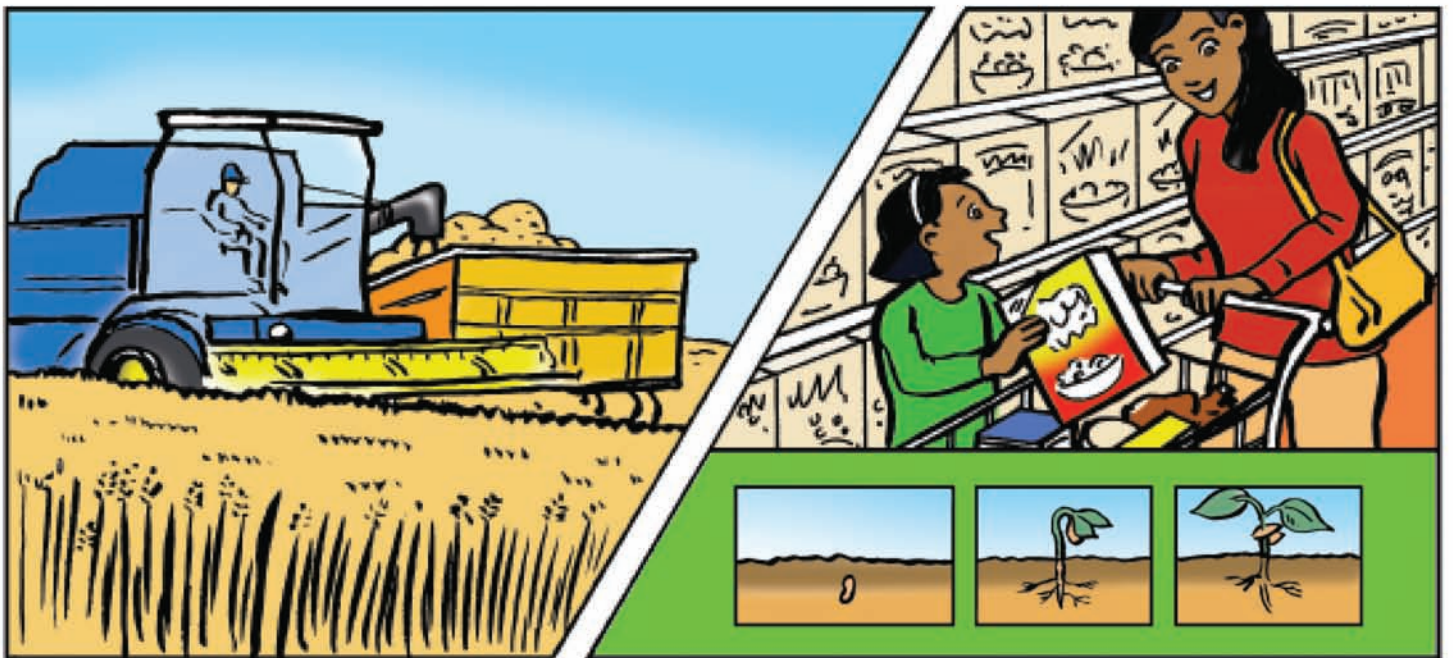




**RIGHT SOURCE** **RIGHT RATE** **RIGHT TIME** **RIGHT PLACE**





# the **4Rs**

**RIGHT SOURCE RIGHT RATE RIGHT TIME RIGHT PLACE**

## **INSIDE:**

- 3.....4Rs of Health
- 5.....4Rs of Eating
- 8.....Right Time & Right Source
- 10 .....Background Information
- 11.....4Rs of Soil
- 13 .....Fertilizer & the 4Rs
- 15 .....Right Rate, Right Place
- 16 .....Discover the 4Rs! Experiment
- 18 .....Graphic Organizers
- 26 .....4R Scramble
- 27.....4R Badges

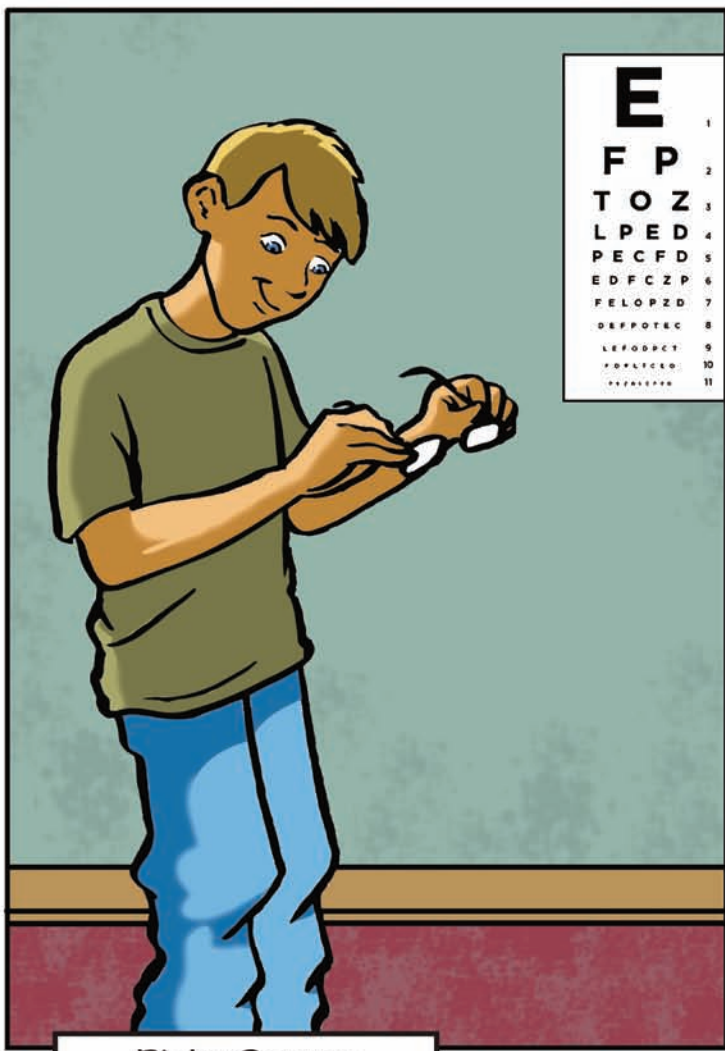
Nutrients for Life Canada would like to thank Nutrients for Life Foundation (USA) for allowing us to use the content of their educational and technical material necessary for the production of this document.



# 4Rs of Health



Henry cannot see the board in class. He visits the eye doctor, who tests his vision. The eye doctor prescribes eyeglasses for him.



Right Source

Some people have perfect vision, and others, like Henry, need glasses, contact lenses, or even surgery.



Right Rate

Not every person that needs eyeglasses requires the same strength of lens. After some tests, the eye doctor tells Henry that he is nearsighted, which means he has trouble seeing far away objects. The amount of correction in his glasses will bring his vision back to normal. Rate matches the amount of something needed. Rate is a measure, quantity, or frequency.



