

HARVEST OF THE MONTH - SEPTEMBER / TOMATOES

Grades 9-12

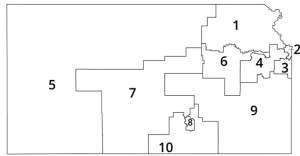


Kansas leads the world in the success of each student.

JULY 10, 2025



900 S.W. Jackson Street, Suite 600
Topeka, Kansas 66612-1212
(785) 296-3203
www.ksde.gov/board



SUCCESS DEFINED

A successful Kansas high school graduate has the

- Academic preparation,
- Cognitive preparation,
- Technical skills,
- Employability skills and
- Civic engagement

to be successful in postsecondary education, in the attainment of an industry recognized certification or in the workforce, without the need for remediation.

OUTCOMES

- Social-emotional growth
- Kindergarten readiness
- Individual Plan of Study
- Civic engagement
- Academically prepared for postsecondary
- High school graduation
- Postsecondary success



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MISSION

To prepare Kansas students for lifelong success through rigorous, quality academic instruction, career training and character development according to each student's gifts and talents.

VISION

Kansans leads the world in the success of each student.

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Kansas leads the world in the success of each student.

July 1, 2025

HARVEST OF THE MONTH

September / Tomatoes

INTRODUCTION

Over the next few weeks, we will be learning about a kind of food that we grow in Kansas. I'm going to give you some clues to see if you can guess what this food is.

- This is a round or oval fruit that is often mistaken for a vegetable. Show where fruits and vegetables are found on a MyPlate.gov poster¹. They come in many colors include red, yellow, orange, green and even purple and pink!
- They grow on a vine.
- They are good for your heart's health.
- They can be eaten fresh and are used as an ingredient in things like juice, soup, sauces, salsa, or ketchup
Ingredient - an ingredient is one part of a mixture.
- Show picture.

Can you guess what food I'm talking about? We will be learning about tomatoes!

Optional: You could also place a tomato in a brown paper bag and let the children reach in and feel it without peeking to see if they can guess what it might be as you give the clues



1 <https://www.myplate.gov/sites/default/files/2020-12/Coloring%20Sheet.pdf>

VOCABULARY

Antioxidant - A substance that helps protect the body's cells from damage caused by harmful molecules called free radicals

Depolarization - A change in a cell's electrical charge, usually in a nerve or muscle cell, that starts a signal to be sent

Heirloom - A plant variety (like a type of tomato) that has been passed down through generations without being changed by modern breeding

Hybrid - A plant or animal made by crossing two different types to get certain traits, like better taste or disease resistance

Olfactory - Related to the sense of smell

Receptor Proteins - Special proteins on or in a cell that receive signals, like from chemicals or hormones, and help the cell respond

Sensory Evaluation - A way to test how things like food taste, smell, look, or feel by using the senses

Tastant - A chemical substance that can be tasted, like sugar or salt

Taste - One of the five senses that helps us identify flavors such as sweet, sour, salty, bitter, and umami

Taste Bud Cells - Tiny cells found on the tongue that detect different tastes and send that information to the brain

GENERAL RESOURCES

Key Factors Affecting Watermelon Yield Loss²

Boyce Thompson Institute for Plant Research³

ENGAGE

Background

Tomatoes are one of the most popular fruits on the planet and are an important source of micronutrients like lycopene (a powerful antioxidant that protects DNA from damage). Tomatoes come in a variety of types. Sauce tomatoes (like Roma or San Marzanos) usually have an oblong shape, thicker cell walls, less water content. Slicing tomatoes (like Beefsteak or Globe tomatoes) are usually larger, globular, and higher in water content with thinner skin. Tomatoes can also be classified as hybrid or heirloom tomatoes. Hybrid tomatoes are cross-pollinated between different varieties and usually have higher yields. They are typically more uniform in appearance and taste. Heirloom varieties are those whose taste and appearance are more unique and variable. They are open-pollinated plants that are considered true-breeding and have produced similar fruits for at least 40-50 years. Heirlooms are usually less resistant to disease than hybrids.

2 <https://www.sciencedirect.com/science/article/abs/pii/S0304423817301152>

3 <https://btiscience.org/visiting-bti/>

4 | Kansas State Department of Education | www.ksde.gov

Tomato flavor can be quite complex. Flavor arises from the combination of taste and olfactory (smell) senses in response to specific molecules like sugars, acids, and volatile compounds. Modern and hybrid tomatoes tend to be described as less flavorful than heirlooms because they often have been selected for size and firmness, which can reduce the concentration of sugars and production of volatile compounds that lend tomatoes their flavor.

Food scientists often use sensory evaluations to help them understand consumer preferences for flavor. Students will conduct a sensory evaluation of a variety of tomatoes in order to better understand the complexity of tomato flavor.

Teacher Preparation:

Prepare small pieces of several types of tomato varieties for each group. Consider providing cherry tomatoes, an heirloom tomato, a grocery-store variety slicing tomato, and a sauce tomato. Each variety should be given an identifying code.

