

HARVEST OF THE MONTH - JANUARY / BEEF

Grades 9-12

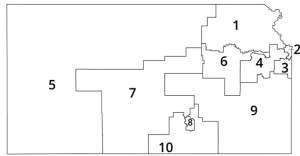


*Kansas leads the world in the success of each student.*

JULY 17, 2025



900 S.W. Jackson Street, Suite 600  
Topeka, Kansas 66612-1212  
(785) 296-3203  
[www.ksde.gov/board](http://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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Vice Chair  
[Danny.Zeck@ksde.gov](mailto:Danny.Zeck@ksde.gov)

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[Melanie.Haas@ksde.gov](mailto:Melanie.Haas@ksde.gov)

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[Michelle.Dombrosky@ksde.gov](mailto:Michelle.Dombrosky@ksde.gov)

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[Connie.O'Brien@ksde.gov](mailto:Connie.O'Brien@ksde.gov)

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[Cathy.Hopkins@ksde.gov](mailto:Cathy.Hopkins@ksde.gov)

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[Jim.Porter@ksde.gov](mailto:Jim.Porter@ksde.gov)

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[Debby.Potter@ksde.gov](mailto:Debby.Potter@ksde.gov)

## 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.

## MOTTO

Kansans Can

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[Randy.Watson@ksde.gov](mailto:Randy.Watson@ksde.gov)

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[Renee.Nugent@ksde.gov](mailto:Renee.Nugent@ksde.gov)

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*Kansas leads the world in the success of each student.*

July 1, 2025

## HARVEST OF THE MONTH

# January / Beef

### INTRODUCTION

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

- This is another type of food we get from cattle.
- Its an excellent source of protein and give us 10 essential nutrients including B-vitamins, zinc, and iron that give us energy, helps us to have strong muscles and help keep us healthy.
- This type of food can include things like hamburgers, steak, and roasts.

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



# VOCABULARY

**Allele:** A variant of a gene

**Mutation:** A change in the original DNA sequence

**Heterozygous:** Having two different alleles for a trait

**Homozygous:** Having two identical alleles for a trait

**Phenotype:** The set of observable characteristics of an organism that results from the interaction of genotype and environment

**Genotype:** The genetic makeup of an organism

**Hyperplasia:** The enlargement of an organ or tissue caused by an increase in the reproduction of its cells

**Hypertrophy:** An enlargement of an organ or tissue caused by an increase in the size of individual cells within the organ or tissue

## GENERAL RESOURCES

United States Department of Agriculture<sup>1</sup>

National Institutes of Health<sup>2</sup>

### ENGAGE

In this lesson, students will explore the double muscling phenomena in various cattle breeds. To introduce students to the phenomenon, start by showing images of normal cattle (a) and carcasses compared to cattle affected by double muscling (b) as shown below.



1 <https://www.ars.usda.gov/>

2 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4494293/>

| Normal Cattle                                                                     | Double Muscled Cattle                                                              | Meat from a Hybrid                                                                  |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |  |

Have students record their observations and questions in a notice/wonder chart in their science notebooks.

## EXPLORE

To start this section, students will use a collaborative annotation strategy to analyze multiple texts that describe the genetics behind double muscling in cattle. Print off each selection below, and tape it to the middle of a large butcher paper. Spread the texts around the room to allow students space to move around. It is suggested that students use colored pens or markers to write on the butcher paper. Have students look for important details about what might cause this condition in cattle, and why it might be good or bad for (1) the cattle, (2) the consumer, and (3) a farmer/ producer.

- Managing Double Muscling Through Selection<sup>3</sup>
- Can You Have Your Beef and Eat it Too? <sup>4</sup>
- Double Muscling<sup>5</sup>
- Double Muscling Infographic<sup>6</sup>

## EXPLAIN

At this point in the lesson, students will compile what they have learned about double muscling using a summary or graphic organizer. Once they have all of their information collected, have students create an initial model to explain the effects of double muscling on the beef industry. For more information on creating an initial model visit the Teaching Science in 3-D website<sup>7</sup>. Once individuals have created their models, they will share them with small groups to identify characteristics that are the same and different. Have students revisit and update their models and provide a written explanation for submission.

