

corn

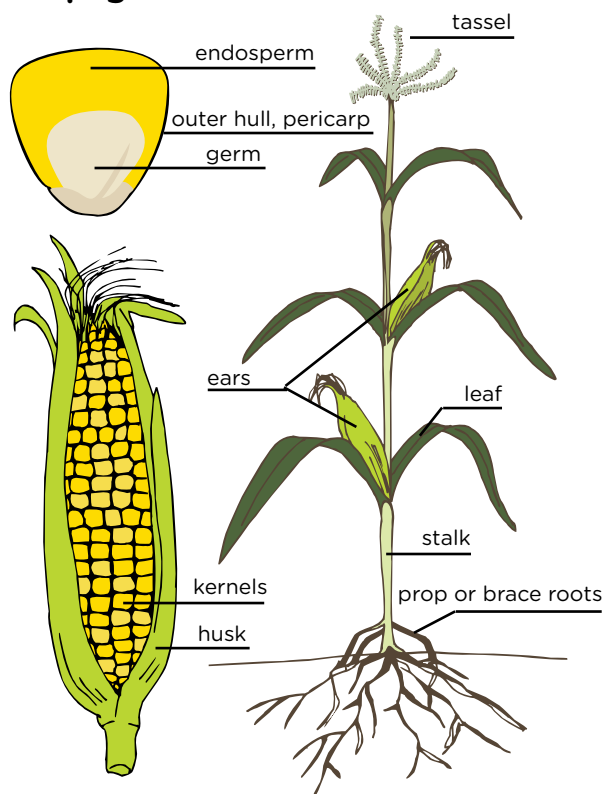
This issue of the North Dakota Ag Mag focuses on corn in North Dakota. The information and activities are geared primarily toward the state's third, fourth and fifth graders.

Three issues of the Ag Mag are developed each school year. Subscriptions are free, but if you're not on the mailing list or if you know someone else who wants to be added, contact the North Dakota Department of Agriculture at 1-800-242-7535 or ndda@nd.gov.

The magazine also is on the North Dakota Agriculture in the Classroom website at www.ndda.nd.gov/aitc.

This magazine is one of the N.D. Agriculture in the Classroom Council activities that helps K-12 teachers integrate information and activities about North Dakota agriculture across the curriculum in science, math, language arts, social studies and other classes. It's a supplemental resource rather than a separate program.

Answers to Growing Strong and Tall on page 1



Corn Production

The Agriculture Cycle

Idea: Introduce corn by asking students about different ways they've seen corn used – both edible and inedible. Talk about some other agriculture products grown in your region, and follow them through their cycles.

Answers to Gardening with the Three Sisters

1. seeds
2. healthy
3. circular
4. diameter
5. soil
6. stalk
7. leaves



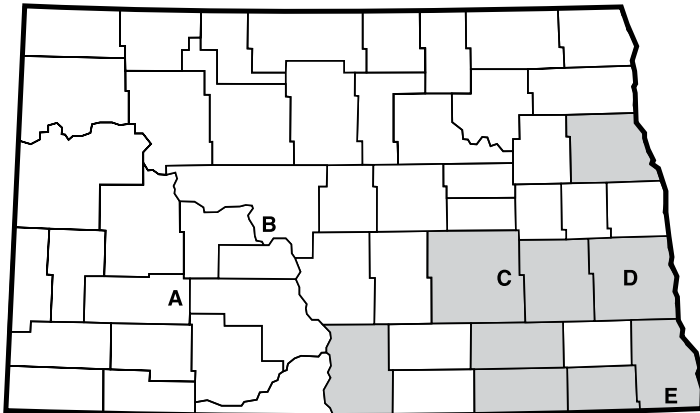
Answers to Today's Corn Farmers Use Modern Equipment

1. Corn is planted in the spring using a planter. The machine drops the (**kernels** or kernal) into rows and then presses the soil around each one.
2. Corn is planted in rows at about 24,000 to 32,000 plants per (aker or **acre**), which is an area about the size of a football field.
3. Fertilizer is applied to the soil to provide (**nutrients** or nootrients) for the growing plant and increase yields. Rain or irrigation is very important, too, because corn needs lots of water to grow.
4. Between late September and November, the corn will be (**mature** or matour) and dry enough to be harvested by a large combine.
5. The combine removes each ear of corn and (**separates** or seperates) the kernels from the corncob.
6. Corn (**stalks** or stocks) usually are left to protect the soil and decompose to provide nutrients for next year's crops.

