

LET'S LEARN ABOUT FLORIDA LETTUCE!

This Virtual Farm Field Trip unit is all about lettuce. It begins with an informative 5-minute video, transporting students to Traders Hill Farm in Hilliard, Florida. Your students will meet farmers Tracy and Kathy to learn how Florida lettuce is planted, grown, harvested and distributed.

We encourage you to expand the learning experience using this section's worksheets and guided activities, including a taste test. You may choose to use all these resources or pick the ones best suited to your classroom.



ACCESS VIRTUAL FARM FIELD TRIP

Scan code or visit:
FarmToSchoolFL.com/FieldTrips



FLORIDA LETTUCE FUN FACTS

- Fresh lettuce is mostly water. Eating it helps you stay hydrated.
- Lettuce has vitamin K for strong bones.
- Lettuce comes in many colors: green, red and even purple.
- Romaine is the second most common type of lettuce grown in the U.S. behind iceberg, both of which are grown right here in Florida.
- Lettuce can grow in different ways! **Field lettuce** grows outside in the dirt, drinking rain and soaking up sunshine. **Hydroponic lettuce** grows with its roots right in water filled with plant food. **Aquaponic lettuce** grows in water too, but with fish. The nutrients from the fish feed the plants.
- In Florida, lettuce is largely grown outside in the rich soils south of Lake Okeechobee.

BEFORE YOU WATCH: DISCUSSION STARTERS

Get students thinking about agriculture, science and nutrition by asking questions such as:

- What do plants need to grow? What happens if they don't get what they need?
- Can a plant grow without dirt? What might it need instead?
- Let's name some vegetables. Can you think of any that are green?
- Close your eyes and imagine you are at a farm. What do you see? Hear? Smell?
- Today, we'll be taking a virtual field trip to visit a Florida lettuce farm. What do you know about lettuce?
- Have you eaten lettuce before? What did it taste like?

TRIVIA TOSS

Want to liven up your video trivia sheet exercise? Have students answer questions or complete their worksheets separately, then come together in teams to compare and finalize answers. Go around the room asking each team a question. If they answer it correctly, they get a chance to toss a ball into one of three buckets to get a prize for their team. Prizes might be a homework pass, free time, extra computer time or lunch in the classroom.

AFTER YOU WATCH: SUGGESTED QUESTIONS

Find video comprehension questions, answers and video timestamps for finding those answers below. See the worksheet section of these resources for a trivia sheet covering the questions below for more independent student work.

- What animals live in the water and help feed the lettuce? (*Fish, tilapia; 0:43*)
- What is it called when plants are grown in water instead of soil? (*Hydroponics, and adding fish makes it aquaponics; 0:36*)
- How long is the growing cycle of lettuce on this farm? (*About 35–40 days; 0:59*)
- True or false: Romaine lettuce is about 95% water. (*True; 1:45*)
- What is the ideal temperature for growing lettuce? (*About 70°F; 2:02*)
Teacher Tip: 70°F is about the same temperature we keep inside our homes and classrooms. Ask why growing lettuce inside a greenhouse helps farmers hold that perfect temperature all year, even when it's really hot or really cold outside.
- What does it mean when a lettuce plant "bolts"? (*It starts growing flowers and seeds and won't taste as good; 2:50*)
- True or false: Lettuce is a good source of vitamin K, which helps keep your bones strong. (*True; 2:53*)
Teacher Tip: Ask students what other foods keep bones strong. (Dairy!)
- What happens to the fish waste in the filtration system? (*The system turns fish waste into food for the plants; 3:32*)
- True or false: Lettuce is part of the legume (or pea) family. (*False, it's in the sunflower family; 3:51*)
- What is a nursery on the farm? (*A place where plants are grown, where lettuce starts growing from the seed; 4:00*)
- True or false: An outdoor farm can grow more lettuce in less space than a greenhouse using hydroponics or aquaponics. (*False, this greenhouse grows 5 times more lettuce in the same space; 1:50*)



GEOGRAPHY MOMENT

Ask students to find Hilliard on a map of Florida. (Hint: It's in the far northeast corner, near the Georgia border just above Jacksonville.)

USING THESE TEACHING TOOLS

Below is an overview and guide for using the teaching tools included in this section, including guided activities, recipes and worksheets. We've included the education standards each tool complements, materials needed for each activity, a brief overview of each tool and tips for building your lessons.

You can find each of these tools on the following pages, along with additional information and pointers.

GUIDED ACTIVITIES

TOOL	COMPLEMENTARY STANDARDS	MATERIALS NEEDED	ABOUT THIS TOOL	TEACHER TIPS
Video, Discussion Questions and Trivia Toss (in Classroom Guide) <i>On page 226</i>	Standard(s) Supported: SC.5.L.15.1, SC.4.P.8.1, SC.4.L.16.4, SC.4.L.17.1, SC.5.L.14.2, HE.4.PHC.1.4, HE.5.PHC.1.4	<ul style="list-style-type: none"> - 3 buckets, boxes or similar containers - 2 palm-sized balls (enough for each team to have one) 	This activity gets students out of their seats as they respond to questions about the Virtual Farm Field Trip video.	Use this activity to complement or reinforce the Romaine Lettuce Video Trivia sheet. You might also watch the video a second time after the discussion so students can listen for details they missed.
Lettuce Three Ways <i>On page 233</i>	Standard(s) Supported: SC.4.P.8.1, SC.4.P.9.1, HE.4.PHC.1.4, HE.5.PHC.3.2	<ul style="list-style-type: none"> - Head of romaine lettuce - Lemon and/or salt, or a homemade vinaigrette (see recipe on following pages) - Store-bought creamy salad dressing 	In this activity, you'll guide students through tasting lettuce in three different forms – plain, with a simple seasoning and with a creamy dressing.	Start by asking your school nutrition team if they can support you by acquiring and/or preparing the food items. Use this activity to introduce students to new, nutritious foods. Educate them on the nutritional differences between whole foods – like fresh lettuce – and packaged foods with long ingredient lists – like store-bought dressing.

