Food and Agriculture Center for Science Education

More from Less: Improving Beef Genetics

Middle School, Life Science

Task Overview

In this task, students will write an argument that justifies the selection of a particular bull to be mated with a group of cattle to meet the criteria set forth by the producer. First, students will identify trait heritability and make connections between trait heritability and making cattle produce beef more efficiently. Then, students review basic probability of outcomes for calf traits based on the expected differences from two different bulls. Students are introduced to a concept called Expected Progeny Difference. Next, students are asked to focus on a production trait of growth and make comparisons of the genetic difference between two calves on several economically and environmentally important traits. Last, students justify a decision to select a particular bull to be used in a selective breeding program to get a desired outcome.

Next Generation Science Standards

Three-Dimensional Claim

Write an argument from available evidence that supports, or refutes, the effect of selective breeding on certain characteristics passed from the parent to offspring based on relevant criteria.

This task is intended to elicit student learning of the following **NGSS elements** for each of the three dimensions:

Disciplinary Core Ideas

LS4.B: Natural Selection (MS)

- In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed on to offspring.

Science and Engineering Practices

Engaging in Argument from Evidence (MS)

- Make an oral or written argument that supports or refutes the advertised performance of a device, process, or system, based on empirical evidence concerning whether or not the technology meets relevant criteria and constraints.

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Crosscutting Concepts

Cause and Effect (MS)

- Phenomena may have more than one cause, and some cause-and-effect relationships in systems can only be described using probability.

Suggestions for Use

This task is intended to be used as a formative assessment to identify student strengths and weaknesses with the ideas of genetics and heredity and evaluation of possible solutions considering sustainable practices. The use of this task will help to identify students' strengths and needs to provide feedback to students. This will support shifts in instructional practice during a mid-unit assessment.

Background Information

Traits passed from parent to offspring influence the efficiency of the offspring. Certain traits, such as feed efficiency are of special importance to a livestock producer as feed is expensive to produce and comes with ecological impacts for production. Cattle that are better able to efficiently convert feed into pounds of protein (beef) for human consumption are more profitable to cattle farmers and have less of an impact on the environment. While some traits that control feed efficiency are highly heritable, others are less easily passed from one generation to the next and attributed to environmental conditions in which the calf was raised. So, understanding the traits that can be influenced, and consequently improved upon, is important to making more beef from fewer cattle that require fewer resources.

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Assumptions

This task assumes students have prior knowledge about sexual reproduction and heritability of traits. While this task does not require them to perform a Punnett square, this background activity will also prove helpful.

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Collaborations

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