

TEACHER'S GUIDE

AG MAG: A GROWING POTENTIAL—SCIENCE, TECHNOLOGY, ENGINEERING, AND MATH IN AGRICULTURE

NEBRASKA STATE EDUCATION CONTENT STANDARDS CONNECTION

Ag Mag can be utilized to support Nebraska Academic Standards including:

- LA 4.15.b Apply context clues (e.g., word, phrase, and sentence, and paragraph clues) and text features to infer meaning of unknown words.
- LA 4.15.c Acquire new academic and content-specific grade-level vocabulary, relate to prior knowledge, and apply in new situations.
- LA 4.15.e Determine meaning using reference materials.
- LA 4.16.d Summarize a literary text and/or media, using key details to identify the theme.
- LA 4.16.e Determine main ideas and supporting details from informational text and/or media.
- LA 4.16.i Construct and/or answer literal, inferential, and critical questions and support answers with explicit evidence from the text or additional sources.
- LA 4.16.l Build background knowledge and activate prior knowledge to identify text-to-self, text-to-text, and text-to-world connections before, during, and after reading.
- LA 4.16.o Demonstrate an understanding of text via multiple mediums (e.g., writing, artistic representation, video, other media).
- LA 4.21.d Compose paragraphs with grammatically correct sentences of varying length, complexity, and type.

- LA 4.2.2.a** Communicate information and ideas effectively in analytic, descriptive, informative, narrative, poetic, persuasive, and reflective modes to multiple audiences using a variety of media and formats.
- LA 4.3.1.a** Communicate ideas and information in a clear and concise manner suited to the purpose, setting and audience (formal voice or informal voice), using appropriate word choice, grammar, and sentence structure.
- SS 4.2.12.a** Compare Nebraska with different regions and the goods and services each region produces (e.g., beef, wheat, telemarketing, cotton, coal).
- SS 4.3.5.e** Describe human adaptations to the physical environment. (e.g., use of air conditioning, irrigation, agricultural activities).
- MA 4.1.2.a** Add and subtract multi-digit numbers using the standard algorithm.
- MA 4.1.2.b** Multiply a four-digit whole number by a one-digit whole number.
- MA 4.1.2.c** Multiply a two-digit whole number by a two-digit whole number using the standard algorithm.
- MA 4.1.2.d** Divide up to a four-digit whole number by a one-digit divisor with and without a remainder.
- MA 4.2.3.a** Solve real-world problems involving multi-step equations comprised of whole numbers using the four operations, including interpreting remainders.

AG MAG INTEGRATION IDEAS

READING CENTER IDEAS & RESOURCES FOR AG MAG

Sum It Up

How do we summarize what we read? Use the “Sum It Up” worksheet included in this guide to have students read content and write a summary. This can be done per page or per article/section.

Get the Idea with 5 W's

What can we learn and identify through reading content? Have students complete the “Get the Idea with 5 W's” worksheet as they read *AgMag* pages or articles for purpose. Lead class discussion using the student responses on the worksheet.

SCIENCE, TECHNOLOGY, ENGINEERING AND MATH IN AGRICULTURE—PAGE 1

- Prior to distributing *AgMag* to students, pose/post: “How do we think science, technology, engineering, and math are used in agriculture?”
 - Have students think on the question for 30 seconds. Write down their ideas on a piece of paper or sticky note. Partner with another student and have each share their ideas.
 - Then lead an entire class discussion by having students share with whole class. Use some additional questions such as: What led you to those ideas? Why do you think that?
 - Explain that the class will be exploring STEM connections in agriculture. Distribute *AgMag* to each student and read through page 1 together.
- There are 7.4 billion people on Earth today. There is estimated to be 9 billion people by 2050.
 - Discuss with students what that increase means. There will be about 1.6 billion more people on the planet in 2050. In 2017, there were approximately 325.7 million people in the United States. That means that there will be an additional five times (approximate) the number of people in the U.S. living on earth! That's a lot!
- Complete the Think & Discuss together as a class or in small groups.
 - After reading page 1 and having class discussion, what other ways will STEM be used in agriculture?
 - How can each student be involved in an agricultural career? Have individuals, small groups, or the entire class research agricultural career opportunities—and specifically focus on some in science, technology, engineering, and math. Share findings with the entire class.

