# The Book Planter

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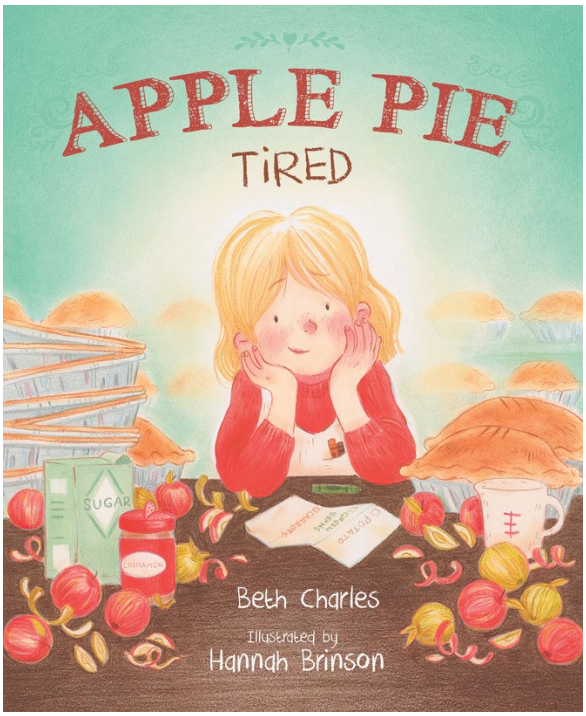


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## *Apple Pie Tired*

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Lola's family has an apple orchard and every year they sell hundreds of apple pies for customers' Thanksgiving tables. It's always a big job, so this year Lola is going to cook Thanksgiving dinner on her own to help out. She has a plan and a list. But Mom and Dad need her help making all the pies too. Lola's list keeps getting left behind and Thanksgiving arrives without crossing off a single thing. Luckily, aunts and uncles and cousins arrive ready to help the family prepare a Thanksgiving feast!

**Discussion Questions**

1. What is Lola's big plan at the start of the story? Why does she want to do it all by herself?
2. How do the family's busy days at the apple orchard get in the way of Lola's plan?
3. What does the phrase "apple pie tired" mean by the end of the story?
4. How does Lola's family react when they arrive and see she is not ready? What do they do to help?
5. How do you think Lola feels when her list gets left behind and she cannot cross anything off? Have you ever felt that way when a plan changed?
6. Why does Lola say, "Big jobs work better with a little help" at the end? Do you agree with her?
7. How does the family show care and teamwork in this book?
8. Why do you think everyone asks for pumpkin pie for dessert instead of apple pie at the end of the story?
9. Have you ever worked hard on a big project or family event? What was it like?
10. If you could plan a big holiday meal with your family, what job would you want to do?

**Student Motivator**[1]

1. Show students a red apple and a red onion. Ask, "Which one would you like to eat in a pie? How can you tell the difference between the apple and the onion?"

2. As a class, list the physical characteristics of the apple and the onion. Point out that many of these characteristics are heritable traits that can ben used to tell apples from onions.
3. Optional: Show other types of fruits and vegetables that have both similar and different characteristics. Have students observe, record, and discuss the similarities and differences.

**Activity 1: Apple Exploration**[1]

Materials:

- Gala apples (or other slow-to-brown variety like Empire or Cortland), 1 per group
- Granny Smith apples (or other tart, green variety like Crispin or Pippin), 1 per group
- McIntosh apples (or other soft-flesh variety like Braeburn or Red Delicious), 1 per group
- Measuring tapes, 1 per group
- Scales that weigh in grams, 1 per group
- Apple Data Sheet, 1 per student

Procedures:

1. Divide the students into small groups. Provide each group with a Gala, Granny Smith, and McIntosh apple (or similar varieties); one measuring tape; one scale; and an Apple Data Sheet for each student.
2. Have students record the color and smell of each apple variety on their data sheets.
3. Have students predict each apple's weight in grams and circumference in centimeters.
4. Teaching Tip: When students make predictions, encourage them to use a known variable for comparison. For example, if you are using gram weights, have a student place 100 grams in one hand and an apple in the other. This way, the student has a known quantity against which to compare the apple's weight and a basis for making his/her prediction. As soon as one apple's mass is known, the apple can then become the next known quantity.
5. Have students measure the actual weight and circumference of each apple.
6. Have students make a prediction about how many seeds are in each apple.
7. Cut each apple open for the groups, designating one slice for observing how long it takes the apple to turn brown. Ask students to observe the inner characteristics of the apple and record on their data sheets the color of the inside flesh and actual number of seeds inside each apple.