TOOL	COMPLEMENTARY STANDARDS	MATERIALS NEEDED	ABOUT THIS TOOL	TEACHER TIPS
Lemon and Olive Oil Vinaigrette <i>On page 235</i>	Standard(s) Supported: SC.4.P.9.1, SC.4.P.8.1	Equipment required: <ul style="list-style-type: none"> - Small jar with a tight-fitting lid - Measuring cup - Measuring spoons - Paper or cloth towels for spills - Bowls or cups to serve Ingredients (adjust quantities based on class size): <ul style="list-style-type: none"> - ½ cup extra virgin olive oil - 1 tablespoon white wine vinegar or apple cider vinegar - 1 tablespoon lemon juice - 2 teaspoons honey or sugar - ¼ teaspoon garlic powder - ¼ teaspoon salt - Pinch black pepper 	Use this recipe to prepare your own vinaigrette for the Lettuce Three Ways exercise.	At this grade level, students can make the dressing themselves in groups of four. Multiply equipment and ingredient quantities by the number of groups.

TOOL	COMPLEMENTARY STANDARDS	MATERIALS NEEDED	ABOUT THIS TOOL	TEACHER TIPS
Lettuce Lab: What Makes Water Climb a Leaf? (Teacher Guide and Student Sheets) <i>On page 236</i>	Standard(s) Supported: SC.5.N.1.1, MA.4.DP.1.2 / MA.4.DP.1.3	<ul style="list-style-type: none"> - Pale inner romaine leaves: 2 per group, cut from the same head and as close to the same size as possible, plus a few extras (some won't take the dye well) - Clear cups: 2 per group - Water - Dark food coloring: red or blue work best; 15–20 drops per cup for a deep color - Scissors - Ruler: for measuring both leaves before the test begins - Timer or clock: for recording observation times - Paper plates or newspaper: the rib holds a lot of water and slicing gets wet - Paper towels: for drips and dye spills (dye stains!) - Magnifying glass (optional): for viewing the xylem lines up close - Aprons or old shirts (optional): food coloring stains hands and clothes 	In this investigation, students compare a whole romaine leaf with a trimmed one standing in dyed water, recording where the color appears and how bright it is over time. The contrast between the two leaves shows that water leaves the plant fastest wherever a tube is open.	This activity complements life science lessons about how plants move water, and the timed observations and brightness scale make it a data collection lesson as well. Standardize the trim across groups so results can be compared, and remind students that the dyed lettuce is for science, not snacking.

WORKSHEETS

TOOL	COMPLEMENTARY STANDARDS	MATERIALS NEEDED	ABOUT THIS TOOL	TEACHER TIPS
Romaine Lettuce Video Trivia & Farm Math <i>On page 240</i>	Standard(s) Supported: MA.4.AR.1.1 / MA.4.AR.2.2, MA.5.AR.1.1	- Writing instrument	This worksheet tests students' comprehension of the Virtual Farm Field Trip by asking questions answered in the video, then applies farm facts to word problems.	You might hand the worksheet out before the video so students can answer as they go, or wait until after. Consider pairing it with the "Trivia Toss" activity in this Classroom Guide.
Farm Math: Lettuce <i>On page 242</i>	Standard(s) Supported: MA.4.AR.1.1, MA.4.AR.2.2, MA.5.AR.1.1, MA.5.AR.2.1, MA.5.AR.2.4, MA.4.M.1.2, MA.4.DP.1.2 / MA.4.DP.1.3	- Writing instrument	This worksheet opens with a box of farm facts, then asks students to use them across a set of multi-step problems: writing and solving equations, working with remainders and reading a table of one week's harvest.	This worksheet complements math lessons on equations, division and data. Students show their work and carry an answer forward from one problem to the next, so it suits partner work or a guided walkthrough as a class.
Reading: Ways to Grow Lettuce, with Close Reading and Replay! Sum It Up <i>On page 244</i>	Standard(s) Supported: ELA.4.C.3.1, ELA.4.R.3.2, SC.4.L.16.2 / ELA.5.C.3.1, ELA.5.R.3.2	- Writing instrument	This worksheet pairs a passage covering all three ways lettuce is grown with close reading questions and a short written summary that draws on both the passage and the video.	This worksheet complements reading comprehension and vocabulary lessons. The summary at the end asks students to pull from two sources at once, which is good preparation for the essay prompt later in this section.
Life Cycle of Lettuce <i>On page 247</i>	Standard(s) Supported: SC.4.L.16.1	- Writing instrument	This worksheet has students label each stage of the lettuce plant's life cycle using a word bank, then briefly describe what is happening in each phase.	This worksheet complements life science lessons about plant life cycles and reproduction. It builds on the 2–3 version by asking students to explain each stage rather than only order it.

WORKSHEETS

TOOL	COMPLEMENTARY STANDARDS	MATERIALS NEEDED	ABOUT THIS TOOL	TEACHER TIPS
Expository Essay Prompt and Plan Your Essay <i>On page 248</i>	Standard(s) Supported: ELA.4.C.1.4 / ELA.5.C.1.4, ELA.4.C.3.1 / ELA.5.C.3.1	<ul style="list-style-type: none"> - Writing instrument - A separate sheet of paper for the finished essay 	This prompt asks students to write an expository essay explaining how aquaponic farming grows lettuce without soil, and giving reasons a school might choose to serve locally grown lettuce. A planning page walks them through a hook, a central idea, two body sections and a conclusion.	The source notes box supplies facts from the video, so students practice selecting and citing evidence rather than recalling from memory. You might have students plan in class and draft at home.
Teacher Scoring Guide <i>On page 250</i>	Standard(s) Supported: ELA.4.C.1.4 / ELA.5.C.1.4, ELA.4.C.3.1 / ELA.5.C.3.1		This guide gives you what to look for when scoring the expository essay — structure, evidence and elaboration, and conventions — along with sample strong points a student might include.	Use this guide to set your expectations before students write. You might also share the three scoring categories with the class so they know what is being assessed.
Answer Key <i>On page 251</i>			See here for answers to each worksheet.	

LETTUCE THREE WAYS

This group activity brings the field trip to life as students get the opportunity to taste lettuce three ways: plain, with simple seasoning or with a creamy dressing.