In 1850, about 75 to 90 hours of labor and several acres were required to produce 100 bushels of corn. Today, about two hours of labor and one acre of land are required to produce 100 bushels of corn.

Answers to Find North Dakota's Corn Belt

A bushel is about the size of a laundry basket.



Source: www.nass.usda.gov

Discuss why corn is grown mostly in southeastern North Dakota.

Answers to Math Challenges

1. $4+3+3+5 = 15$ ears of corn
2. $55-(10+13+6+9) = 17$ ears of corn
3. $77+140+65+90 = 372$ acres
4. $510-30 = 480$ acres
5. $120 \text{ bushels/acre} \times 10 \text{ acres} = 1,200 \text{ bushels}$
6. $120 \text{ bushels/acre} \times 100 \text{ acres} = 12,000 \text{ bushels}$
7. $56 \text{ lbs/bushel} \times 12,000 \text{ bushels} = 672,000 \text{ lbs of corn}$
8. $56 \text{ lbs} \div 4 = 14 \text{ lbs}$
9. $120 \text{ bushels} \times 325 \text{ cans per bushel} = 39,000 \text{ cans of pop}$
10. $39,000 \div 6 = 6,500 \text{ six-packs}$

Idea: Ask students how they think life would be different if we had to produce all our own food. Discuss how family chores and life are different in the city than on a farm. Briefly discuss why more families lived on farms years ago. Ask students to brainstorm what inventions or discoveries allowed so many people to leave their farms. (Improved transportation, large and powerful tractors and combines, crop protection chemicals, fertilizers, crop varieties that yield more, etc.) Ask students to trace all the food they have eaten that day and all the people who have worked to get that food to them.

Idea: Have students research the difference between field corn, sweet corn and popcorn. What are some of the foods and other products made from each?

Idea: Have students research North Dakota Native Americans' traditions and stories about corn in their culture. See "Buffalo Bird Woman's Garden" at <http://digital.library.upenn.edu/women/buffalo/garden/garden.html> and similar websites and books. Also, have students research the importance of corn provided to the Lewis and Clark expedition by the Mandans during the winter of 1804-05.

Idea: Learn about state-of-the-art corn research with a 3:11 video and virtual tour at www.bayer.com/en/us/marana.

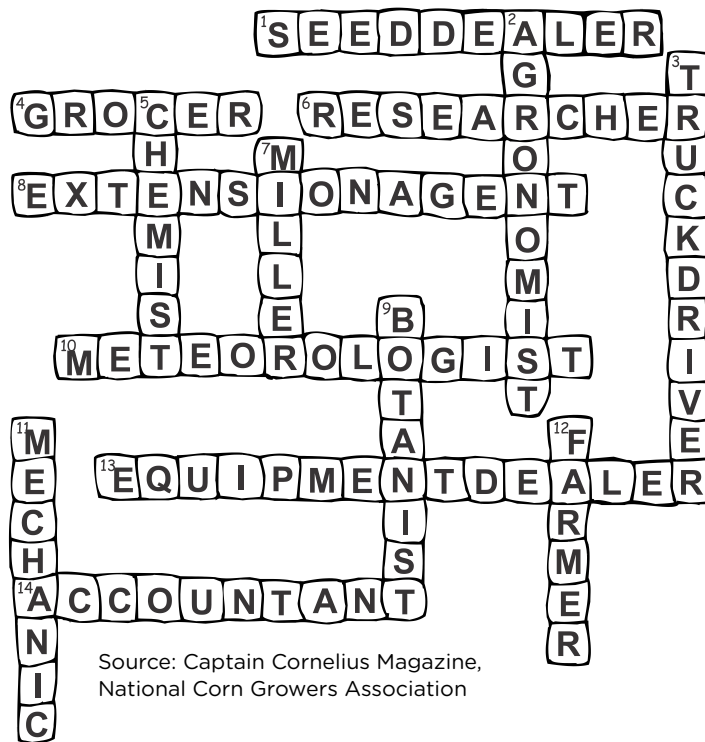
Corn Processing

Answers to North Dakota's Corn Processing

- B** Blue Flint Ethanol, Underwood
- C** Dakota Spirit AgEnergy, Spiritwood
- E** Guardian Energy, Hankinson
- A** Red Trail Energy, Richardton
- D** Tharaldson Ethanol, Casselton