8. Cut each apple into small sections and allow students to taste the differences among the apples. As they are tasting, remind them to pay attention to the texture (crunchy, juicy, etc.) of the apple as well as the flavor. Be sure to follow proper health and safety regulations for step 7, or ask the cafeteria workers to slice the apples for tasting. Have students record their observations on the data sheet.
9. Using the background information, explain to students why apples turn brown after they are cut. If any of their apples have started to turn brown, have them record on their data sheets that these varieties are fast to brown. Ask them to continue observing their cut apples to compare their rate of browning as you do the next activity.
10. Discuss the variation that students observed between different apple varieties. Explain to students that these variations are examples of traits that can be passed from parent to offspring.

**Activity 2: Apples in the Orchard**[1]

1. Show students the How Does it Grow? Apples video. (https://www.youtube.com/watch?v=UWLmEh1HIBw)
2. Use the following discussion questions to explore the video:
    - Why don't farmers grow apples from seed? (*Each seed is genetically unique, meaning that when it grows into a mature tree, the apples it produces will be different from those produced by its parent trees*.)
    - What is grafting? (*The process of joining a cut stem – or bud –with the trunk of another tree s that the two grow together*.)
    - Why do apple farmers graft their trees? (*Grafting allows farmers to "clone" the apple trees that produce the fruit they want. A grafted branch has the same genetic makeup as the tree it was taken from*.)
    - Do all apple varieties ripen at the same time? (*No, some varieties ripen earlier than others, so planting different varieties allows farmers to extend their length of harvest*.)
3. Explain to students that apples have been selectively bred for thousands of years to produce the varieties that we know today. Apple breeders, unlike farmers, plant apple trees from seed in order to find and develop new traits. Under human cultivation, the traits that give apple trees a survival advantage are the traits that are most useful and desirable to people. Ask students to brainstorm all the different traits they can think of that might be desirable in an apple tree (e.g., pest resistance, grows fast, has strong branches, produces big apples, juicy apples, sweet apples, crips apples), and write them on the board.
4. Circle all the traits that are directly related to the fruit of the apple tree (e.g., produces big apples, juicy apples, sweet apples, crisp apples). Point out that these are like the characteristics that students observed and recorded on their Apple Data Sheets.

5. Based on the information from their data sheets, ask students to vote on which apple variety was their favorite. Imagine that an apple breeder crossed the two favorite class varieties. What characteristics might the resulting apple have?

**Extension Activities**[1]

- **Grocery Store Fruit and Vegetable Characteristics**
  Many grocery stores have informational sheets on fruits and vegetables. Have students go to the grocery store with a parent or other adult and find out information about a particular fruit or vegetable from the manager of the Produce Department. For example: How many kinds of apples are carried by the grocery store? Which apples are best for cooking, eating or storing? Which apple has the shortest growing season, the longest growing season? Which apple sells the best? Which are the most expensive and why? Where do apples grow in your state? (Use the NC Apples Ag Mag for answers!)
- **Browning Apples**
  Students observed browning in different varieties of apples, but what about browning under different conditions? Have your students think of ways they might slow the browning of apples (add lemon juice, wrap apple slices in plastic, put them in the freezer, etc.). Cut slices of apples, and compare the rate of browning under the different conditions suggested by the students. Make observations over two or three days. Don't forget to provide a control slice (a sliced apple with nothing done to it).
- **Testing Apple Ripeness**
  Apple growers try to pick their apples at precisely the right time. They have several ways to test for ripeness that students can try in the classroom. These observations will work best with apples picked in the early fall when you can find varying stages of ripeness—they will not work well with apples from the grocery store.
  ***1: Seed Color Test***
  Rate the color of the seeds in the apple. A ripe apple has brown seeds. Apple growers use the following scale:
    - 1 = clear (no color)
    - 2 = trace of color (tips of seeds are brown)
    - 3 = 1/4 color
    - 4 = 1/2 color
    - 5 = 3/4 color
    - 6 = fully brown

  ***2: Flesh Color Test***
  Check the flesh color of the apple by holding a very thin slice—about 1/16th of an inch (1.58 mm)—up to a bright light. A ripe apple has almost no green flesh. Apple growers use the following scale:
    - 1 = flesh all green
    - 2 = some loss of green from center of fruit

- 3 = heavy green band 1/2 inch (1.27 cm) thick under skin
- 4 = heavy green band 1/4 inch (6.35 mm) thick
- 5 = heavy green band 1/8 inch (3.17 mm) thick
- 6 = green essentially gone from under skin

Have students give their apple a rating from 1 to 6. Remind students that these tests for ripeness involve a skill that scientists must develop—the ability to make careful observations.