MATERIALS



Head of romaine
lettuce



Lemon and/or salt,
or a homemade
vinaigrette
(see recipe on
following pages)



Store-bought
creamy salad
dressing

COLLABORATE WITH YOUR CAFETERIA

Consider partnering with your school nutrition team to obtain these food items and/or prepare a lettuce-wrap-style dish for your taste test. Be sure to contact them ahead of time, discuss the support you will need and show gratitude for their collaboration!

SUGGESTED QUESTIONS

Lead a discussion as your students try lettuce three different ways. Questions like the following can help kids better connect with their food, think about their preferences and encourage them to make nutritious choices in the future.

Before the tasting:

1. Have you tried romaine lettuce before? How did you eat it? What did you think?
2. If not, what do you think it will taste like?
3. Did you know that there are hundreds of lettuce types? How do you think the different kinds look, feel and taste different from each other?

As they try the plain lettuce:

1. What do you think of the texture of the plain lettuce? Is it crunchy or soft?
2. Describe the flavor. Is it like lettuce you've tasted before? If yes, how so? If not, how is it different?
3. How would you feel about eating fresh lettuce as a snack? Why? What might you eat it with?

As they try the lettuce with a squeeze of lemon, sprinkle of salt or homemade vinaigrette:

1. How is this lettuce similar to the plain lettuce you just tried?
2. How is it different?
3. Have you eaten lettuce like this before? How else have you had it? Which way do you prefer?

As they try the lettuce with the creamy dressing:

1. How does the texture of this lettuce compare to the other lettuce you tried?
2. Describe how the creamy dressing looks and tastes. How is it the same or different from the lemon, salt or vinaigrette you tried?
3. Before today, did you know that adding different dressings can change the texture of the lettuce? What other dips, dressings or sauces might you try eating with lettuce?
4. What's one new way you'd like to try eating lettuce after today?

TEACHER TIP:

Use this as a quick nutrition lesson. Explain that whole foods with just one ingredient — like fresh lettuce — are usually more nutritious than packaged foods with a long list of ingredients.

A food with lots of ingredients — like store-bought dressing — is like a puzzle with many pieces, and some pieces might not be so nutritious (like added sugar). Simple foods you recognize are better for your body and help you feel your best.

Pass around the dressing bottle and read the ingredient list together. Ask: "Any long words we can't say?" Then you may point out the amount of sodium and saturated fat, and lack of vitamins in one serving. Encourage students to compare this to fresh lettuce. There isn't an ingredient list — because it's just lettuce!

ITALIAN DRESSING	
Nutrition Facts	
About 48 servings per container	
Serving size 2 tbsp (30g)	
Amount per serving	
Calories 80	
% Daily Value*	
Total Fat 8g	10%
Saturated Fat 1.5g	7%
Trans Fat 0g	
Cholesterol less than 5mg	2%
Sodium 520mg	23%
Total Carbohydrate 2g	1%
Dietary Fiber 0g	0%
Total Sugars 2g	
Includes 2g Added Sugars	3%
Protein 0g	
Vitamin D 0mcg	0%
Calcium 0mg	0%
Iron 0mg	0%
Potassium 0mg	0%

*The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

INGREDIENTS: WATER, SOYBEAN OIL, DISTILLED VINEGAR, HIGH FRUCTOSE CORN SYRUP, SALT, EGG, ROMANO CHEESE (MILK, SALT, CULTURES, ENZYMES), DEHYDRATED GARLIC, SUGAR, SPICES, XANTHAN GUM, DEXTROSE, CALCIUM DISODIUM EDTA, ADDED TO PROTECT FLAVOR, ANNATTO COLOR, NATURAL FLAVORS. CONTAINS: EGG, MILK.

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REFRIGERATE AFTER OPENING. SHAKE WELL.

ALTERNATE IDEAS

If you have extra time to prepare, or if your school's nutrition team agrees to prepare a dish for your taste test, here are some great options to use in place of either of the dressing options:

- Lettuce varieties side by side
- Chilled vs. room-temperature lettuce
- Lettuce as a dipper (with hummus or ranch)
- "Massaged" romaine (massage vinaigrette into lettuce for a change in taste and texture)
- Lettuce wrap burger sliders
- Lettuce boats with Southwestern style fillings
- Lettuce cups with Asian-inspired chicken filling

LEMON AND OLIVE OIL VINAIGRETTE RECIPE

Estimated Yield: About ½ cup dressing (4 two-tablespoon servings)

EQUIPMENT REQUIRED	MATERIALS AND INGREDIENTS	DIRECTIONS
<ul style="list-style-type: none"> - Small jar with a tight-fitting lid - Measuring cup - Measuring spoons - Paper or cloth towels for spills - Bowls or cups to serve 	<p><i>Adjust quantities based on class size.</i></p> <ul style="list-style-type: none"> - ⅓ cup extra virgin olive oil - 1 tablespoon white wine vinegar or apple cider vinegar - 1 tablespoon lemon juice - 2 teaspoons honey or sugar - ¼ teaspoon garlic powder - ¼ teaspoon salt - Pinch black pepper 	<ol style="list-style-type: none"> 1. Combine all ingredients in the small jar. 2. Seal jar tightly and shake vigorously until dressing appears combined and slightly cloudy. 3. Serve over chopped romaine.

TIP: You might choose to demonstrate how to make the dressing for the class, or have students work in small groups to shake and mix their own jars as a hands-on activity. Observe how the oil and vinegar combine/emulsify, then discuss why they eventually separate into distinct layers.



CUSTOMIZE YOUR DRESSING

Switch up your dressing by experimenting with other flavors. Stir in a tablespoon of grated Parmesan cheese for a richer, cheesy flavor. Add a teaspoon of Dijon mustard to add a little kick and help the dressing emulsify. Or have fun playing with different seasonings and herbs like basil, Italian seasoning or chives.

LETTUCE LAB: WHAT MAKES WATER CLIMB A LEAF?

TEACHER GUIDE

In this investigation, students place two romaine leaves in dyed water — one left whole, one with the leafy part trimmed down to its white rib — and compare how fast and how brightly the color appears in each. The trimmed leaf is the surprise: Because every cut edge is an open tube where water can escape, the dye races to those edges and pools there, often within a single class period. Students see, with their own eyes, that the brightest spots mark where water is leaving the leaf fastest. It ties directly to what they saw on Traders Hill Farm, where nutrient-rich water travels from the fish tanks, up through the roots and out into every leaf.