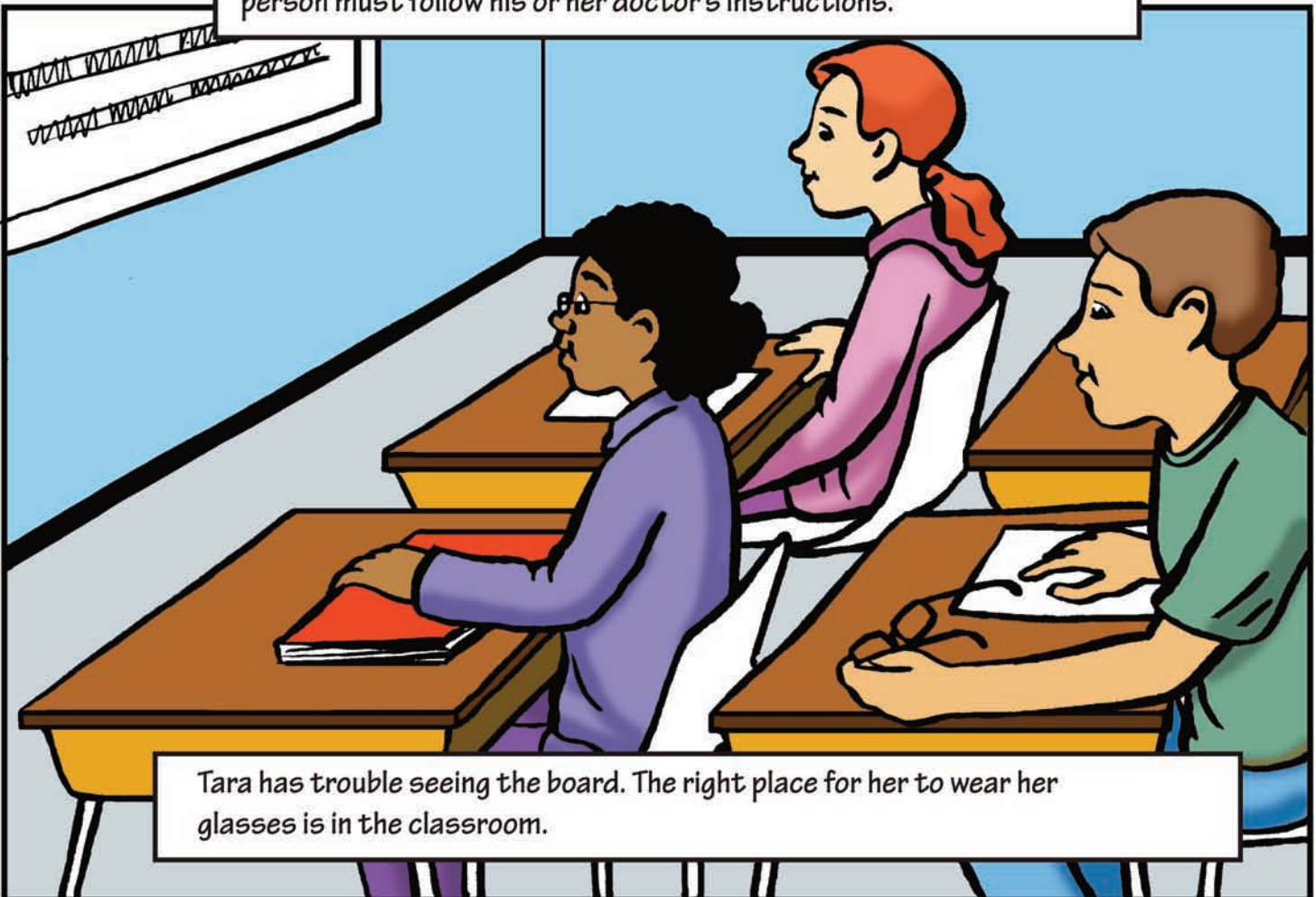
Justin only needs to wear his glasses when reading.

Isabella wears her contacts all day. She is following the eye doctor's instructions and wearing them at the right time.

Right Time & Right Place



The right time can be different from person-to-person, so each person must follow his or her doctor's instructions.

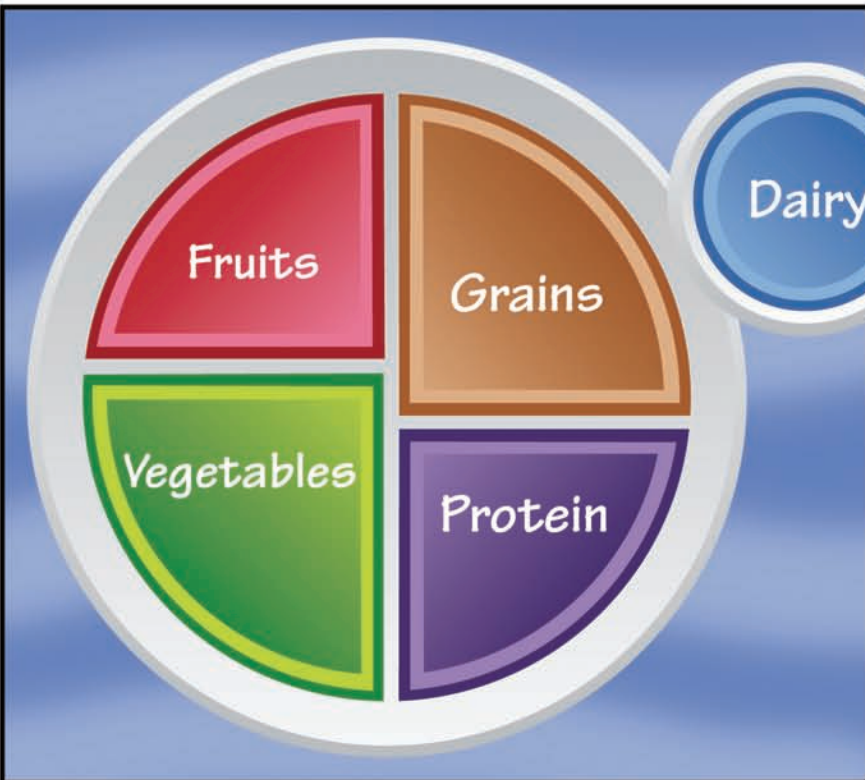


Tara has trouble seeing the board. The right place for her to wear her glasses is in the classroom.



# 4RS of Eating

Antoine likes to eat healthy food, but sometime he gets things a little messed up.