1. $540,000,000 \text{ gallons} \div 30,000 \text{ gallons/car} = 18,000 \text{ tank cars}$
2. $18,000 \text{ tank cars} \times 50 \text{ feet per tank car} = 900,000 \text{ feet}$
3. $900,000 \text{ feet} \div 5,280 \text{ feet/mile} = 170.5 \text{ miles}$

Answers to Corn Means Business



Biodegradable Plastic from Corn

Source: Corn Marketing Program of Michigan

Place a tablespoon of cornstarch in a paper cup or plastic bag. Add 2 drops of corn oil and mix. Add a tablespoon of water and mix. Add 2 drops of food coloring and mix. You have just created biodegradable plastic. Shape and let harden. Break it down by dissolving it in water.

Corn Distribution

Answers to Corn on the Move

- 3** The elevator stores the corn until selling it to a company that will process it into cornstarch or other products, such as ethanol or livestock feed.
- 6** A semitruck picks up the paper tableware from the manufacturer and delivers it to stores across the region where you can buy it.
- 1** The farmer buys corn seed from a seed dealer and plants it in the spring.
- 4** The corn is delivered to the cornstarch processor by railroad or semitruck.
- 2** In the fall, the farmer harvests the corn and sells it to the elevator or stores it.
- 5** The manufacturer makes cornstarch and turns some of it into biodegradable cups and straws.

Idea: Have students draw pie or bar charts to illustrate the percentages from "Where Does U.S. Corn Go?" on page 5.

Idea: Have students learn where most U.S. ethanol exports go at <https://www.youtube.com/watch?v=Isu9xFvSneo>.

Idea: Have students learn more about grain elevators at <https://www.youtube.com/watch?v=NZ-kH5WLTao>.

Corn Consumption

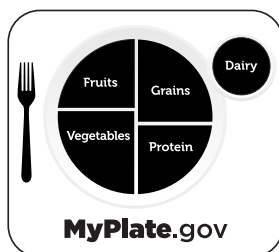
Answers to Ethanol: A Renewable Energy Source

About 14.2 billion (1.) **gallons** of fuel ethanol are consumed in the U.S. each year. For E15 fuel, which is a blend that's 15% ethanol and 85% petroleum-based (2.) **gasoline**, that would be about 947 million 15-gallon gas tanks.

Henry (3.) **Ford** designed the first Model T in 1908 to run on ethanol. Today all major car manufacturers design their cars for a 10% ethanol blend. Many models use a fuel called E85 that is 85% ethanol. At some gas (4.) **pumps**, drivers can select their own blends of gas and ethanol.

Ethanol is a (5.) **renewable** fuel since corn can be grown every year. Ethanol has a higher octane number than gasoline, which provides increased power and (6.) **performance**. Using ethanol also results in less carbon monoxide (7.) **pollution** for our environment and helps the U.S. be less (8.) **dependent** on importing oil from other countries.

www.MyPlate.gov shows how to build a healthy diet, and corn foods fit in two of the plate's sections. When corn is served as kernels, creamed, as hominy or in succotash, corn is in the vegetables group. When corn is processed into cereal or tortillas, it's in the grains group.



Idea: Ask students to bring cereal boxes. Read the ingredient labels to see which contain corn and if there is a corn sweetener (high fructose corn syrup, glucose or dextrose) added to the grain.

Idea: Have students assess their food choices and activity levels at www.myplate.gov.

Idea: Corn is fermented to make ethanol. Use the Yeast Alive activity from Education World at www.educationworld.com/a_lesson/showbiz_science/showbiz_science060.shtml to use cornstarch and corn syrup to create alcohol and carbon dioxide through fermentation.

