



CTE Externship Lessons: Livestock Nutrition & Feed Development

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This resource was created by Tennessee teachers who participated in teacher externships sponsored by the Tennessee Department of Education, Division of Career and Technical Education. Many of the resources within the activities may be specific to industries where teachers completed their externship. Teachers may opt to substitute resources from companies within their region for better local alignment.

This resource is best for:

Teachers of:	<i>Agriscience</i>	Career Cluster:	<i>Agriculture, Food, and Natural Resources</i>
Addressing Standard(s):	Standard 13	Grade-Band	<i>9-10</i>

Learning Objectives: The goal of this activity is to develop a student’s understanding of livestock nutrition and feed development. The student will be able to differentiate between monogastric and ruminant digestive systems while understanding the components of an effective livestock feed formulation. This activity will allow students to demonstrate proficiency of Tennessee’s Standards for Literacy in Technical Subjects along with CTE course standards.

Texts	Text Complexity Analysis
<p>Text 1 Title: “Nutrition of Meat Goats”</p> <p>Author: J. Luginbuhl and M. Poore</p> <p>Citation/Publication Information: 1998, Department Of Agriculture, North Carolina State University</p> <p>Link: http://www.cals.ncsu.edu/an_sci/extension/animal/meatgoat/MGNutr.htm</p>	<p>Quantitative: Lexile: 1480</p> <p>Qualitative: The purpose is explicit and the text structure, features, and use of graphics are simple and clear, with few complex concepts. The language is explicit and clear, but includes domain specific vocabulary. A moderate level of understanding of the subject matter is required.</p>



	<p>Reader and Task: This style is simple, direct, and interesting. The students will need some basic prior knowledge of ruminant animals and nutritional terms (ruminant, cellulose, colostrum, weaning, etc.). There will have to be intentional scaffolding and review of some of the vocabulary terms necessary to discuss this article, although the concepts are not complex. Although the Lexile score is outside of the range, the sentence structure is simple and understanding can be accomplished providing vocabulary is reviewed.</p>
<p>Text 2 Title: “Formulating Rations With Pearson Square” Author: J. Wagner and T.L. Stanton Citation/Publication Information: 2012, Colorado State University Extension Link: http://www.ext.colostate.edu/pubs/livestk/01618.html</p>	<p>Quantitative: Lexile: 1360</p> <p>Qualitative: Though the purpose is clearly stated, the organization and main ideas, text features, and the use of graphics are essential in understanding content. Language is conventional, vocabulary should be familiar for students, and the sentence structure is simple.</p> <p>Reader and Task: The reader may develop an interest in the content because of how easy the Math is to understand. By the time students read this article, students should have an understanding that different feeds provide different protein contents. The complexity of the task associated (creating and solving Pearson Squares), should not interfere with the reading experience. This reading is only slightly outside of the range, and will require support with direct instruction and guided practice in class.</p>
<p>Text 3 Title: “The effects of feeding sericea lespedeza hay on growth rate of goats naturally infected with gastrointestinal</p>	<p>Quantitative: Lexile: 1450</p>



<p>nematodes” (abstract and Figures 1-2 only) Author: D. A. Moore, T. H. Terrill, B. Kouakou, S. A. Shaik, J. A. Mosjidis, J. E. Miller, M. Vanguru, G. Kannan and J. M. Burke</p> <p>Citation/Publication Information:2008, Journal of Animal Science</p> <p>Link: http://www.journalofanimalscience.org/content/86/9/2328.long</p>	<p>Qualitative: The purpose is explicit and organization is simple characteristic of a scientific abstract. The text features and use of graphics technical and essential in understanding the content. The language is dense, with difficult vocabulary requiring use of context clues and implicitly derived definitions. Scaffolding of vocabulary and contextual clues will be necessary for student engagement.</p> <p>Reader and Task: This style of writing is very difficult for students because of the domain specific vocabulary. Understanding of complex subject-specific terms and symbols (<, >, ±, etc.) will be important to preview with students prior to assigning this reading. This is a short passage, but will have to be scaffolded because of the complexity.</p>
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ELA/Literacy Standards addressed by task	
Strand	Grades 9-10
Reading in Technical Subjects: Key Ideas and Details	<ol style="list-style-type: none"> 1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details or explanations or descriptions. 2. Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon or concept; provide an accurate summary of the text. 3. Follow precisely a complex, multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
Reading in Technical Subjects: Craft and Structure	<ol style="list-style-type: none"> 4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
Reading in Technical Subjects: Integration of Knowledge and Ideas	<ol style="list-style-type: none"> 7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. 9. Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.