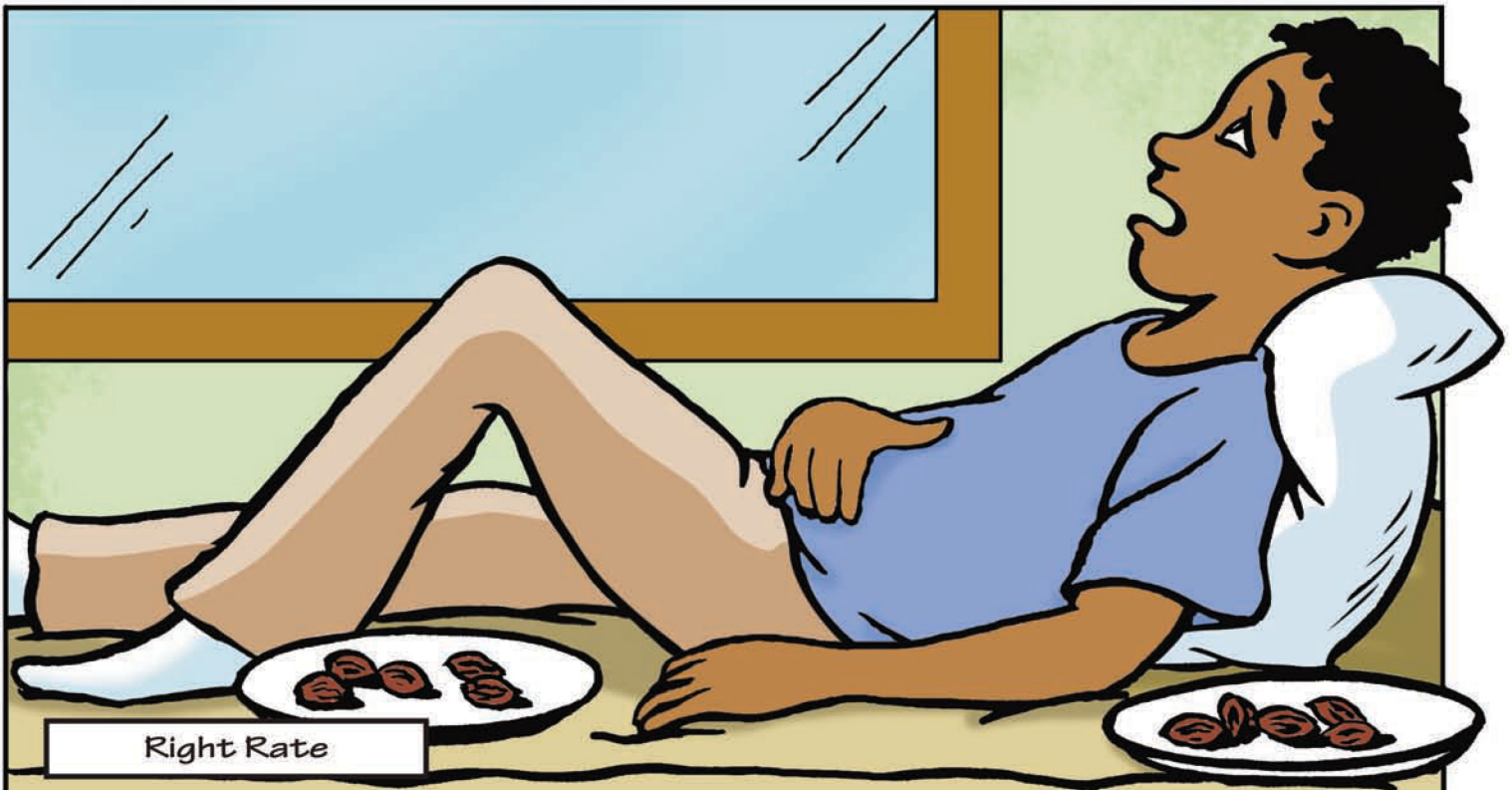


### Right Source

Antoine decided to try dog food. He is eating the wrong source of food! The right source of food matches Antoine's health needs. Instead, Antoine should try to eat vegetables, grains, fruit, dairy, and protein every day.







Right Rate

Antoine just ate two plates of peaches! Although peaches are good for you, two plates is a bit too much to eat at once. Antoine has a bellyache now; he ate peaches in the wrong amount.

The right rate would match the proper portions of food. Instead, his doctor tells him to eat about...