A LINK BETWEEN SCIENCE AND AGRICULTURE—PAGE 2

- Ask the class to close their eyes. What do they picture when they hear the word agriculture? Have students open their eyes and share.
 - *May get responses like farmer, animals, plants, tractor, food, etc.*
- Raise your hand if you pictured a scientist in a lab.
 - *Likely not many responses. Scientists are an important part of agriculture. Did you know that there are scientists using satellite-linked computer program to examine global climate changes! And there are many more ways science is used and applied in agriculture.*
- Have students complete the matching activity at the top of page 2.
 - A soybean plant uses sunlight to turn carbon dioxide into “food” = photosynthesis
 - The study of how traits are passed from a bull and cow to the baby calf = genetics
 - Tracking how a pig’s digestive system converts feed into muscle and meat = biology
 - How the soil converts fertilizers into nutrients for plant growth = chemistry
- What are some other examples where science is found in agriculture?
 - *Anything involving plants, animals, fertilizer, nutrients, water quality, and many other examples include science in agriculture.*
- Have students find a partner. Have pairs brainstorm and write down as many “traits” or characteristics that they can think of that get passed from parent to child.

Examples: height, hair color, eye color, weight, health conditions, hair lines, etc.

 - Ask students to share their lists with the whole class.
 - Explain that these are all due to genetics.
 - Ask if they predict genetics is used in agriculture. Yes!!
 - Students read content feature on Caitlyn Bruns.
 - Underline two interesting facts they learned from the article and have them share with the class.
- To access additional resources, activities and videos to learn more about science in agriculture, check out these links:
 - Science of Agriculture (short animations, interactives, and videos teach math and science concepts crucial to the study of agriculture):
<http://scienceofagriculture.org>
 - Agriculture Research Service—Sci4Kids, Science, Agriculture, and You
<https://www.ars.usda.gov/oc/kids/noflashkids/nonflashindex/>

- USDA for Kids— USDA provides students, parents, and teachers with youth-gearred Information and resources related to agriculture
<https://www.usda.gov/our-agency/initiatives/usda-kids>
- Agronomy For Me, Grades K-4
<https://www.agronomy4me.org/K-4>

ROBOTS: COMING TO A DAIRY FARM NEAR YOU—PAGE 3

- Pose/post this question for student response: “What do we think of when we hear the word ‘technology?’”
 - Have students work individually or in small groups to create a list then report out to entire class. Capture list on writing surface.
 - *Responses might include: smart phones, computers, tablets, smart boards, apps (Skype, Google Hangout, FaceTime, etc), 3D printers, robots, drones, etc.*
 - Of all the technologies we listed, which ones do you predict are used in farming/agriculture? *Have students circle or put a star next to ones on the list.*
 - *It is likely that **all** technology items listed can be used in some part of agriculture!*
 - What do we think are other technologies used in agriculture?
 - *Self-steering tractors, use of GPS, controlling equipment from apps on smart phones, etc. These are just a few examples—students may not have context to know specific ag examples.*
 - What are advantages to using technology in agriculture?
 - *It helps farmers, ranchers, and people in agribusinesses be more efficient. Food, fuel, and fiber can be produced faster, better, and less expensive. Technology in farming, ranching, and the agriculture industry is everywhere! Using technology helps farmers feed the world.*
- Students read content about Demerath Dairy—Nebraska’s First Robotic Dairy.
 - Use the “Sum It Up” worksheet included in this guide to have students write a paragraph summary of what they learned about the dairy.
 - Lead class discussion around the following:
 - Students share their summaries.
 - Share one thing you learned that surprised you.
 - Other than robots, what is another example of technology the dairy uses?
Electronic collar on each cow, distribution of cherry flavored pellet.
 - What are two reasons the Demerath’s decided to use robots?
Decreases time and labor, more cows milked, collect data and information.