Each student pair will need to assign a taste-tester and evaluator who will record data.

Sensory Evaluation Tool

Tomato	Sweet	Acidic (Sour)	Umami (savory)	Juicy	Firmness
1	☆☆☆☆☆	☆☆☆☆☆	☆☆☆☆☆	☆☆☆☆☆	☆☆☆☆☆
2	☆☆☆☆☆	☆☆☆☆☆	☆☆☆☆☆	☆☆☆☆☆	☆☆☆☆☆
3	☆☆☆☆☆	☆☆☆☆☆	☆☆☆☆☆	☆☆☆☆☆	☆☆☆☆☆
4	☆☆☆☆☆	☆☆☆☆☆	☆☆☆☆☆	☆☆☆☆☆	☆☆☆☆☆

Analysis:

Student teams will share data. Class will calculate average “stars” for each tomato variety for each characteristic.

Students will **make a claim** about which variety of tomato would be best as a slicing tomato, and which would be best as a sauce tomato. They should **use evidence** from the sensory evaluation to support their claim.

Following a class discussion, students should be introduced to the lesson's driving question—**Why do different varieties of tomatoes taste different?**

EXPLORE

The perception of taste is a complex neurological process. Watch ‘Taste: Anatomy and Physiology, Animation’ video⁴ that describes the neurophysiology of taste. Ask students to model the sensation and perception of the taste of an ideal slicing tomato OR an ideal sauce tomato. Students should include important components (such as tastants like sugars, acids, amino acids; taste bud cells; microvilli with receptors; cranial nerves; important brain structures) and mechanisms (such as tastant binding and depolarization). Students may engage in a peer review process to help them refine their models. Use this rubric⁵ from “The Wonder of Science⁶” to evaluate student models.

4 <https://www.youtube.com/watch?v=K9JSBzEEA0o>

5 https://docs.google.com/document/d/1JW8jUzFMYiHC7Be7yub9l0oEmNCFCGx3tiXBuDY0E_w/template/preview

6 <https://thewonderofscience.com/>

ELABORATE

Environmental factors such as soil composition and water availability can contribute to the flavor of crops like tomatoes. Have students read about the practice of dry farming⁷, which proponents claim is less intensive and produces more flavorful tomatoes.

Ask students to complete the Engaging in Argument from Evidence graphic organizer⁸ from “The Wonder of Science”⁹ as they read.

Other Sources

A chemical genetic roadmap to improved tomato flavor¹⁰ (article)

7 <https://www.sciencenews.org/article/dry-farming-agriculture-climate-change>
 8 https://drive.google.com/file/d/1vn_TCsdAm0dD7UmKKFHISyOP99P1qPyn/view
 9 <https://thewonderofscience.com/>
 10 <https://www.science.org/doi/10.1126/science.aal1556>
 6 | Kansas State Department of Education | www.ksde.gov

KANSAS SCIENCE STANDARDS ADDRESSED

HS-LS2-7 Ecosystems: Interactions, Energy, and Dynamics

Students who demonstrate understanding can:

HS-LS2-7

Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*

Clarification Statement

Examples of human activities can include urbanization, building dams, and dissemination of invasive species.

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Design, evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Disciplinary Core Ideas

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species.

LS4.D: Biodiversity and Humans

- Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). (secondary)
- Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (secondary) (Note: This Disciplinary Core Idea is also addressed by HS-LS4-6.)

ETS1.B: Developing Possible Solutions

- When evaluating solutions it is important to take into account a range of constraints including cost, safety, reliability and aesthetics and to consider social, cultural and environmental impacts. (secondary)

Crosscutting Concepts

Stability and Change

- Much of science deals with constructing explanations of how things change and how they remain stable.

HS-LS1-2 From Molecules to Organisms: Structures and Processes

Students who demonstrate understanding can:

HS-LS1-2

Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms

Clarification Statement

Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.

Assessment Boundary:

Assessment does not include interactions and functions at the molecular or chemical reaction level.

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices

Developing and Using Models

Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

- Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system.

Disciplinary Core Ideas

LS1.A: Structure and Function

- Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level.

Crosscutting Concepts

Systems and System Models

- Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales..

Additional Science & Engineering Practices Addressed:

SEP-2: Developing and Using Models

SEP-4: Analyzing and Interpreting Data

SEP-5: Using Mathematics and Computational Thinking

SEP-6: Constructing Explanations and Designing Solutions

SEP-7: Engaging in Argument from Evidence

Companion Texts for this study:

- Physiology of Taste video¹¹
- Dry farming could help agriculture in the western U.S. amid climate change¹²

11 <https://www.youtube.com/watch?v=K9JSBzEEA0o>

12 <https://www.sciencenews.org/article/dry-farming-agriculture-climate-change>

For more information, contact:

Eryn Davis

Farm to Plate Project Coordinator
Child Nutrition and Wellness

(785) 296-5060

Eryn.Davis@ksde.gov



Kansas State Department of Education
900 S.W. Jackson Street, Suite 102
Topeka, Kansas 66612-1212

<https://www.ksde.gov>



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