<p>Writing in Technical Subjects: Text Types and Purposes</p>	<p>2. Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.</p> <ul style="list-style-type: none"> a. Introduce a topic; organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension. b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience’s knowledge of the topic. c. Use appropriate and varied transitions and syntax to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts. d. Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic. e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).
<p>Writing in Technical Subjects: Production and Distribution of Writing</p>	<p>4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.</p>
<p>Tennessee CTE Standards addressed by task</p>	
<p><i>Agriscience</i></p>	<p>13. Classify the types of digestive systems in domestic animals, and compare and contrast their anatomical and physiological differences. Synthesize research on animal nutrition (using academic journals or publications from Tennessee Extension Service) to produce an informative narrative, including defining and applying nutrition specific terminology, to examine the stages of digestion and associated processes. (TN Reading 4, 9; TN Writing 2, 4; TN A&P 5)</p>



What key insights should students take from these resources?

1. Animals have specific nutritional components required of their diet, without which they will not survive.
2. Mathematical tools, such as the Pearson square, can be used to formulate and modify nutrient content in animal feed.
3. When developing a feed, costs must be considered in conjunction with nutritional goals and marketing strategies.

Text-Dependent Questions

Text 1: "Nutrition of Meat Goats"

1. How does the digestive system of a cow differ from that of a goat? How does that impact feeding strategies?
2. How are the nutritional requirements for weaning or lactating goats different from non-lactating adult goats?
3. What happens to excess dietary protein in a goat's body?
4. What is a method of preventing ketosis in goats?
5. Describe the author's recommended feed formulation and feeding program.

Text 2: "Formulating Rations With Pearson Square"

1. What is the purpose for creating a Pearson square?
2. Distinguish between the values represented in the left-hand and right-hand corners of a Pearson square.
3. Which Pearson square steps would you modify to in order to mix more than two ingredients?
4. Based on the author's description, would it matter if a given ingredient was calculated in a dry or wet form?
5. Using corn (10% CP) and alfalfa meal (45% CP) as ingredients, calculate the percentages of each required to feed with a 20% protein content.

Text 3: "The effects of feeding sericea lespedeza hay on growth rate of goats naturally infected with gastrointestinal nematodes" (abstract and Figures 1-2 only)

1. Using the text, infer the function of "chemical anthelmintic".
2. Why a group of goats was fed a supplement of *Sericea lespedeza*?
3. How is growth being measured in this study? Refer to figures 1 and 2.
4. Summarize the data represented on figures 1 and 2.
5. What are the ultimate conclusions of this study?



Writing Mode	Writing Prompt
<i>Informational/Explanatory</i>	<p><i>Write an essay from the point of view of a feed lab employee. You have the idea to produce a feed that utilizes Sericea lespedeza as a “natural” worm prevention. Write a proposal to your manager for this new type of feed. Include a summary of the nutritional requirements of meat goats and a discussion of the benefits of Sericea lespedeza, citing the relevant texts provided. Create a chart showing your final feed formulation, including the itemized cost for producing 100 lbs. of feed (citing a source for current market prices) and total protein percentage.</i></p>
Additional Resources	
<p>Suggested Additional Website References:</p> <ul style="list-style-type: none"> • http://www.bloomberq.com/markets/commodities/futures/agriculture/ 	



Potential Lesson Plan Design: This plan is for two 90-minute lessons.

Day 1:

Bell ringer: Brainstorm what nutritional requirements a human being needs to survive. Discuss as a class and describe project of learning how to develop a feed for a farm animal.

Lecture: Monogastric vs. ruminant animals; common nutritional terms

Reading: Read selections from “Nutrition of Meat Goats”. In groups of 3-4, discuss and list the nutritional requirements of goats. For each, describe its role in metabolism as described in the article. Groups work to answer additional analysis questions.

Lecture: Discuss importance of protein as common limiting nutrient in animal diets. Describe common sources of protein in animal feed. Describe how Pearson square crosses work, using modified selections from text “Formulating Rations With Pearson Square”.

Activity 1: Students complete example Pearson square crosses in groups of 3-4 (teacher to provide practice problems) to determine percentages (in a two-ingredient mix) of each ingredient required to produce a given protein content. Teacher to walk the room and assess and assist.