The Science: Plants move water through tiny tubes called **xylem** that run from the roots up into every leaf. Water isn't pushed up — it's **pulled**. As water evaporates from the leaf's surface into the air (**transpiration**), it tugs the next water molecule up behind it, and the whole column of water holds together and rises, a lot like sipping juice through a straw. The dye rides along with the water, so wherever water exits fastest, the dye piles up and shows brightest.

Why the trimmed leaf matters: *An intact blade has a waxy coating and tiny pores that slow water's escape, so its color spreads gradually along the veins. A trimmed rib has **open, exposed xylem** all along its cut edges — an unobstructed exit. Water rushes out there, so the dye concentrates into a bold line right at the cuts. That contrast is the whole lesson, and students can reason their way to it if you let them.*

Time: ~15-20 minutes setup

Check after a few hours, but the boldest results appear the next day. If you can, start in the morning so students see progress before the day ends. Check back again the next day.

 **SETUP TIP:** Re-cut each stem right before the students stand it in the water. A fresh cut reopens the tubes and is the #1 thing that makes color show.

MATERIALS (PER GROUP)

- Pale inner romaine leaves: 2 per group, cut from the same head and as close to the same size as possible, plus a few extras (some won't take the dye well)
- Clear cups: 2 per group
- Water
- Dark food coloring: red or blue work best; 15–20 drops per cup for a deep color
- Scissors
- Ruler: for measuring both leaves before the test begins
- Timer or clock: for recording observation times
- Paper plates or newspaper: the rib holds a lot of water and slicing gets wet
- Paper towels: for drips and dye spills (Dye will stain hands and fabric.)
- Magnifying glass (optional): for viewing the xylem lines up close
- Aprons or old shirts (optional): food coloring stains hands and clothes

Ask your cafeteria for a few heads of romaine if you can. Pale inner leaves show the color far better than the dark outer ones.

Standardize the trim. This is where results can go sideways between groups. Show the class exactly what "trimmed" means: green blade snipped off both sides, rib and tip left intact. If one group barely trims and another strips it bare, their data won't be comparable, which is worth pointing out as a real-world lesson in why scientists standardize procedures.

WHAT TO EXPECT / TROUBLESHOOTING

- **What success looks like:** Leaf B (trimmed) shows a bold, concentrated line of color right along its cut edges, often visible within an hour. Leaf A (whole) colors more slowly and diffusely, following its veins and midrib.
- **Faint color?** The dye may be too weak, the cut wasn't fresh or not enough time has passed. Add more dye, re-cut the base and wait longer (overnight is best).
- **No color at all?** The leaf may be too thick or dark, or the base dried out and sealed. Try a paler inner leaf with a fresh cut.
- **Both leaves look the same?** The trim was too light. More blade needs to come off so the rib is genuinely exposed.
- **Leaf wilted or slimy?** The leaf was old, or it's sitting too deep. Use a fresh inner leaf and about an inch of water.

Student Sheet "Analyze: Defend Your Conclusion" Answer Key:

1. **Which showed color faster?** Leaf B, the trimmed one (usually clearly ahead by the 30-minute check).
2. **Where did the color collect?** Leaf A: gradually along the veins and midrib. Leaf B: concentrated in a bright line right along the cut edges, where the xylem is open and water escapes fastest.
3. **Prediction and evidence:** Accept any prediction. Require students to cite specific times and brightness numbers from their table, not just a yes or no.
4. **Farm connection:** Both show water being pulled up from the bottom. At Traders Hill Farm, nutrient-rich water moves from the fish tanks to the roots, up the stem and out into the leaves. As water evaporates from those leaves, it keeps tugging more up behind it, feeding the whole plant all the way to the top.

FACILITATING THE DISCUSSION

Use the "Defend Your Conclusion" questions on the student sheet to guide students from what they saw to what caused it to how it works on the farm. Find an answer key to the right.

EXTEND LEARNING

- **Change the environment:** Put one cup in direct sun and one in shade, or aim a fan at one. Faster evaporation means faster color. Students can predict this before testing it.
- **Look closer:** Slice a rib open lengthwise and view the xylem with a magnifying glass, or hold a dyed leaf up to a window. The colored veins glow and are much easier to trace.
- **Graph it:** Plot brightness (1–5) against time for both leaves on the same grid. Two lines on one graph make the difference impossible to miss and hit the data standards directly.

Name _____ Date _____

Lettuce Lab: What Makes Water Climb a Leaf?

At Traders Hill Farm, water is always on the move, carrying nutrients from the fish to the lettuce roots. But how does water travel *up* through a plant, against gravity? In this investigation, you'll find out by watching colored water move through two leaves that are shaped differently, making the invisible visible.



Our Question:

How does trimming the leaf blade change how colored water moves?

Materials (per group)

- Pale inner romaine leaves: 2 per group, cut from the same head and as close to the same size as possible, plus a few extras (some won't take the dye well)
- Clear cups: 2 per group
- Water
- Dark food coloring: red or blue works best; 15–20 drops per cup for a deep color
- Scissors
- Ruler: for measuring both leaves before the test begins
- Timer or clock: for recording observation times
- Paper plates or newspaper: the rib holds a lot of water and slicing gets wet
- Paper towels: for drips and dye spills (dye stains!)
- Magnifying glass (optional): for viewing the xylem lines up close
- Aprons or old shirts (optional): food coloring stains hands and clothes

Set Up a Fair Test

1. **Fill both cups with the same amount of water** and stir in the same number of drops of red or blue food coloring.
2. **Prepare Leaf A:** full blade. Leave this romaine leaf whole, with all its green.
3. **Prepare Leaf B:** trimmed. Carefully snip the green blade off both sides. Leave the white rib and the very tip intact.
4. **Make a fresh cut** — don't skip this!
Right before you put each leaf in its cup, snip straight across the bottom of the leaf to make a clean, fresh cut.
Why? The bottom of a leaf seals itself shut once it's been sitting out — like a scab. A fresh cut reopens the tiny tubes so water can climb inside. If you skip this step, your leaf may not take up any color at all.
Cut both leaves the same way and put them in the water **right away**.
5. **Start your timer** as soon as both leaves are standing in their cups. Record the clock time on your lab sheet.