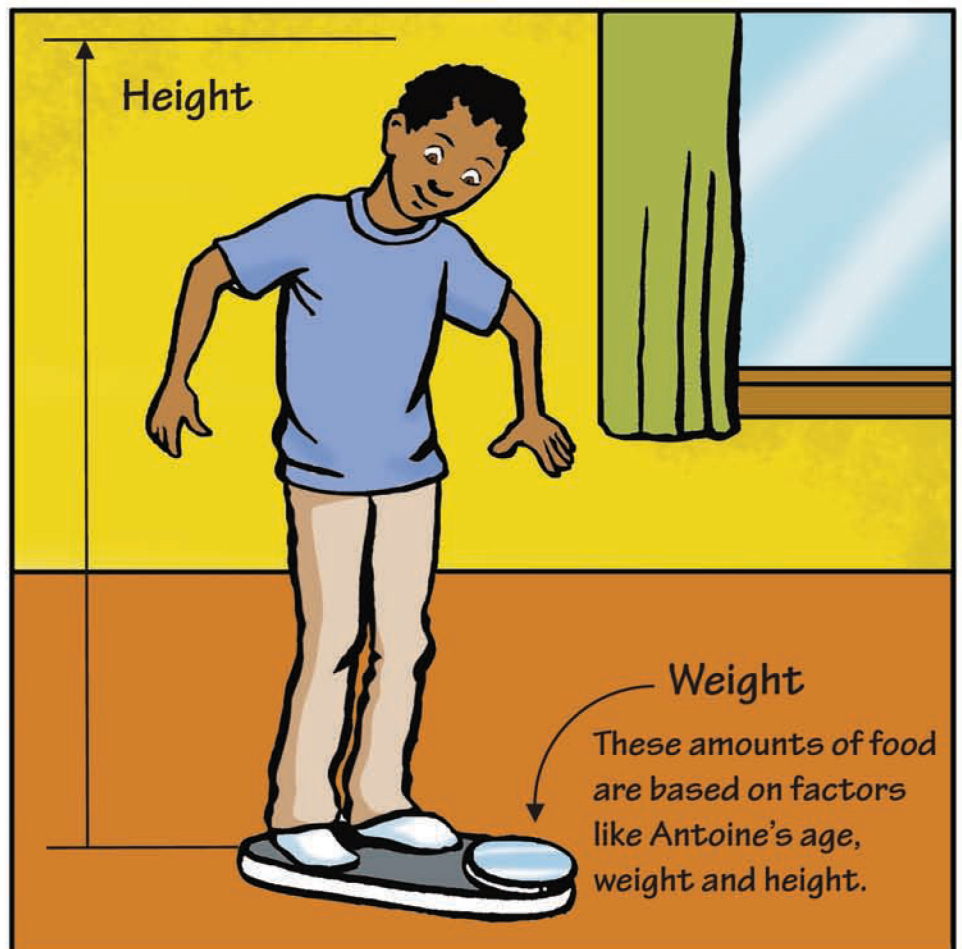
600<sub>gr</sub>  
of vegetables

170<sub>gr</sub>  
of grains

480<sub>gr</sub>  
of fruits

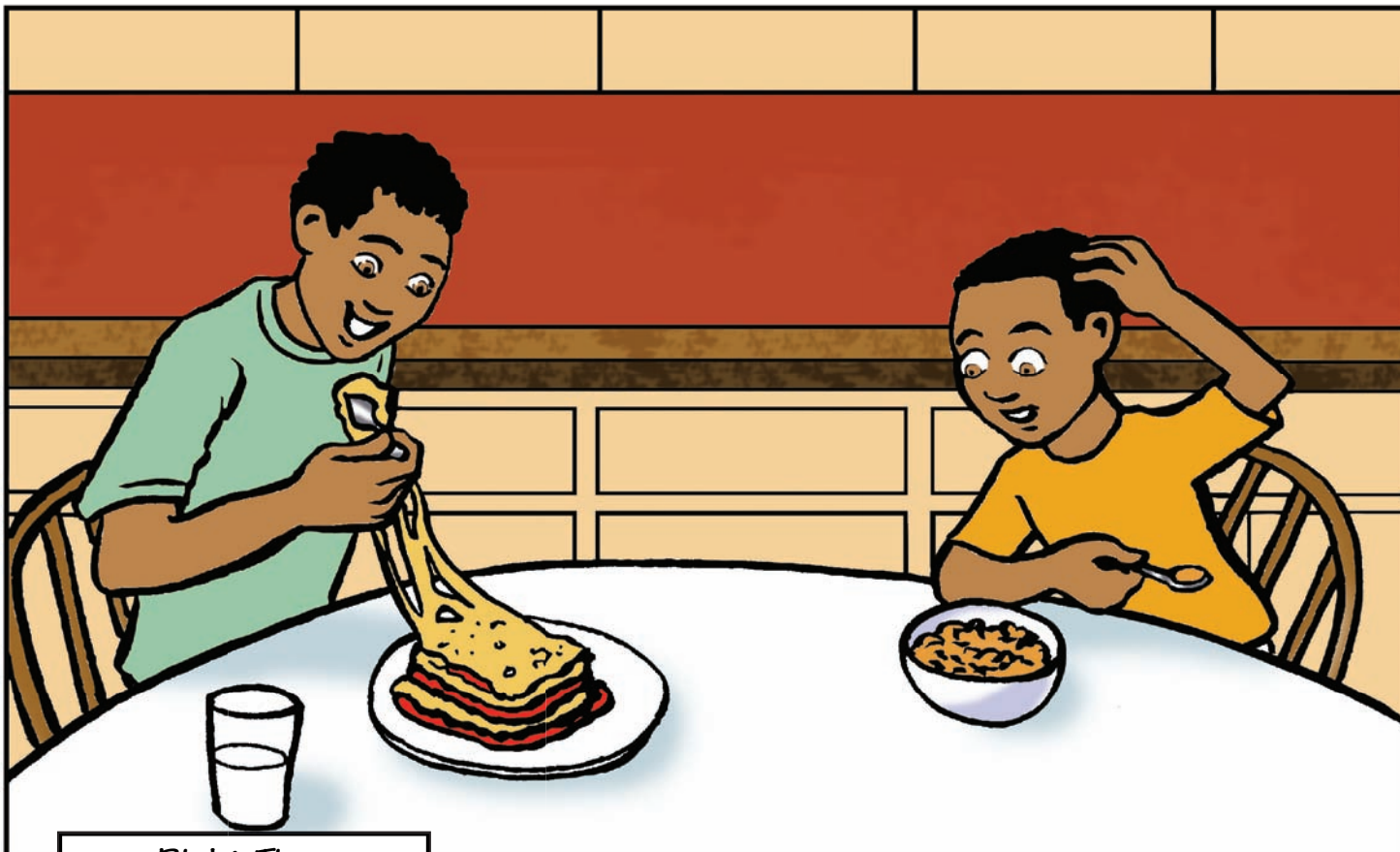
625<sub>ml</sub>  
of dairy, and about

155<sub>gr</sub>  
of protein a day.



These amounts of food are based on factors like Antoine's age, weight and height.



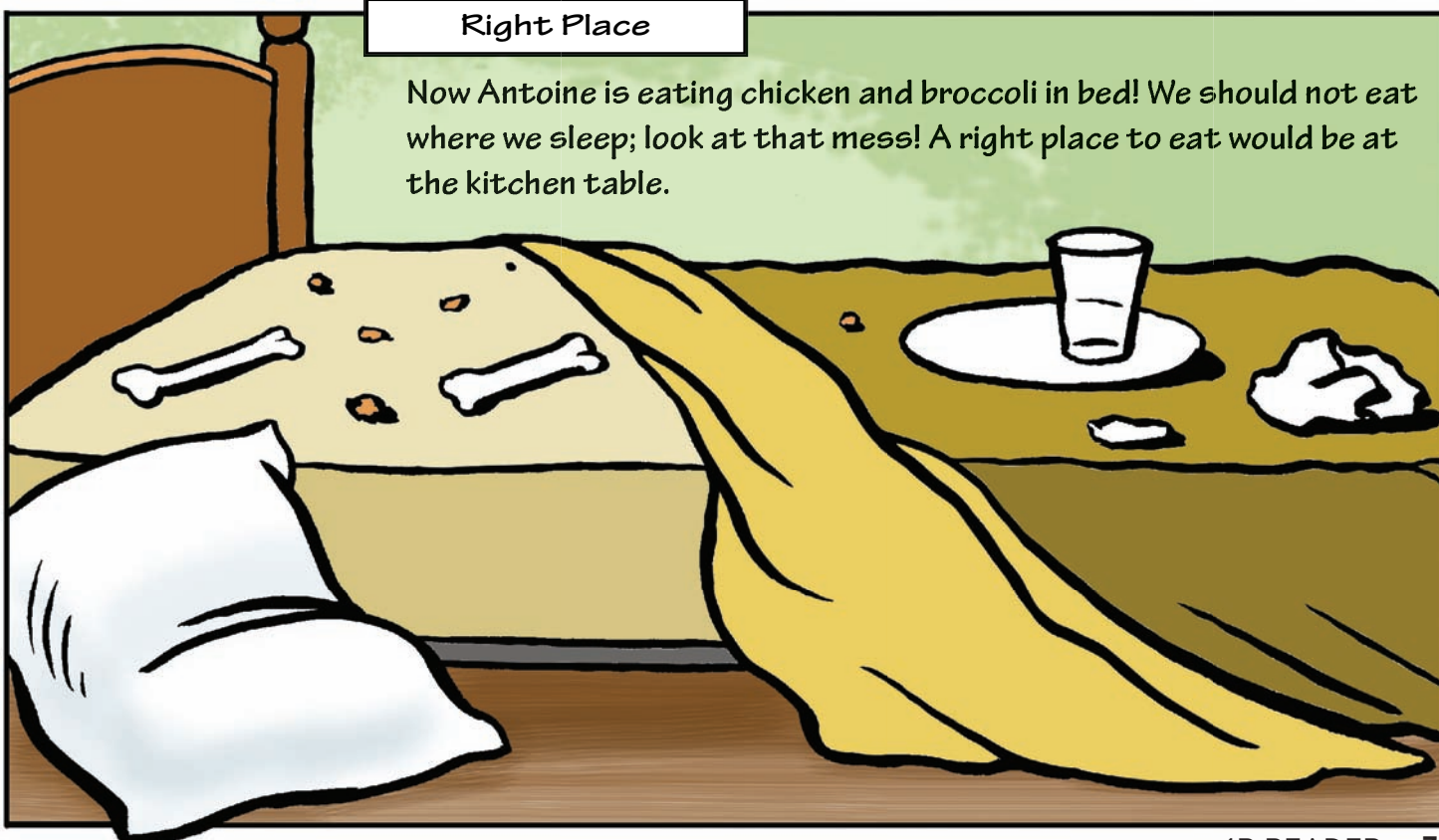


### Right Time

Antoine just ate a full meal thirty minutes ago, but now he's already eating again and he isn't even hungry! Eating when he's full is the wrong time to eat.

### Right Place

Now Antoine is eating chicken and broccoli in bed! We should not eat where we sleep; look at that mess! A right place to eat would be at the kitchen table.





# Right Time & Right Source



Antoine is getting ready for a walk on a snow day. What is Antoine doing wrong?

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**Comprehension Check:** Think about the 4Rs from the previous pages. Write or draw what each “R” means to you. Then share with a partner and discuss as a class to check comprehension.

**Right Source**

**Right Amount**



**The 4Rs  
Four  
Square**

**Right Place**

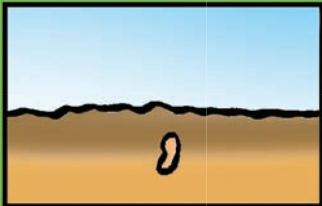
**Right Time**



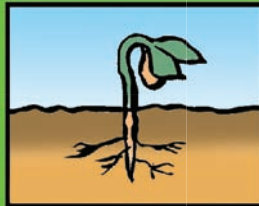
# Background Information on the **4Rs** of Nutrient Stewardship



Farmers test the soil and might apply fertilizer based on the results.