Activity 2: Students calculate the protein percentage of a given multi-ingredient recipe, given the recipe and the protein content of the ingredients. Students complete practice problems provided by teacher.

Closer: Overview of what we learned today

Text Under Discussion	Sample Teacher Dialogue & Guiding Questions
<p>Text 1: “<i>Nutrition of Meat Goats</i>”.</p>	<ol style="list-style-type: none"> 1. What are the five major components of a goat’s diet? For each of the goat diet components, describe its overall role in goat metabolism.
<p>Text 2: “Formulating Rations With Pearson Square”</p>	<ol style="list-style-type: none"> 1. What is the purpose for creating a Pearson square? 2. Distinguish between the values represented in the left-hand and right-hand corners of a Pearson square. 3. Which Pearson square steps would you modify to in order to mix more than two ingredients? 4. Based on the author’s description, would it matter if a given ingredient was calculated in a dry or wet form? 5. Using corn (10% CP) and alfalfa meal (45% CP) as ingredients, calculate the percentages of each required to feed with a 20% protein content.



Day 2:

Bell ringer: Formative assessment on Day 1 material – including Pearson square crosses and other math

Activity (groups of 3): Use web price list (<http://www.bloomberg.com/markets/commodities/futures/agriculture/>) or printout to develop and estimate the cost of a goat feed with an 18% protein content.

Lecture: How to add value to feed? How are feeds/food marketed so as to justify higher prices?

Activity: Read and summarize abstract from “Sericea lespedeza” article; summarize information presented in graphs 1 and 2 from article.

Activity: Modify your feed to include some amount of “sericea lespedeza” for worm prevention. How much would this increase the food cost?

Closer activity: Presentation of feed formulations and production costs to class

Text Under Discussion	Sample Teacher Dialogue & Guiding Questions
<p>Text 3: “The effects of feeding sericea lespedeza hay on growth rate of goats naturally infected with gastrointestinal nematodes” (abstract and Figures 1-2 only)</p>	<p>How does the inclusion of Sericea lespedeza in a goat’s diet impact its growth and health? What impact do gastrointestinal nematodes have on goat growth rate?</p>



Discussion: These texts could be explored orally and used to form the basic foundation of a lesson or series of lessons. Close-reading questions should be developed in advance in order to drive student understanding of the material while also practicing reading skills. For information on how to develop questions for this type of discussion, visit http://www.tncore.org/literacy_in_science_and_technology/curricular_resources/text_dependent_questions.aspx.

Writing and/or Assessment: The writing prompt included can be either a constructed-response assessment or a longer-term writing assignment for students to develop and refine over time to gauge student understanding of technical content as well as reading and writing skills as outlined by the Tennessee State Standards for English Language Arts in Technical Subjects. An appropriate writing rubric – such as those found at http://www.tncore.org/literacy_in_science_and_technology/assessment/scoring_resources.aspx – should be used to assess student work.

- **Culminating Assessment:** If using this material as an assessment, present all three texts to students at once, and provide them with the prompt and materials to use to construct their response. This should be a timed exercise (for example, 90 minutes). Use this exercise as an assessment to measure student progress toward reading and writing expectations as well as content knowledge. This is a good primer activity for state assessments.
- **Task:** If using this material as a writing task, you may scaffold the texts with close readings and text-based questions to guide student exploration of the texts. A culminating task of this lesson or sequence of lessons could be the writing prompt – either assigned in class, as homework, or as a report that is drafted and refined over time to build writing skills.
- **In-class work:** The writing prompt can also be shortened and used as an exit slip or journal entry at the conclusion of a lesson or series of lessons and then used formatively to determine student understanding of marketing concepts.

Scaffolding and support for students with special needs, English language learners, and struggling readers: Consider pre-teaching synonyms of difficult vocabulary words. Lower-level readers and ELL students can still be challenged without being overloaded with difficulty. This strategy can also be used to differentiate for stronger readers by introducing new, and more challenging, vocabulary. Struggling readers would also benefit from visual aids to illustrate many of the ideas presented. Pictures, diagrams, and charts alongside the text will go far to aid students as they dissect the articles.

Note: Social, ethnic, racial, religious, and gender bias is best determined at the local level where educators have in-depth knowledge of the culture and values of the community in which students live. TDOE asks local districts to review these materials for social, ethnic, racial, religious, and gender bias before use in local schools.