This lettuce is for science, not snacking.
Food coloring stains — protect your clothes and your table.

Continued →

Lettuce Lab Log

Predict

Before you start, write your prediction: Which leaf do you think will show the color faster and brighter? And where on each leaf do you think the color will collect? Why?

Observe and Describe

Check your leaves after about 30 minutes, again after a few hours, and again the next day if you can. Each time, look closely and record on your worksheet for each leaf:

- Where is the color?
- How bright is it, on a scale of 1 (barely any) to 5 (bold and vivid)?
- On a separate page, sketch what you see so you can compare over time.

Time checked	Leaf A — Full blade (Where is the color? brightness 1–5)	Leaf B — Trimmed rib (Where is the color? brightness 1–5)
Start (0 min)		
After ~30 min		
After _____ hours		
Next day		

Analyze: Defend Your Conclusion

1. Which leaf showed color faster? _____
2. Where did the color collect on each leaf? On the trimmed rib, watch what happens right at the cut edges. What did you notice there? _____

3. Was your prediction correct? What does the evidence show? _____

4. How is this like the way water travels from the fish tanks all the way up into the lettuce plants at Traders Hill Farm? _____

Look Closer

Try holding a dyed leaf up to a window or light. The colored veins glow and are much easier to trace. A magnifying glass makes the xylem lines and the rest of the leaf structure even easier to see up close.

Name _____ Date _____

Romaine Lettuce Video Trivia & Farm Math

Write a complete sentence to answer each question below.

1. In aquaponics, the fish help the lettuce grow. Explain how the fish help feed the lettuce plants.

2. What does it mean when a lettuce plant "bolts"? _____

3. Name one reason eating lettuce is good for your body. _____

Circle whether the statements below are true or false.

4. At Traders Hill Farm, lettuce is grown in water instead of soil.

TRUE | FALSE

5. A garden outside can grow more lettuce in a small space than a greenhouse can.

TRUE | FALSE

6. Lettuce grows best in cold weather, around 40°F.

TRUE | FALSE

Choose the correct word to fill each blank.

Word Bank: **fish · nursery · hydroponics**

7. _____ means growing plants in water instead of soil.

8. Adding _____ to a hydroponic system turns it into an aquaponic system.

9. A _____ is the place on the farm where lettuce plants first start growing from seeds.

Continued →

Farm Math

Solve each problem and write your answer in the box.

1. Romaine lettuce takes about 40 days to grow. If 15 days have already passed, how many more days until the lettuce is ready to pick?

_____ days

2. Each flat holds 25 lettuce plants. One row on the farm has 50 flats. How many lettuce plants are in a full row?

_____ plants

3. A row has 50 flats. The workers have already planted 32 flats. If they can plant 6 more flats each hour, how many more hours until the row is finished?

_____ hours

4. Remember that one row holds 50 flats, and each flat holds 25 lettuce plants. Farmer Tracy wants to harvest one full row and share it equally among 8 school cafeterias. How many lettuce plants will each cafeteria receive, and will she have any leftover? If so, how many?

_____ plants

_____ leftover plants

Name _____ Date _____

Farm Math: Lettuce

At Traders Hill Farm, romaine lettuce grows in **8 lanes**. Seedlings start in trays called **flats**, and each flat holds **25 plants**. **50 flats** fit in one row. Nearby, **5 tilapia tanks** (with about **200 fish each**) feed the plants through aquaponics. From seed to harvest, romaine takes about **40 days** to grow.

Directions: Use these farm facts to solve the problems below. Show your work and write your answer in the box.

1. The farm has 8 lanes of romaine lettuce, and each lane has the same number of plants. Altogether, the farm has 10,000 plants. Write and solve an equation using "n" for the number of plants in one lane.

Equation:

Answer: _____

2. The farm has 5 tilapia tanks, and each tank holds about 200 fish. Write a multiplication equation and solve it to find about how many tilapia live at the farm in all.

Equation:

Answer: _____

3. A crop of lettuce takes about 40 days to grow from seed to harvest. The water pumps run 24 hours a day, every day. How many total hours do the pumps run during one crop cycle?

Answer: _____

4. A farmer has 1,355 lettuce seedlings from the nursery ready to be put into flats. If 25 plants fit on one flat, how many flats will the farmer need to plant all the lettuce? (Careful – think about the leftover plants!)

Answer: _____

4a. 50 flats fit in one row. How many rows will the farmer need for all of those flats?

Answer: _____

5. All 8 lanes are harvested (see your answer to question 1 for the number of plants per lane). The heads are packed into cases, with 24 heads per case. How many full cases can the farm fill, and how many heads of lettuce will be left over? Show your work.

Full cases: _____

Heads left over: _____

6. The chart below shows how many cases of lettuce the farm harvested each day for one week.

Day	Monday	Tuesday	Wednesday	Thursday	Friday
Cases harvested	280	300	250	320	290

- 6a. How many cases did the farm harvest total that week?

Answer: _____

- 6b. Which day had the most cases, and which had the fewest? What is the difference between them?

Most: _____ Fewest: _____ Difference: _____

Name _____ Date _____

Ways to Grow Lettuce

Directions: Read the passage about how lettuce is grown. Then, answer the questions.

Did you know there's more than one way to grow lettuce? In fact, there are three! Farmers can grow lettuce in soil, in water with added nutrients, or in water using fish.

The most common way is to grow lettuce in soil, out in an open field. The plant's roots pull water and nutrients from the dirt. This is how most store-bought lettuce is usually grown. But lettuce doesn't really need soil. It needs water and nutrients. So, farmers have found ways to grow it right in water. The catch is that the water must have nutrients added, or the plants won't survive.

There are two ways to add nutrients. **Hydroponic** lettuce grows in water, and farmers add the nutrients by hand. **Aquaponic** lettuce also grows in water, but its nutrients come from a surprising source: fish! The fish live in nearby tanks. As water flows out of the tanks, it passes through a filtration system that turns the fish waste into nutrients, the tiny bits of food plants need. That nutrient-rich water then flows to the lettuce, where the roots drink it up.