***3: Starch Test***

Divide the class into groups. Give each group an apple, and have them cut the apple in half at a right angle to the core. Apply iodine to the cut surface, drain away any excess, and allow it to stand for a few minutes. (Emphasize that iodine is poison and is not to be taken internally.) The apple will turn a dark purple or blue-black wherever starch is present. Remind students that in a ripe apple the starch has changed to sugar, so a ripe apple will have very little dark stain. Have students give their apple a rating from 1 to 6 based on the amount of dark stain on the apple. A rating of 6 indicates a perfectly ripe apple. *Note: This test works well at any time of year with bananas, which are commonly available at varying stages of ripeness.*

Apple growers commonly use the following rating system:

- 1 = all blue-black (full starch)
- 2 = all blue-black except in seed cavity and halfway to vascular area (oval area around core)
- 3 = all blue-black except in seed cavity and vascular area
- 4 = half blue-black
- 5 = blue-black just under skin
- 6 = no blue-black (free of starch)

**Sources**

1. https://agclassroom.org/matrix/lessons/538/

**K-5 Subject Areas: English Language Arts, Science, Math**

**English Language Arts**

- K.CT.1.1 Ask and answer questions about key details in a text.
- K.CT.1.2 Use self-monitoring, repeated reading, recounting, writing in response to texts, and discussions with peers and adults to strengthen comprehension.
- K.CD.F.4.1 Read texts for a variety of purposes.
- K.CD.1.1 Determine the topic of a text.
- K.CD.1.2 Describe characters or individuals, settings, major events, or ideas in a text.
- K.CD.2.3 Describe how the words and pictures or illustrations work together to provide information in texts.
- K.CD.2.4 Identify words and phrases that contribute to meaning in a text.
- K.CW.7.1 Introduce the topic or text and state an opinion.
- K.CW.7.2 Support an opinion with at least one reason.
- K.CW.7.3 Connect an opinion and at least one reason, using a linking word or phrase.
- K.CW.8.1 Introduce the topic.
- K.CW.8.2 Provide at least one fact about the topic.
- K.CW.8.3 Connect a topic with at least one fact, using a linking word or phrase.
- K.CW.9.1 Recount a single event or idea.
- K.CW.9.2 Describe what happened, using at least one key detail.
- 1.CT.1.1 Ask and answer questions about key details in a text.
- 1.CD.F.4.1 Read texts for a variety of purposes.
- 1.CD.F.4.2 Confirm or self-correct word recognition and understanding, as necessary.
- 1.CD.F.4.3 Read texts with accuracy, appropriate rate, and prosody on successive readings.

