from each sample of rice, are the differences between the rice samples like the differences between beagles or between beagles and German shepherds? Does your answer agree with your previous conclusion? Discuss your conclusion with the class.

Create Your Explanation

Name: _____ Date: _____

Use this page to explain the lesson of your recent investigations.

Write a brief summary of the results from your investigation. You will use this summary to help you write your Explanation.

Claim—a statement of what you understand or a conclusion that you have reached from an investigation or a set of investigations.

Evidence—data collected during investigations and trends in that data.

Science knowledge—knowledge about how things work. You may have learned this through reading, talking to an expert, discussion, or other experiences.

Write your Explanation using the **Claim**, **Evidence** and **Science knowledge**.

Explain

You have investigated several traits in rice. You will now compare the types of rice to decide if there is only one kind of rice or many kinds. You will begin by making a claim about how many kinds of rice there are. Then, using a *Create Your Explanation* page, you will develop an explanation of your claim and support it with evidence. *Your Create Your Explanation* page helps you make sure your explanation connects your claim with your evidence and science knowledge.

Whether there is only one kind of rice or many kinds of rice is your claim. Your results from the investigations you carried out and the demonstration you observed are your evidence. You may have some science knowledge from your own experiences or from readings. Record all this information in the appropriate boxes. Then write a statement using your evidence and science knowledge to support your claim. This is your explanation.

A good explanation can convince someone else that your interpretation is good. If your statement doesn't seem convincing, revise your claim so your evidence and the science you know support it. Because your understanding of rice and the traits of rice may not be complete, you may not be able to fully explain your explanation. But you will use what you have read and what you know to develop your best claim and explanation. Scientists finding out about new things use the same procedure. When they only partly understand something, it is impossible for them to form a "perfect" explanation. They do the best they can based on what they understand. As they learn more, they make more accurate or clearer explanations. You will explain your results the best you can based on what you know now. Then, after you learn more, you can make your claims and explanations more accurate.

Share Your Explanation

Share your group's claim and explanation with the class. Tell the class what makes your claim accurate based on your evidence and science knowledge. Pay special attention to how the other groups have supported their claims with science knowledge. Ask questions or make suggestions if you think a group's claim is not as accurate as it could be or if the group has not supported their claim well enough with evidence and science knowledge.

What's the Point?

Rice grains can be compared by the amount of starch they contain. Because starch is a main source of food energy, it is important to understand how much starch each type of rice contains. The more starch in a grain, the better its nutritional value.