That is the kind of farming they do at Traders Hill Farm in Hilliard, Florida. The farm was founded in 2013, and its mission is to help people live healthier lives. At Traders Hill, farmers raise their lettuce inside greenhouses. Greenhouses are special buildings that protect plants from the outdoors. Inside, the lettuce grows in pools of water. Nearby, fish in tanks provide nutrients for the lettuce plants. This is what makes Traders Hill an aquaponic farm.

Growing indoors has big advantages. Outside in a field, a lot of lettuce goes bad and gets thrown away. But inside, the conditions are just right, so fewer plants are wasted. That also means the farm can grow fresh lettuce all year long, even when it is cold outside! Greenhouses also keep out bugs, so farmers use fewer harsh chemicals. That is healthier for you and for the environment. Because aquaponic and hydroponic systems reuse their water, they use far less of it than lettuce grown outdoors in a field.

Close Reading

Circle the best answer.

1. What is this passage **mostly** about?
 - a. How fish live in the water tanks on a farm
 - b. The three different ways farmers can grow lettuce
 - c. Why lettuce is a healthy food to eat
 - d. How to build a greenhouse
2. In the passage, the word **nutrients** means:
 - a. kinds of soil
 - b. substances that help plants grow
 - c. tools that farmers use
 - d. types of fish
3. According to the passage, what is one **advantage** of growing lettuce in a greenhouse?
 - a. Farmers use fewer harsh chemicals.
 - b. Lettuce grown outdoors uses fewer chemicals.
 - c. Greenhouse lettuce cannot grow all year long.
 - d. Lettuce grown outdoors can grow all year long.
4. Based on the passage, which of these is **NOT** a way farmers grow lettuce?
 - a. By using nutrients from fish waste
 - b. By planting lettuce in fishponds
 - c. By adding nutrients to the water lettuce grows in
 - d. By planting lettuce in the soil

Dig Deeper

Answer in complete sentences.

5. The passage says that when lettuce is grown indoors, fewer plants are wasted. Why do you think growing indoors leads to less waste? Use details from the passage to explain.

6. In one sentence, explain where aquaponic lettuce gets its nutrients.

Replay! Sum It Up

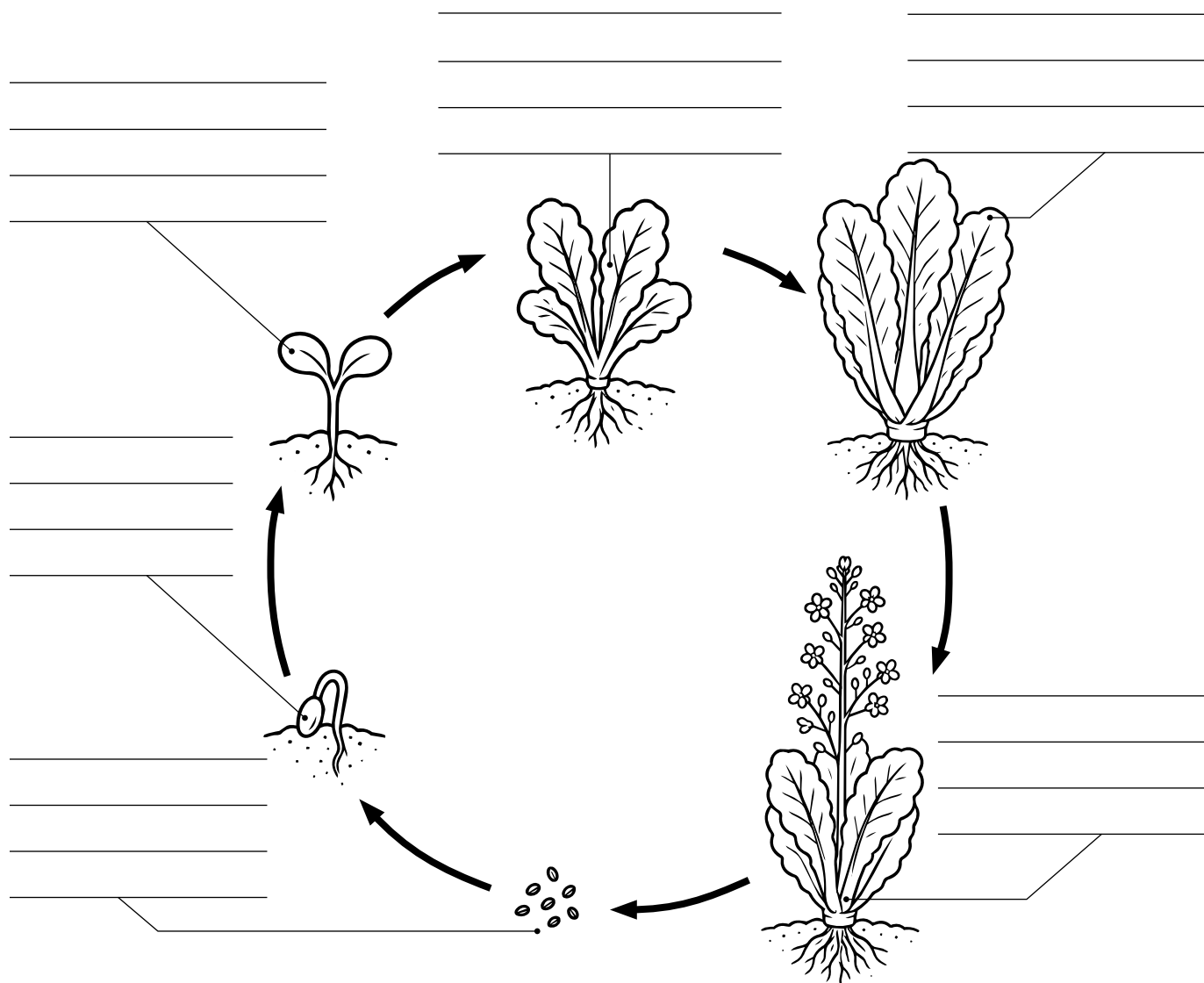
Using the passage **and** the video, write 3–4 sentences that summarize the different ways lettuce is grown.

Be sure to name all three methods and tell one way aquaponic farming is different from growing lettuce in a field.

Name _____ **Date** _____

Life Cycle of Lettuce

Directions: Label each part of the lettuce plant's life cycle using the terms in the word bank. Then, briefly describe what is happening in each phase.