- 1.CD.1.1 Determine a theme or main idea in a text.
- 1.CD.1.2 Describe the relationship between two characters or individuals, their experiences, settings, major events, or ideas in a text.
- 1.CD.2.1 Identify the point of view and perspectives in a text.
- 1.CD.2.3 Use information provided by the words and pictures or illustrations in a text to identify perspectives in a text.
- 1.CD.2.4 Identify words and phrases that contribute to meaning in a text.
- 1.CW.3.1 Capitalize names of people and dates.
- 1.CW.3.2 Use correct end punctuation for sentences.
- 1.CW.3.3 Use commas in dates and to separate single words in a series.
- 1.CW.3.4 Use commas before coordinating conjunctions in compound sentences.
- 1.CW.3.5 Use apostrophes to form contractions.
- 1.CW.4.1 Print all uppercase and lowercase letters legibly and proportionally, using appropriate spacing between letters and words.
- 1.CW.4.2 Produce and expand complete simple and compound sentences.
- 1.CW.5.1 Recall relevant information from experiences or gather relevant information from provided sources to answer questions.
- 1.CW.7.1 Introduce the topic or text and state an opinion.
- 1.CW.8.1 Introduce the topic.
- 1.CW.8.2 Provide facts about the topic.
- 1.CW.8.3 Connect a topic with facts, using linking words or phrases.
- 1.CW.8.4 Provide a concluding statement related to the information or explanation presented.
- 1.CW.9.1 Recount two or more appropriately sequenced events or ideas.
- 1.CW.9.2 Describe what happened, using key details.
- 1.CW.9.3 Signal order, using transition words.
- 1.CW.9.4 Provide closure.
- 2.CT.1.1 Ask and answer questions about key details, referring explicitly to the text as the basis for the answers.
- 2.CD.1.1 Determine a theme or main idea in a text.
- 2.CD.1.2 Describe the relationship between two characters or individuals, their experiences, settings, major events, or ideas in a text.
- 2.CD.2.1 Explain the relationship between the point of view and perspectives in a text.
- 2.CD.2.2 Describe the overall structure and purpose of a text.
- 2.CD.2.3 Distinguish the differences in perspectives between characters or individuals in a text.
- 2.CD.2.4 Identify words and phrases that contribute to meaning in a text.
- 2.CW.6.1 Plan written and spoken products by organizing information and ideas around a topic.
- 2.CW.6.2 Draft written and spoken products to accurately address purpose, task, and audience.
- 2.CW.6.3 Revise and edit written and spoken products, using support and collaboration with peers and adults.
- 2.CW.7.1 Introduce the topic or text and state an opinion from a specific perspective.
- 2.CW.7.2 Support an opinion with reasons and evidence.
- 2.CW.7.3 Connect an opinion with reasons and evidence, using linking words and phrases.
- 2.CW.7.4 Provide a concluding statement or section related to the opinion presented.
- 3.CT.1 Independently read and listen to texts at the high end of the 2-3 text complexity band, applying skills from the grade 3 standards proficiently.
- 3.CD.F.4 Orally read texts with fluency to support comprehension.
- 3.CD.1 Explain how theme and main idea are conveyed and supported by key details in texts.
- 3.CD.2 Explain the purpose and perspectives in a text.
- 3.CD.3 Compare and contrast multiple texts about the same or similar themes and topics.
- 3.CW.1 Engage effectively in collaborative discussions about texts, building on others' ideas and clearly expressing their own.
- 3.CW.5 Construct short research projects about topics, concepts, or themes aligned to grade 3 content.
- 3.CW.6 Use a recursive process to refine spoken and written products.
- 3.CW.7 Construct spoken and written opinion texts, supporting a perspective with reasons and evidence.
- 3.CW.8 Construct spoken and written informative and explanatory texts to examine a topic and clearly convey ideas and information.
- 3.CW.9 Construct spoken and written poetic, descriptive, and narrative texts to develop real or imagined experiences, events, or ideas using effective technique, descriptive details, and clear sequences.
- 4.CT.1 Independently read and listen to texts within the 4-5 text complexity band, applying skills from the grade 4 standards proficiently.
- 4.CD.1 Explain the development of themes and main ideas through key details in texts.
- 4.CD.2 Explain how the purpose and perspectives in a text influence the way content is described.
- 4.CD.3 Compare and contrast how multiple texts approach similar themes and topics.
- 4.CW.1 Engage effectively in collaborative discussions about texts, building on others' ideas and clearly expressing their own.
- 4.CW.4 Produce sentences appropriate for grade 4, with increasing fluency and complexity.
- 4.CW.5 Construct short research projects about topics, concepts, or themes aligned to grade 4 content.
- 4.CW.7 Construct spoken and written opinion texts, supporting a perspective with reasons and evidence.
- 4.CW.8 Construct spoken and written informative and explanatory texts to examine a topic and clearly convey ideas and information, through the addition of related content.
- 4.CW.9 Construct spoken and written poetic, descriptive, and narrative texts to develop real or imagined experiences, events, or ideas using effective technique, descriptive details, and clear sequences.
- 5.CD.1 Explain the development of themes and main ideas through key details in texts.
- 5.CD.2 Explain how the purpose and perspectives in a text influence the way content is described.
- 5.CW.1 Engage effectively in collaborative discussions about texts, building on others' ideas and clearly expressing their own.
- 5.CW.4 Produce sentences appropriate for grade 5, with increasing fluency and complexity.
- 5.CW.5 Construct short research projects about topics, concepts, or themes aligned to grade 5 content.
- 5.CW.7 Construct spoken and written opinion texts, supporting a perspective with reasons and evidence.

- 5.CW.8 Construct spoken and written informative and explanatory texts to examine a topic and clearly convey ideas and information, through the addition of related content.
- 5.CW.9 Construct spoken and written poetic, descriptive, and narrative texts to develop real or imagined experiences, events, or ideas using effective technique, descriptive details, and clear sequences.