Plant the seed.



The seed grows a plant.



The plants receive fertilizer as prescribed by the soil scientist.



The plants receive fertilizer as prescribed by the soil scientist. Food grows from the plants. Farmers harvest the food. The food from the plant goes to the store.

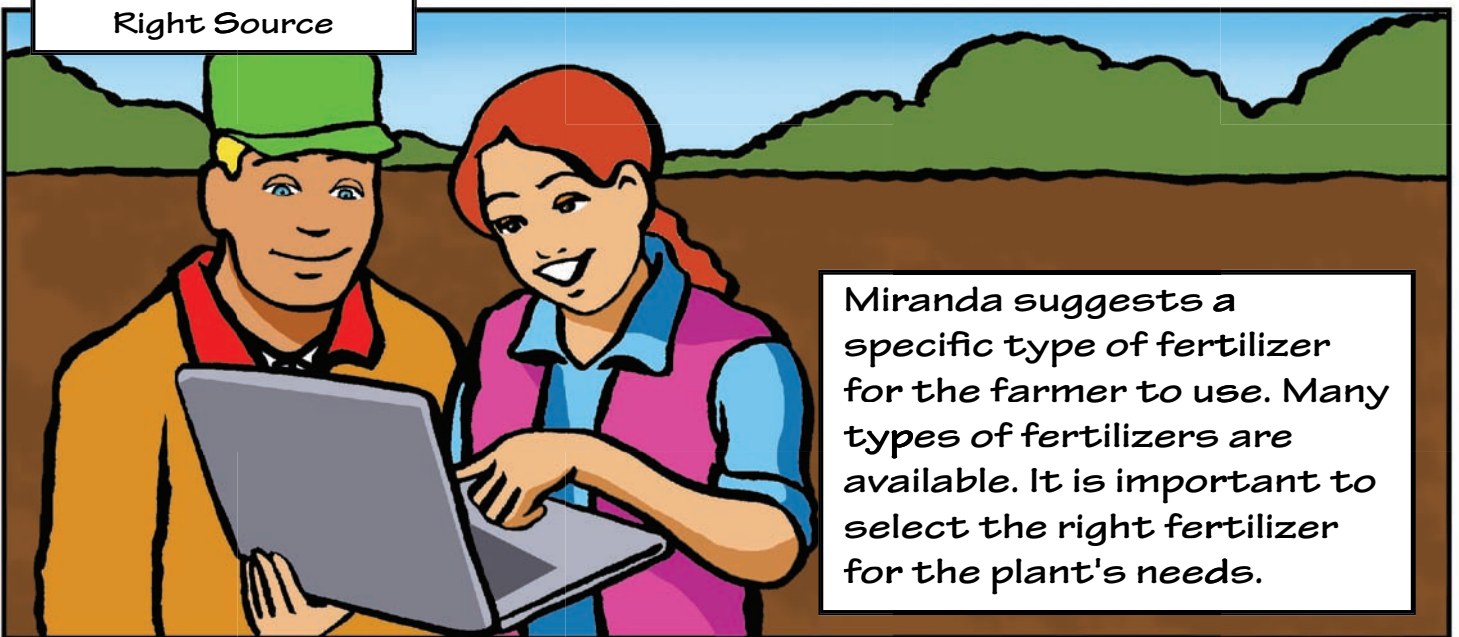


# 4RS of Soil

Meet Miranda, an agronomist! An agronomist is a scientist who helps farmers make decisions about growing the food we eat on their farms. Today Miranda is providing advice to the farmer about fertilizer needs for the growing plants.

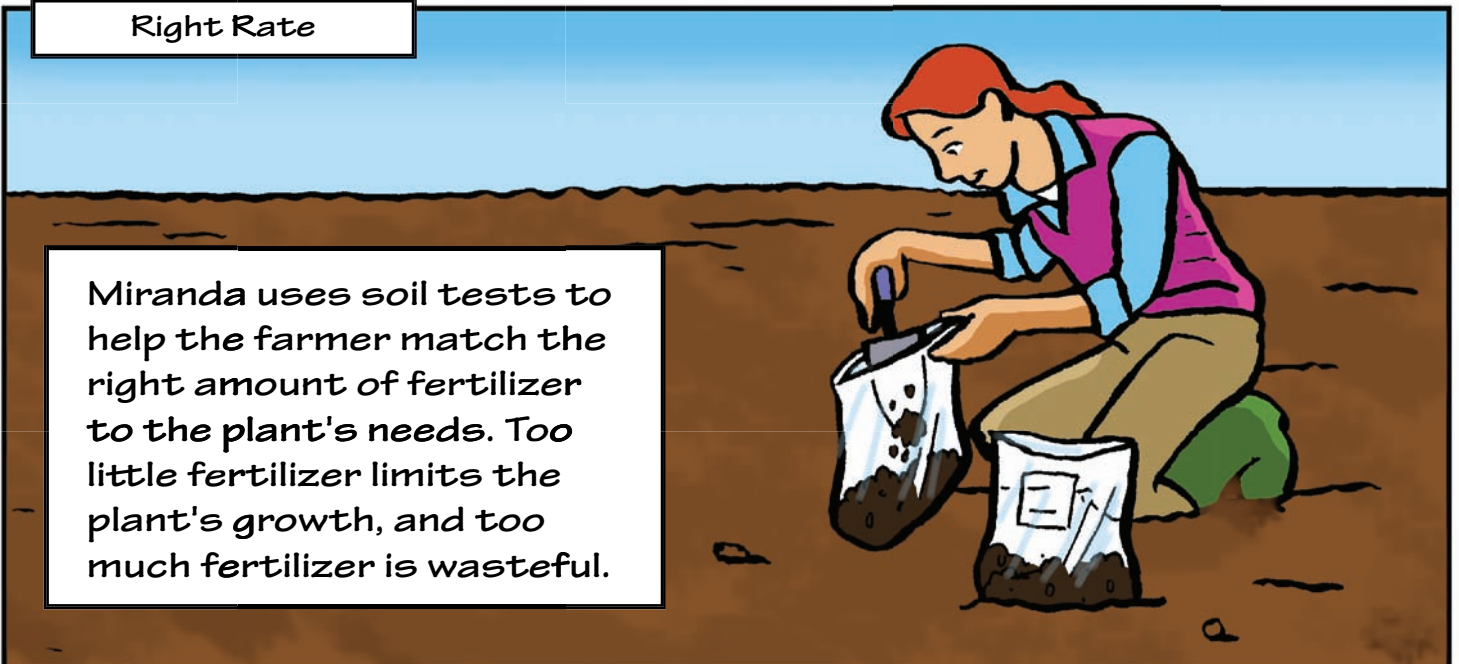


## Right Source



Miranda suggests a specific type of fertilizer for the farmer to use. Many types of fertilizers are available. It is important to select the right fertilizer for the plant's needs.