Word Bank

Seed

Seedling

Mature Plant

Germination

Young Plant

Flowering/Bolting (reproduction)

Name _____ Date _____

Expository Essay Prompt

Write an expository essay explaining how aquaponic farming grows lettuce without soil and giving reasons a school might choose to serve locally grown lettuce. Use facts and details from the video to support your ideas.

Be sure to:

- Introduce your topic clearly and state a central idea.
- Group related information into paragraphs.
- Develop your topic with facts, details and examples from the video.
- Use linking words and phrases (*because, another reason, for example, also, finally*) to connect your ideas.
- Write a conclusion that wraps up your essay.
- Check your spelling, capitalization and punctuation.

Source Notes from the Video:

Facts you can use as evidence.

- Aquaponic lettuce grows in water, not soil — the roots hang in nutrient-rich water.
- The farm raises fish (tilapia). The filtration system turns the fish's waste into nutrients that feed the plants; the clean water flows back to the fish, all day, every day.
- The farm grows lettuce **365 days a year**, even when it is cold outside.
- Growing indoors, the farm grows about **5 times more lettuce** in the same space as an outdoor field, and uses far less water.
- Screens and covers keep out pests, so the farmers use **fewer harsh chemicals**.
- Romaine takes about **35–40 days** to grow.
- Lettuce is harvested early in the morning and shipped to local schools the **same day**, so it arrives very fresh. The farm's biggest customer is the school district.

Plan Your Essay

Introduction

Hook (an interesting first sentence): _____

What will your essay explain? (central idea): _____

Facts & Details (Body)

Part 1: How does aquaponic farming grow lettuce without soil?

- Detail: _____

- Detail: _____

Part 2: Why might a school choose locally grown lettuce? (Give at least two reasons.)

- Reason: _____

- Reason: _____

Conclusion

Restate your central idea in a new way: _____

A final thought for your reader: _____

Write Your Essay

Write your essay on a separate sheet of paper.

Teacher Scoring Guide

Purpose, Focus & Organization (structure): Look for a clear central idea, a logical order (introduction → body → conclusion), grouped paragraphs and transitions connecting ideas.

Evidence & Elaboration (development): Look for relevant facts and details from the video, explained in the student's own words — e.g., that plants grow in nutrient-rich water instead of soil; that fish waste becomes the plants' food; and reasons for local lettuce such as freshness (same-day delivery), year-round supply, less water and fewer chemicals, and supporting a nearby farm.

Conventions: Look for complete sentences, correct capitalization, end punctuation and grade-appropriate spelling.

Sample strong points a student might include:

- How it works without soil: The roots sit in water full of nutrients; the fish and the filtration system provide those nutrients; and the water recirculates so little is wasted.
- Reasons a school might choose local lettuce: It arrives shortly after being picked, so it is very fresh; it can be grown all year; it uses less water and fewer chemicals; and buying it supports a local Florida farm.

ANSWER KEY

**4-5 Worksheet
Lettuce**
Standard(s) Supported: ELA.4.R.3.2 / ELA.5.R.3.2, MA.4.AR.1.1 / MA.4.AR.2.2, MA.5.AR.1.1

Name _____ Date _____

Romaine Lettuce Video Trivia

Write a complete sentence to answer each question below.

- In aquaponics, the fish help the lettuce grow. Explain how the fish help feed the lettuce plants.
The fish make waste, and the farm's system turns that waste into nutrients (food) that the lettuce plants use to grow.
- What does it mean when a lettuce plant "bolts"? **It means the plant starts growing flowers and going to seed. Its leaves turn bitter, so it does not taste as good.**
- Name one reason eating lettuce is good for your body. **Accept either: Romaine is about 95% water, so it helps keep you hydrated; or it has vitamin K, which helps keep your bones strong.**

Circle whether the statements below are true or false.

4. At Traders Hill Farm, lettuce is grown in water instead of soil.	TRUE FALSE
5. A garden outside can grow more lettuce in a small space than a greenhouse can.	TRUE FALSE
6. Lettuce grows best in cold weather, around 40°F.	TRUE FALSE

Choose the correct word to fill each blank.

Word Bank: fish · nursery · hydroponics

- Hydroponics** means growing plants in water instead of soil.
- Adding **fish** to a hydroponic system turns it into an aquaponic system.
- A **nursery** is the place on the farm where lettuce plants first start growing from seeds.

Continued →

**4-5 Worksheet
Lettuce**
Standard(s) Supported: ELA.4.R.3.2 / ELA.5.R.3.2, MA.4.AR.1.1 / MA.4.AR.2.2, MA.5.AR.1.1

Farm Math

Solve each problem and write your answer in the box.

- Romaine lettuce takes about 40 days to grow. If 15 days have already passed, how many more days until the lettuce is ready to pick?
 $40 - 15 = 25$ days
- Each flat holds 25 lettuce plants. One row on the farm has 50 flats. How many lettuce plants are in a full row?
 $25 \times 50 = 1,250$ plants
- A row has 50 flats. The workers have already planted 32 flats. If they can plant 6 more flats each hour, how many more hours until the row is finished?
 $50 - 32 = 18$ flats left; $18 \div 6 = 3$ hours
- Remember that one row holds 50 flats, and each flat holds 25 lettuce plants. Farmer Tracy wants to harvest one full row and share it equally among 8 school cafeterias. How many lettuce plants will each cafeteria receive, and will she have any leftover? If so, how many?
 **$50 \times 25 = 1,250$ plants
 $1,250 \div 8 = 156$ remainder 2
156 plants plants
2 leftover plants leftover plants**

**4-5 Worksheet
Lettuce**
Standard(s) Supported: MA.4.AR.1.1, MA.4.AR.2.2, MA.5.AR.1.1, MA.5.AR.2.1, MA.5.AR.2.4, MA.6.M.1.2, MA.6.DP.1.2 / MA.6.DP.1.3

Name _____ Date _____

Farm Math: Lettuce

At Traders Hill Farm, romaine lettuce grows in **8 lanes**. Seedlings start in trays called **flats**, and each flat holds **25 plants**. **50 flats** fit in one row. Nearby, **5 tilapia tanks** (with about **200 fish each**) feed the plants through aquaponics. From seed to harvest, romaine takes about **35–40 days** to grow.