**Science**

- PS.K.1 Understand how objects are described based on their physical properties and how they are used.
- LS.K.1 Understand the characteristics of living organisms and nonliving things.
- LS.K.2 Understand characteristics of organisms that make the alike and different.
- LS.1.1 Understand the basic needs of a variety of plants and animals in different ecosystems.
- LS.2.2 Understand that organisms differ from or are similar to their parents and other offspring based on characteristics of the organism.
- LS.3.2 Understand how plant structures aid in survival.
- LS.3.3 Understand how environmental factors aid in the survival of plants.
- LS.5.2 Understand interdependence of plants and animals within their ecosystem.
- LS.5.3 Understand some characteristics of an organism are inherited and other characteristics are acquired.

**Math**

- 1.MD.1 Order three objects by length; compare the lengths of two objects indirectly by using a third object.
- 1.MD.2 Measure lengths with non-standard units.
    - Express the length of an object as a whole number of non-standard length units.
    - Measure by laying multiple copies of a shorter object (the length unit) end to end (iterating) with no gaps or overlaps.
- 2.MD.1 Measure the length of an object in standard units by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.
- 2.MD.2 Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen.
- 2.MD.3 Estimate lengths in using standard units of inches, feet, yards, centimeters, and meters.
- 2.MD.4Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.

# Apple Data Sheet

| OUTER CHARACTERISTICS | Color | Smell | Predicted weight (grams) | Actual weight (grams) | Predicted circumference (cm) | Actual circumference (cm) |
|---|---|---|---|---|---|---|
| Variety name: | | | | | | |
| Variety name: | | | | | | |
| Variety name: | | | | | | |

| INNER CHARACTERISTICS | Color of inside flesh | Predicted number of seeds | Actual number of seeds | Taste | Texture | Slow or fast to brown after cutting |
|---|---|---|---|---|---|---|
| Variety name: | | | | | | |
| Variety name: | | | | | | |
| Variety name: | | | | | | |

**Background Agricultural Connections**

If you take the time to observe, similarities can be found even between an apple and an onion. And certainly you will notice many **traits** that make them different too. Close observation of the traits of living things is the first step to understanding **heredity**.

Apples have been selectively bred for thousands of years to produce the varieties that we know today. Honeycrisp, Gala, Red Delicious, Granny Smith, and the many other apples in the grocery store all come from the same species of tree, but they have distinctly different characteristics. Some are sweet and others are tart. Some are good for baking, while others are best eaten fresh. Some store well for a long time, but others need to be used soon after ripening. Knowledge of how traits are inherited in apples has allowed breeders to develop the many different varieties found in orchards and grocery stores around the world.

Apples can reproduce by seed, but farmers almost never grow apple trees from seed. In order for apple fruit and seeds to form, the flowers of the tree must first be pollinated. Some fruit trees can self-pollinate, but apple trees must be cross-pollinated with pollen from a different variety of apple tree. This means that each apple seed is genetically unique, and there is no guarantee that the tree it grows into will produce fruit anything like that of its parents. If a farmer started an apple orchard by growing trees from seed, each tree would produce apples with different flavors, colors, and ripening times, making it difficult to manage and market the crop. So, most apple orchards begin by **grafting** a desirable apple variety onto a strong rootstock. A section of a stem with leaf buds is inserted into the trunk of another. The two will fuse together and the stem section will grow and produce apples just like the tree it was taken from.

While wild variability is not desirable to farmers, it is the working palette of **plant breeders**. Breeders plant apple trees from seed in order to bring out new characteristics and combine characteristics from desirable varieties. Breeders work not only to provide consumers with new, tasty varieties of apples, but also to create apple trees that are resistant to disease and pests and have other traits that make it easier for farmers to grow a healthy, reliable crop. The process of selective breeding takes many, many years, but modern biotechnology provides innovative techniques that allow breeders to develop new traits more quickly.

In 2015, the first genetically modified apple varieties were approved for sale in the United States. The Arctic Apples contain a trait that prevents them from turning brown when they are sliced or bruised. The flesh of most apples will turn brown when exposed to air. This is due in large part to an enzyme called polyphenoloxidase, which causes many fruits to produce brown pigment when exposed to oxygen and may change their texture and flavor. Methods like cooking or lowering the pH of cut apples can minimize the activity of this enzyme and prevent browning. In Arctic Apples, a gene silencing technique was used to prevent the apples from producing polyphenoloxidase and thus make them resistant to browning.