## Right Rate



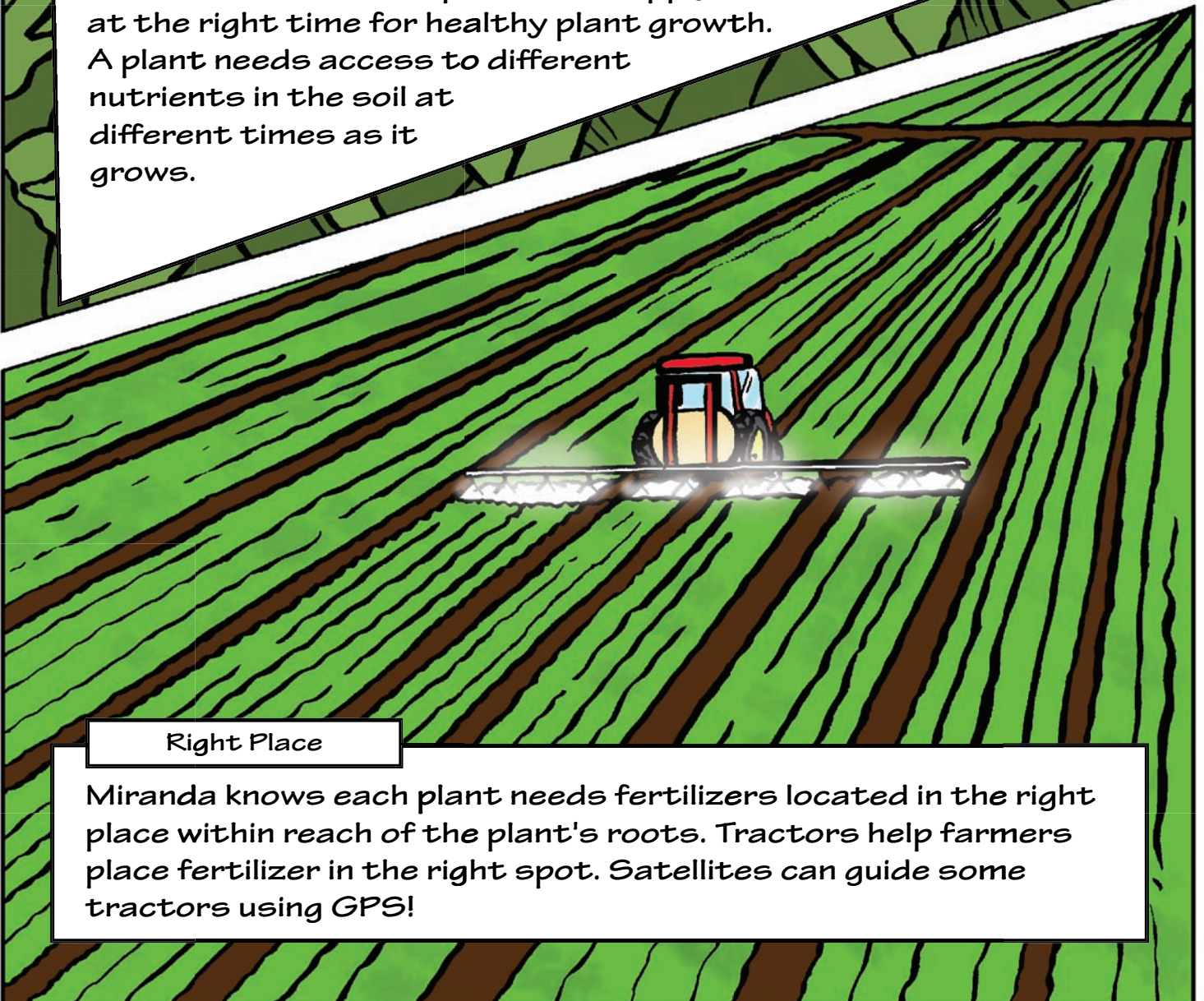
Miranda uses soil tests to help the farmer match the right amount of fertilizer to the plant's needs. Too little fertilizer limits the plant's growth, and too much fertilizer is wasteful.



## Right Time



Miranda knows it is important to apply fertilizer at the right time for healthy plant growth. A plant needs access to different nutrients in the soil at different times as it grows.



## Right Place

Miranda knows each plant needs fertilizers located in the right place within reach of the plant's roots. Tractors help farmers place fertilizer in the right spot. Satellites can guide some tractors using GPS!



# Fertilizer & the 4Rs

## Words to Know:

**Acidity** (/əˈsɪdədē/) *noun*. The level of acid in a substance, such as water or soil.

**Crops** (ˈkrop) *noun*. A plant that has been grown to be harvested for profit.

**Decompose** (de·com·pose) *verb*. The act or to cause something to slowly break down by natural processes, such as dead plants.

**Fertilizer** (fer·til·iz·er) *noun*. A substance that is added to soil to supply one or more essential plant nutrients.

**Harvest** (/ˈhɑrvəst/) *noun*. The process of gathering or picking crops.

**Nutrient** (ˈnü-trē-ənt, ˈnyü-) *noun*. A substance that provides the nutrition needed for health and growth.

**Organic** (əˈgænɪk ˈmætə) *noun*. Part of soil that comes from organisms, such as decomposed plants.



utrients help plants grow healthy. With each harvest, plants remove nutrients from the soil. The nutrients in the soil must be replaced so the next round of plants or **crops** will grow healthy. Farmers and gardeners add **fertilizer** to the soil to replace nutrients. In areas where nothing is harvested, like a forest, the nutrients removed by plants are returned to the soil after the plants die. The dead plants slowly **decompose** in the spot where they grew. Decomposing plants add nutrients back into the soil. Sometimes plants are removed before they die and decompose, such as when a gardener harvests carrots or tomatoes. When part of or the whole plant is removed from the soil, the nutrients used by the plant must be replaced. This happens in agriculture, too. In agriculture, some soil nutrients are removed in the form of harvested crops and plants, so the nutrients must then be replaced.

Fertilizer is one way to replace nutrients in the soil. The main nutrients in most fertilizers are nitrogen, phosphorus, and potassium. All three play important roles in growing healthy plants. Fertilizer is usually a liquid or solid. Bags of fertilizer are the most common in garden centers. They are sold in a variety of mixtures.



# Fertilizer & the 4Rs

**How do farmers and gardeners know which nutrients to apply?** The results of a soil test show nutrient levels in the soil. On a large farm or in a backyard garden, a soil test can provide a farmer or a gardener with important information about soil conditions, help grow healthy plants, and help get the most out of harvests. The tests provide other important details about the soil, such as the amount of organic matter and the soil's acidity. Based on the soil test results, farmers and gardeners choose the right fertilizer that replaces the nutrients in the soil that are needed.

## The 4R Nutrient Stewardship



### RIGHT SOURCE

Matches fertilizer type to crop needs. Gardeners should ensure that the type of fertilizer used matches their garden's needs. Soil tests help the farmer match the right type of fertilizer to the plant's needs.



### RIGHT RATE

Matches amount of fertilizer to crop needs. Apply fertilizer at a rate that the plant can use. If the rate is too low, then your garden might suffer with less produce, flowering and growth. If the rate is too high then fertilizer is wasted and can leak into the environment.



### RIGHT TIME

Makes nutrients available when crops need them. Choose the best time to apply fertilizer. This means the fertilizer should be applied when the plants in your garden need the nutrients during the growing season.



### RIGHT PLACE

Keeps nutrients where crops can use them. Gardeners should apply fertilizer following the instructions and labels on the product. This helps avoid runoff or leaching into surface or groundwater.