Directions: Use these farm facts to solve the problems below. Show your work and write your answer in the box.

- The farm has 8 lanes of romaine lettuce, and each lane has the same number of plants. Altogether, the farm has 10,000 plants. Write and solve an equation using "n" for the number of plants in one lane.
Equation:
 **$8 \times n = 10,000$ (or $10,000 \div 8 = n$).
 $n = 1,250$ plants per lane.**
Answer: _____
- The farm has 5 tilapia tanks, and each tank holds about 200 fish. Write a multiplication equation and solve it to find about how many tilapia live at the farm all.
Equation:
 **$5 \times 200 = 1,000$.
About 1,000 tilapia.**
Answer: _____
- A crop of lettuce takes about 40 days to grow from seed to harvest. The water pumps run 24 hours a day, every day. How many total hours do the pumps run during one crop cycle?
 $40 \times 24 = 960$ hours.
Answer: _____
- A farmer has 1,355 lettuce seedlings from the nursery ready to be put into flats. If 25 plants fit on one flat, how many flats will the farmer need to plant all the lettuce? (Careful — think about the leftover plants!)
 $1,355 \div 25 = 54$ remainder 5. Fifty-four flats hold 1,350 plants, and 5 plants are still left, so the farmer needs 55 flats (round up, the leftover plants still need a flat).
Answer:
4a. 50 flats fit in one row. How many rows will the farmer need for all of those flats?
 $55 \div 50 = 1$ remainder 5. One row isn't enough for all 55 flats, so the farmer needs 2 rows.
Answer: _____

**4-5 Worksheet
Lettuce**
Standard(s) Supported: MA.4.AR.1.1, MA.4.AR.2.2, MA.5.AR.1.1, MA.5.AR.2.1, MA.5.AR.2.4, MA.6.M.1.2, MA.6.DP.1.2 / MA.6.DP.1.3

5. All 8 lanes are harvested (see your answer to question 1 for the number of plants per lane). The heads are packed into cases, with 24 heads per case. How many full cases can the farm fill, and how many heads of lettuce will be left over? Show your work.
 $8 \times 1,250 = 10,000$ heads. $10,000 \div 24 = 416$ remainder 16. The farm can fill 416 full cases, with 16 heads left over.

Full cases: **416**
Heads left over: **16**

6. The chart below shows how many cases of lettuce the farm harvested each day for one week.

Day	Monday	Tuesday	Wednesday	Thursday	Friday
Cases harvested	280	300	250	320	290

6a. How many cases did the farm harvest total that week?
 $280 + 300 + 250 + 320 + 290 = 1,440$ cases.
Answer: _____

6b. Which day had the most cases, and which had the fewest? What is the difference between them?
Most: Thursday (320). Fewest: Wednesday (250). Difference: $320 - 250 = 70$ cases.
Most: _____ Fewest: _____ Difference: _____

ANSWER KEY

4-5 Worksheet
Lettuce

Standard(s) Supported: ELA.4.C.3.1, ELA.4.R.3.2, SC.4.L.16.2, ELA.5.C.3.1, ELA.5.R.3.2

Close Reading

Circle the best answer.

- What is this passage **mostly** about?
 - How fish live in the water tanks on a farm
 - The three different ways farmers can grow lettuce
 - Why lettuce is a healthy food to eat
 - How to build a greenhouse
- In the passage, the word **nutrients** means:
 - kinds of soil
 - substances that help plants grow
 - tools that farmers use
 - types of fish
- According to the passage, what is one **advantage** of growing lettuce in a greenhouse?
 - Farmers use fewer harsh chemicals.
 - Lettuce grown outdoors uses fewer chemicals.
 - Greenhouse lettuce cannot grow all year long.
 - Lettuce grown outdoors can grow all year long.
- Based on the passage, which of these is **NOT** a way farmers grow lettuce?
 - By using nutrients from fish waste
 - By planting lettuce in fishponds
 - By adding nutrients to the water lettuce grows in
 - By planting lettuce in the soil

Dig Deeper

Answer in complete sentences.

5. The passage says that when lettuce is grown indoors, fewer plants are wasted. Why do you think growing indoors leads to less waste? Use details from the passage to explain.

Sample answer: Indoors, the conditions are "just right" and greenhouses protect the plants from the outdoors and keep out bugs, so more plants grow well. Outside in a field, weather and pests cause more lettuce to go bad, so more of it is thrown away.

6. In one sentence, explain where aquaponic lettuce gets its nutrients.

Accept: "The fish's waste is turned into nutrients that feed the plants." (Also accept the surrounding sentence about the nutrients coming from fish.)

4-5 Worksheet
Lettuce

Standard(s) Supported: ELA.4.C.3.1, ELA.4.R.3.2, SC.4.L.16.2, ELA.5.C.3.1, ELA.5.R.3.2

Replay! Sum It Up

Using the passage **and** the video, write 3–4 sentences that summarize the different ways lettuce is grown.

Be sure to: name all three methods and tell one way aquaponic farming is different from growing lettuce in a field.

Sample answer: Lettuce can be grown in three ways: in soil in an open field, in water with nutrients added by hand (hydroponic) or in water using fish (aquaponic). In aquaponic farming, like at Traders Hill Farm, the fish's waste feeds the plants instead of farmers adding nutrients by hand. Growing lettuce indoors in water also wastes fewer plants and uses less water than growing it outside in a field.

4-5 Worksheet
Lettuce

Standard(s) Supported: SC.4.L.16.4 / SC.4.L.16.1

Name _____ Date _____

Life Cycle of Lettuce

Directions: Label each part of the lettuce plant's life cycle using the terms in the word bank. Then, briefly describe what is happening in each phase.

Seedling: The young plant grows its first leaves.

Young Plant: More leaves grow as the plant gets bigger.

Mature Plant: The lettuce is fully grown and ready to harvest.

Flowering/Bolting (reproduction): The plant grows a tall stem and flowers so it can produce seeds.

Seed: A baby plant is inside, waiting for the right conditions to grow.

Germination: The seed begins to sprout.

Word Bank		
Seed	Seedling	Mature Plant
Germination	Young Plant	Flowering/Bolting (reproduction)