- Have students creatively think about what technology might look like in the future. Have them draw a technology invention on the bottom of the page and share their ideas!
- Conduct research (as a class, individual, or small group) on more innovative technology currently used in agriculture. Assign one of the following areas to students:
 - Unmanned Aerial Vehicle (UAV)/drone
 - EID (Electronic ID)/RFID tags (Radio Frequency Identification)
 - Autonomous tractors
 - Yield mapping
 - Soil moisture sensors
 - Satellite imagery in agriculture
- Have students research their assigned topic and gather information to answer the following:
 - WHAT it is
 - HOW it is used
 - Find a picture or video that shows/demonstrates
- Have students present their findings to the entire class

MAKING THE CONNECTION: AGRICULTURE & STEM ACROSS NEBRASKA- PAGES 4-5

- Students read the content about Gottsch Cattle Company, including the vocabulary in “Talk Like a Farmer and Rancher.”
 - Have students complete the following as they read:
 - Circle S (science), T (technology), E (engineering), M (math) if individual uses that in their role
 - Complete the math examples

Answers:

Jeremiah Rieken

- No response needed

Troy Bonifas

- **T** and **M**
- Math problem:
 - $972,000 \text{ divided by } 2,000 = 486$ (tons of feed needed)
 - $486 \text{ (tons of feed needed) divided by } 27 \text{ (tons a truck carries per load)} = \mathbf{18 \text{ truck loads of feed to take to Juniata}}$

ag MAG

CONNECTING YOU TO NEBRASKA AGRICULTURE

Issue 3

Dennis Stuckey

- **T** and **M**

- Math Problem:

• $3.8 \times 170 = 646$ (pounds steer will gain)

• $850 \text{ pounds (current weight)} + 646 \text{ (pounds steer will gain)} = 1,496$ (final market weight of steer)

Laurie Fischer

- **T** and **M**

Mike Faimon

- **S**, **T**, **E**, and **M**

Jake Warren

- **S**, **T**, and **M**

Mary Snell

- **S**, **T**, and **M**

• Digging Deeper

- List two examples of how each person at Gottsch uses science, technology, engineering, or math.

• Show video about Gottsch Cattle Company to class. Prior to watching video (13:33), provide students with “listen for” questions/responses:

- Identify **two** things you saw in the video that are similar to what we read.

- What are **three** new things you learned?

- List **three** careers the video talked about.

- Write down one example for each of how science, technology, engineering, and math is used. (four total answers)

Link to video: https://www.youtube.com/watch?v=_Knd805lZhl

BUILD, MODEL, INVENT: AGRICULTURAL ENGINEERING—PAGE 6

- Use a “go get it” moment to have students discover the definition of agricultural engineering. Put each word (or 2-3 words) from the definition on a notecard or piece of paper. Hide them throughout the room. Have students “go get” each card, then as a class, assemble the words in the correct order to form the definition sentence.

Definition: Agricultural engineering is the area of engineering concerned with the design, construction, and improvement of farming equipment and machinery.

Once the class has put the definition in order, lead a discussion on what agricultural engineering and agriculture engineers do. *Sample responses: integrate technology with farming; design new and improved farming equipment to work more efficiently; design and build agriculture infrastructures like dams, water reservoirs, warehouses, etc.; develop form of biofuels; work with water quality and pollution control, etc.*

Why do students think agriculture engineers are important for the agriculture industry?
Agriculture engineers find better ways to do things, which means farmers and ranchers can be more efficient, save time and money, and use technology to better produce food, fuel, and fiber.

Have students raise their hands if they believe there are places in Nebraska for ag engineers to learn and work.

Explain that young people can study agricultural engineering in state AND have opportunities to work in Nebraska too. And those opportunities are in all sizes of communities.

- Students read content about CLAAS and UNL Tractor Test Lab. Have students use the “Sum It Up” worksheet included in this teacher’s guide to direct their reading and write a summary about each article. Have students include one interesting/surprising fact they read about in each article. Students share their summaries and facts with the class. Lead class discussion based on what students share.
- Students complete the Think, Research, Discuss! This can be done as individuals or small groups. Have students answer the questions in paragraph/report style format and present their findings to other small groups or the entire class.
- Other activities/resources for integrating ag engineering activities and lessons into your classroom:

- National Ag In the Classroom Lesson Plan
<https://www.agclassroom.org/teacher/matrix/lessonplan.cfm?lpid=342>
- eGFI Dream Up the Future—A Tasty Experiment
http://teachers.egfi-k12.org/tasty-experiment/?utm_source=Teachers+Newsletter+November+2016&utm_campaign=eGFI+Teachers+November+2016&utm_medium=email
- eGFI Dream Up the Future—What are Gears?
<http://teachers.egfi-k12.org/what-are-gears/>
- Teach Engineering Lesson Plan
https://www.teachengineering.org/lessons/view/cub_bio_lesson05

IT ALL ADDS UP!—PAGE 7

- Write the following multiplication problem on a writing surface:

$$150 \times 3 =$$

Have students solve the problem.