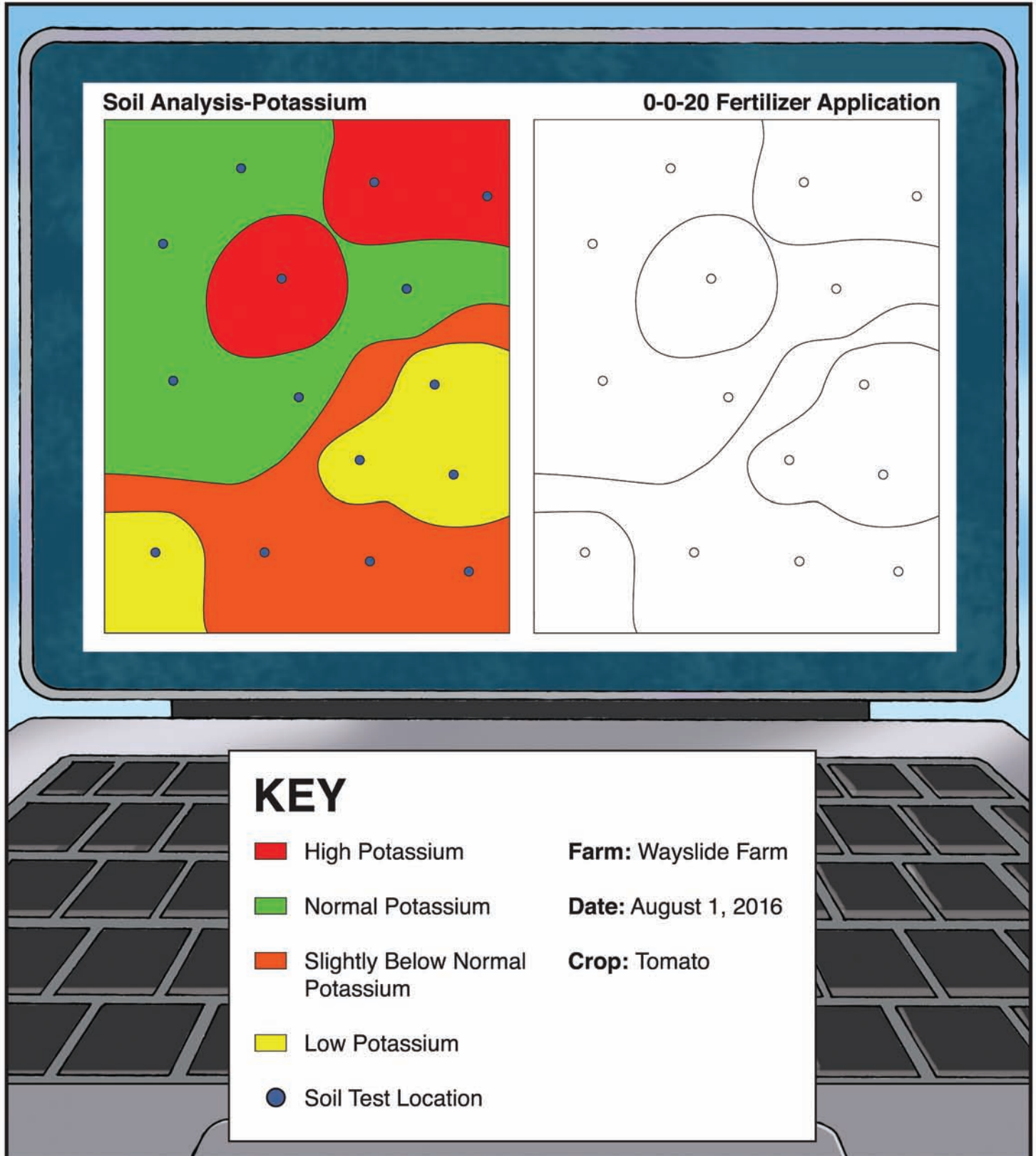
Farmers and gardeners use the 4Rs to make sure they use fertilizer correctly. If fertilizer is used incorrectly, they risk hurting the environment, wasting fertilizer and money, and growing unhealthy crops.

Fertilizer plays an important role in feeding the world. Without the proper nutrients, farmers would not be able to produce enough food for everyone to eat. However, fertilizers must be used properly; that's why 4R Nutrient Stewardship is so important. If the right fertilizer is used at the right rate, the right time, and in the right place, then farmers, gardeners, the environment, and even plants are happy!



# Right Rate, Right Place

In some vegetables, potassium fertilization can increase the vitamin C content. In this field, there are areas that need more potassium than other areas. Maps like these are created with soil tests, mapping technology, and satellites to show farmers exactly where to apply fertilizer. Each dot is a location where the soil was tested. Review the soil analysis map to see the amounts of potassium in different areas. On the 0-0-20 Fertilizer Application map, mark the areas that require the most potassium fertilizer with a blue marker.







**EXPERIMENT**

# Discover the **4Rs!**

## Supplies

- Six 8X8” foil baking pans
- Bag of Potting Mix without fertilizer pre-added
- Bag of Grass Seed
- Lawn fertilizer
- Dissolved table salt solution (sodium chloride):  
125 ml of water and  
144 gr of salt



## For Teachers: Experiment Preparation

Three to four days before the activity, add potting mix to each baking pan. Add grass seed following the manufacturer’s instructions and place in a well-lit area. Water seeds to initiate germination.

For the ‘wrong time’ application, the procedure calls for the teacher to incorrectly apply lawn fertilizer at the wrong time to a pan of grass. Decipher from the instructions how to construct the wrong time for fertilizer application. The wrong time could include before germination or on a hot day with dry soil depending on the fertilizer’s instructions.

Label pans: **Control, 4Rs, Wrong Source, Wrong Rate, Wrong Time, and Wrong Place.**

Read all steps in the procedure and instructions on the fertilizers.

## Teacher Procedure

*Apply appropriate safety precautions and laboratory protocols before performing the following laboratory activities. Follow all manufacturer warnings and proper storage instructions.*

**Questions:** Encourage students to brainstorm questions about fertilizer, specifically the 4R Nutrient Stewardship framework, using the scientific method graphic organizers on page 18-23.

**Hypothesis:** Present the pans of growing grass and supplies to the students. Using the scientific method graphic organizers, provide time for students to discuss and create a hypothesis about what will happen when implementing the 4Rs and what occurs when the 4Rs are disregarded.

**Experiment:** As a class, implement the following instructions.

**Wrong Source:** Apply the dissolved table salt solution to the corresponding pan of grass based on the fertilizer's instructions.

**Wrong Rate:** Apply 20 times the amount of lawn fertilizer to the wrong rate-labeled pan of grass. Adhere to the rest of the instructions on the fertilizer.

**Wrong Time:** Wait to apply the lawn fertilizer until day 12 of the experiment. Adhere to the rest of the instructions on the fertilizer package.

**Wrong Place:** Based on the lawn fertilizer's instructions, apply the fertilizer on the wrong place, such as applying an entire dose to one small corner in the pan. Adhere to the rest of the instructions on the fertilizer.

**4Rs:** Correctly apply the right source, rate, time and place of fertilizer to the 4R pan of grass. Adhere precisely to the fertilizer's instructions.

**Control:** Provide water and sun at the same amount as the other pans.

**Analysis:** Students record their observations on the scientific method graphic organizers over two weeks. Students should measure growth every two days, except for weekends and record grass appearance for each specimen.