3 <https://www.beefcentral.com/genetics/weekly-genetics-review-managing-double-muscling-through-selection/>

4 <https://agresearchmag.ars.usda.gov/AR/archive/2004/Jul/beef0704.pdf>

5 [https://drive.google.com/file/d/1U9vCDo\\_8p5iLPM\\_vrMHW87iHL-3dIp50/view?usp=drive\\_link](https://drive.google.com/file/d/1U9vCDo_8p5iLPM_vrMHW87iHL-3dIp50/view?usp=drive_link)

6 [https://drive.google.com/file/d/1cLqMPJWUVPEmFWyS9bKS2LRVjEQCxoNt/view?usp=drive\\_link](https://drive.google.com/file/d/1cLqMPJWUVPEmFWyS9bKS2LRVjEQCxoNt/view?usp=drive_link)

7 <https://teachingsciencein3d.com/s3-e10-developing-and-using-models-for-ngss/>

## ELABORATE

Ask students to explore this phenomenon further by making connections to using this process on other organisms. Start their research with the Double Bacon Hogs.<sup>8</sup>

Students can create an infographic or short video to share their findings with classmates.

| KANSAS SCIENCE STANDARDS ADDRESSED                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>HS</b> Heredity: Inheritance and Variation of Traits</p> <p>Students who demonstrate understanding can:</p> <p><b>HS-LS3-1</b></p> <p>Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.</p> <p>Assessment Boundary:</p> <p>Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.</p> <p><i>The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.</i></p>                                                                                                                                                                                                                                                                                                                                                    |
| <p>Science and Engineering Practices</p> <p><b>Asking Questions and Defining Problems</b></p> <p>Asking questions and defining problems in 9-12 builds on K-8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.</p> <ul style="list-style-type: none"><li>• Ask questions that arise from examining models or a theory to clarify relationships.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <p>Disciplinary Core Ideas</p> <p><b>LS1.A: Structure and Function</b></p> <ul style="list-style-type: none"><li>• All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins. (secondary) (Note: This Disciplinary Core Idea is also addressed by HS-LS1-1.)</li></ul> <p><b>LS3.A: Inheritance of Traits</b></p> <ul style="list-style-type: none"><li>• Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function.</li></ul> |

8 <https://grist.org/food/super-cows-so-last-year-meet-the-double-bacon-hog/>

## Cause and Effect

### Stability and Change

- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

## HS Heredity: Inheritance and Variation of Traits

Students who demonstrate understanding can:

### HS-LS3-2

Make and defend a claim based on evidence that inheritable genetic variations may result from (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

Clarification Statement:

Emphasis is on using data to support arguments for the way variation occurs.] [Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.

*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

### Engaging in Argument from Evidence

Engaging in argument from evidence in 9-12 builds on K-8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.

- Make and defend a claim based on evidence about the natural world that reflects scientific knowledge, and student-generated evidence.

## Disciplinary Core Ideas

### LS3.B: Variation of Traits

- In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, and viable mutations are inherited.
- Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors.

## Cause and Effect

### Cause and Effect

- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

A sample of Kansas ELA Standards addressed in this unit are listed below. For details and specific grade level standard alignment, see Kansas 2023 English Language Arts Standards.<sup>9</sup>

Reading Foundations: Standard 3; using grade-level phonics and word reading skills

Reading Literature: Standard 1; asking and answering questions about a text

Reading Literature: Standard 4; word meaning/ word choice

Reading Information: Standard 3; Describe the relationship between historical events, scientific ideas or concepts

Reading Information: Standard 12; word meaning/ nuances

Writing: Standard 3; writing effective narratives to share experiences/ information with effective word choice and relevant details

Speaking and Listening: Standard 4; effectively presenting ideas and detailed/ sequenced descriptions with others.

## Companion Texts for this study:

### Digging for Beef

By Heather Barnes & Karen Baltimore

Also available: Digging for Beef Activity Book<sup>10</sup>

### Beef: Growth, Development and Harvesting

By Lucas Courtois

ISBN: 97801-53618-611-6

Publication Date: 10/2020

### Intraspecific Diversity as a Reservoir for Heat-Stress Tolerances in Sweet Potato

By Heider, Struelens, et.al

Publication Date 1/2021

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9 [https://www.ksde.gov/Portals/0/CSAS/Content%20Area%20\(A-E\)/English\\_Language\\_Arts/Kansas%20Standards%20for%20English%20Language%20Arts.pdf?ver=2023-05-17-150345-123](https://www.ksde.gov/Portals/0/CSAS/Content%20Area%20(A-E)/English_Language_Arts/Kansas%20Standards%20for%20English%20Language%20Arts.pdf?ver=2023-05-17-150345-123)

10 <https://ncfarmtoschool.com/wp-content/uploads/2020/06/sweet-potato-activity.pdf>

For more information, contact:

**Eryn Davis**  
Farm to Plate Project Coordinator  
Child Nutrition and Wellness  
(785) 296-5060  
[Eryn.Davis@ksde.gov](mailto:Eryn.Davis@ksde.gov)



Kansas State Department of Education  
900 S.W. Jackson Street, Suite 102  
Topeka, Kansas 66612-1212  
<https://www.ksde.gov>