We know how to solve math equations. Finding the answer to this one is pretty straightforward. Beyond the numbers, it probably doesn't mean much to us. But if we put some descriptions with each of these numbers, we might find more meaning in the answer. That's what happens for farmers and ranchers who use math every day! They use math to calculate information for their operations.

Let's look at our problem again:

A farmer has 150 lambs. She feeds each of them 3 pounds per day. How much total feed does she need to give her lambs per day? Answer: _____

Now we have a real-life application to multiplication. Farmers and ranchers use all kinds of math for their livestock and crop enterprises and helps them make good business decisions.

- Students read content about Mark Lundeen's soybean operation. Have them use the "Sum it Up" worksheet to write a summary about the article. Have students share their summaries.

- Students complete the “Soybeans—Multiply the Uses” activity.
 - Answers:
 - Soap and shampoo
 - Biodiesel
 - Soybean meal
- For more math activities check out Corn Calculations and Nutritional Snack and download the enriching activity guides at: <https://www.nefbfoundation.org/educators/teacher-resources/enriching-activities>
- Check out this lesson from Michigan Ag In the Classroom on real life application of math in agriculture: <https://miagclassroom.org/edu/lesson/math/you.pdf>

HOW CAN YOU BE A PART OF AGRICULTURE AND STEM?—PAGE 8

- Students complete the activity and read the content. Students can dig deeper with an activity in each of the “**You can**” areas:
 - **Farmers Use Science and Technology**

Students use drawings or “hieroglyphics” to summarize information on how Zach uses science and technology to raise corn. Students should use at least three different drawings or hieroglyphics to describe information. Have students share with the class and display visuals in the classroom.
 - **Career in Agriculture Technology**

Hope Lewis is involved in precision agriculture. Have students work in pairs or triads to research and learn about other agriculture technology careers. Collect information on:

 - job responsibilities and/or duties
 - education needed
 - why that job is important for agriculture

Pairs/triads write a one-paragraph summary of information. They will also create a visual to explain the career—could be an illustration, a picture, or video. Have teams share their information with the class.
 - **Learn Where Food Comes From and How It is Grown—Wheat**

As a class, explore the Interactive Map Project, and specifically learn about Nebraska Wheat. <http://www.nefbmap.org>

On the left hand column, click on Maps, and then type “wheat” in filter. There are three maps: Wheat-1915 Wheat-Production, Measured in Bu; Wheat-1965 Wheat-Production, Measured in Bu;

and Wheat-Current, Wheat—Production, Measured in Bu.

Start by clicking on “Wheat-Current-Production, Measured in Bu.” This provides an overview of wheat production in the United States and includes facts and a legend. Click on the state of Nebraska. This provides county specific wheat information. Click on any of the counties to learn more. Nebraska’s county ranking of wheat production is listed below the map.

For additional educational information about Nebraska Wheat Production, explore the Nebraska Wheat Board’s website: <https://nebraskawheat.com>. Click on the Educators pull down menu to learn about Nutrition Facts; How Flour is Milled; read The Story of Wheat for Kids; read about Wheat From Field to Flour; and Take a Wheat Quiz.

Nebraska Agriculture in the Classroom is a program of the Nebraska Farm Bureau Foundation whose mission is to engage youth, educators, and the general public to promote an understanding of the vital importance of agriculture in the lives of all Nebraskans. To learn more or access an electronic version of this publication, visit us at www.nefbfoundation.org or contact the Nebraska Farm Bureau Foundation.

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Special thanks to these organizations for their continuous support: Nebraska Corn Board, Nebraska Beef Council, Nebraska Pork Producers Association, We Support Ag, Nebraska Soybean Checkoff, and Nebraska Wheat Board.

SUM IT UP

PERIODICAL: _____

DATE/ISSUED: _____

COVER TITLE: _____

ARTICLE:

PAGE*

SUMMARY

GET THE IDEA WITH 5W's

ARTICLE: _____

WHO?

WHAT?

WHERE?

WHEN?

WHY & HOW?