**Conclusion:** After two weeks, students should review their hypothesis and observations. Encourage students to summarize what went wrong or right with each specimen. Students should match each pan to the result. Encourage students to compare and contrast the specimens. For instance, ask, "What went wrong with the "Wrong Place" pan? What do you see? How does the "Wrong Place" pan differ from the "4R pan" or the "Control" pan?"

**Communication:** Instruct students to determine a way to communicate their experiment and conclusions. Some possibilities are writing a report, presenting their findings to the principal, posting a blog, or creating a digital board of their findings. Nutrients for Life Foundation would love to see the results!

Share with us



[info@nutrientsforlife.ca](mailto:info@nutrientsforlife.ca)



# Right Source

## QUESTIONS

I wonder...  
What happens...

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## HYPOTHESIS

I think...

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## COMMUNICATION

I learned that...

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## EXPERIMENT

Summarize the procedure

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## CONCLUSION

What went wrong?  
What went right?  
I think that means...

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## ANALYSIS

I found...  
I see...

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## Record observations

Day 1 \_\_\_\_\_  
Day 2 \_\_\_\_\_  
Day 3 \_\_\_\_\_  
Day 4 \_\_\_\_\_  
Day 5 \_\_\_\_\_  
Day 6 \_\_\_\_\_  
Day 7 \_\_\_\_\_

Day 8 \_\_\_\_\_  
Day 9 \_\_\_\_\_  
Day 10 \_\_\_\_\_  
Day 11 \_\_\_\_\_  
Day 12 \_\_\_\_\_  
Day 13 \_\_\_\_\_  
Day 14 \_\_\_\_\_

# Right Rate

## QUESTIONS

I wonder...  
What happens...

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## HYPOTHESIS

I think...

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## COMMUNICATION

I learned that...

---

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## EXPERIMENT

Summarize the procedure

---

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---

---

## CONCLUSION

What went wrong?  
What went right?  
I think that means...

---

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## ANALYSIS

I found...  
I see...

---

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## Record observations

Day 1 \_\_\_\_\_  
Day 2 \_\_\_\_\_  
Day 3 \_\_\_\_\_  
Day 4 \_\_\_\_\_  
Day 5 \_\_\_\_\_  
Day 6 \_\_\_\_\_  
Day 7 \_\_\_\_\_

Day 8 \_\_\_\_\_  
Day 9 \_\_\_\_\_  
Day 10 \_\_\_\_\_  
Day 11 \_\_\_\_\_  
Day 12 \_\_\_\_\_  
Day 13 \_\_\_\_\_  
Day 14 \_\_\_\_\_



# Right Time

## QUESTIONS

I wonder...  
What happens...

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## HYPOTHESIS

I think...

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## COMMUNICATION

I learned that...

---

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## EXPERIMENT

Summarize the procedure

---

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---

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## CONCLUSION

What went wrong?  
What went right?  
I think that means...

---

---

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---

## ANALYSIS

I found...  
I see...

---

---

---

---

## Record observations

Day 1 \_\_\_\_\_  
Day 2 \_\_\_\_\_  
Day 3 \_\_\_\_\_  
Day 4 \_\_\_\_\_  
Day 5 \_\_\_\_\_  
Day 6 \_\_\_\_\_  
Day 7 \_\_\_\_\_

Day 8 \_\_\_\_\_  
Day 9 \_\_\_\_\_  
Day 10 \_\_\_\_\_  
Day 11 \_\_\_\_\_  
Day 12 \_\_\_\_\_  
Day 13 \_\_\_\_\_  
Day 14 \_\_\_\_\_

# Right Place

## QUESTIONS

I wonder...  
What happens...

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## HYPOTHESIS

I think...

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## COMMUNICATION

I learned that...

---

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---

## EXPERIMENT

Summarize the procedure

---

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---

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## CONCLUSION

What went wrong?  
What went right?  
I think that means...

---

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---

---

## ANALYSIS

I found...  
I see...

---

---

---

---

## Record observations

Day 1 \_\_\_\_\_  
Day 2 \_\_\_\_\_  
Day 3 \_\_\_\_\_  
Day 4 \_\_\_\_\_  
Day 5 \_\_\_\_\_  
Day 6 \_\_\_\_\_  
Day 7 \_\_\_\_\_

Day 8 \_\_\_\_\_  
Day 9 \_\_\_\_\_  
Day 10 \_\_\_\_\_  
Day 11 \_\_\_\_\_  
Day 12 \_\_\_\_\_  
Day 13 \_\_\_\_\_  
Day 14 \_\_\_\_\_



# Nutrient Stewardship

## QUESTIONS

I wonder...  
What happens...

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## HYPOTHESIS

I think...

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## COMMUNICATION

I learned that...

---

---

---

---

## EXPERIMENT

Summarize the procedure

---

---

---

---

## CONCLUSION

What went wrong?  
What went right?  
I think that means...

---

---

---

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## ANALYSIS

I found...  
I see...

---

---

---

---

## Record observations

Day 1 \_\_\_\_\_  
Day 2 \_\_\_\_\_  
Day 3 \_\_\_\_\_  
Day 4 \_\_\_\_\_  
Day 5 \_\_\_\_\_  
Day 6 \_\_\_\_\_  
Day 7 \_\_\_\_\_

Day 8 \_\_\_\_\_  
Day 9 \_\_\_\_\_  
Day 10 \_\_\_\_\_  
Day 11 \_\_\_\_\_  
Day 12 \_\_\_\_\_  
Day 13 \_\_\_\_\_  
Day 14 \_\_\_\_\_

# Experiment Control

## QUESTIONS

I wonder...  
What happens...

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## HYPOTHESIS

I think...

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## COMMUNICATION

I learned that...

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## EXPERIMENT

Summarize the procedure

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## CONCLUSION

What went wrong?  
What went right?  
I think that means...

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## ANALYSIS

I found...  
I see...

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## Record observations

Day 1 \_\_\_\_\_  
Day 2 \_\_\_\_\_  
Day 3 \_\_\_\_\_  
Day 4 \_\_\_\_\_  
Day 5 \_\_\_\_\_  
Day 6 \_\_\_\_\_  
Day 7 \_\_\_\_\_

Day 8 \_\_\_\_\_  
Day 9 \_\_\_\_\_  
Day 10 \_\_\_\_\_  
Day 11 \_\_\_\_\_  
Day 12 \_\_\_\_\_  
Day 13 \_\_\_\_\_  
Day 14 \_\_\_\_\_









# Unscramble the tiles to reveal the secret messages!

EXAMPLE:



WOR DIN HE GT FEE LD  
 FEEDING THE WORLD

Right  
Source

MAT CRO ERT S PN CHE ILI TO  
 ZER S F PE TY EED


Right  
Rate

FER OC . OF IZE TIL NT EDS  
 S A MOU MAT RT CHE NE ROP


Right  
Time

CR NTS NUT RIE EW ED OPS HEN  
 M. ES NE MAK ABL AIL AV THE


Right  
Place

CA NU ERE CR NTS WH PS KEE  
 SE RIE OPS M NUT THE




# 4Rs Badges



Great job learning about the 4Rs!  
Cut out your favorite badge and wear it with pride.



**For more soil science and crop nutrient resources:**



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Ottawa, ON K1R 7S8

**Phone: (613) 230-2600**  
**[www.nutrientsforlife.ca](http://www.nutrientsforlife.ca)**  
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Nutrients for Life Canada would like to thank Nutrients for Life Foundation (USA) for allowing us to use the content of their educational and technical materials for this document.