Idea: Have students make biodegradable packing peanuts from cornstarch. Search for Kentucky Farm Bureau Make Your Own Biodegradable Plastic Stuff.

Party Mix

Source: North Dakota Farm Bureau

2 quarts popped popcorn
2 cups pretzel sticks
2 cups cheese curls
1/4 cup butter or margarine
1 tablespoon Worcestershire sauce
1/2 teaspoon garlic salt
1/2 teaspoon seasoned salt

In a shallow baking pan, mix popped popcorn, pretzel sticks and cheese curls. Melt butter or margarine in a small saucepan and stir in seasonings. Pour over dry mixture and mix well. Bake at 250 degrees F. for 45 minutes, stirring several times. Makes 2 1/2 quarts.

Corn Chips

Source: Corn Marketing Program of Michigan

3 1/2 cups water
1 cup cornmeal
2 teaspoons butter or margarine
1 teaspoon salt

Preheat oven to 450 degrees F. Heat water to boiling. Pour into a mixing bowl. Add butter or margarine to water and stir until melted. Add cornmeal and salt, and stir thoroughly. Drop quarter-size spoonfuls of the mixture onto a greased cookie sheet, flatten and bake until golden brown, about 13-15 minutes. Cool and eat.

Pillows and Popcorn

Source: North Dakota Farm Bureau

4 tablespoons butter or margarine
4 cups bite-size rice cereal squares
1 can (3 oz.) french-fried onions
6 cups popped popcorn
1/2 cup grated American cheese

Preheat oven to 325 degrees F. Melt butter in a baking pan. Stir in cereal, onions and popcorn; stir lightly. Sprinkle cheese over top; toss again. Bake, stirring once, about 15 minutes or until mixture is hot and crisp. Season lightly with salt, cool completely and eat. Makes 10 cups.

Dog Biscuits

Source: Exploring Kansas Crops

1/2 cup cornmeal
2 cups whole wheat flour
6 tablespoons corn oil
2/3 cup water or meat broth

Mix dry ingredients together in a large mixing bowl. Add wet ingredients. Use your hands to mix it all together. Roll dough out about 1/4 inch thick on a flour-dusted surface. Cut out biscuits with cookie cutters. Place on a cookie sheet and bake at 350 degrees for about 25 minutes, or until lightly brown. Be sure to allow the biscuits to cool before giving them to your pet!

Cross-Curricular Corn Projects

Science and Math

Idea: Compare the volume of popcorn kernels before and after popping.

Idea: Grow Your Own Corn Plants

(Corn Marketing Program of Michigan) Give each student a small plastic baggie, a paper towel and several corn seeds. Fold and dampen the towel. Place the seeds between the folded layers of towel and place the towel in the plastic baggie. Close the baggie and place it in the sunlight. Each day students should record the changes in the seeds as they sprout. Add small amounts of water to keep the paper towel damp. In about seven days, the seeds should be sprouted and growing. Talk with students about the different parts of the plant that have already begun growing: the roots, stalk and leaves.

Idea: Understand the Parts of a Corn Kernel

(Corn Marketing Program of Michigan)

1. Soak some corn kernels in water overnight. Leave some kernels dry.
2. Look at a dry seed and try to find the main parts of the kernel. Discuss and diagram on paper what might be inside the kernel. Use descriptive words (adjectives and adverbs) to describe the dry kernel.
3. Now take the kernels that have been soaked to investigate the inside. Break apart the kernel, using a plastic knife if necessary. Discuss and diagram what is inside. Identify the pericarp, tip cap, endosperm and germ. Use descriptive words to describe the inside of the kernel. How is it different from the outside? How is it different from the dry kernel? Compare what you expected to find with what you actually found inside the kernel.

History

Idea: Have students research the history of popcorn, different things it was used for, the varieties and the early methods of popping corn.

Social Studies

Idea: List important geographic locations that have played a role in corn's history. Ask students to locate these spots on a map. Have students research the major corn-producing states. (Most of the corn grown in the United States is produced in the Corn Belt, which includes Iowa, Illinois, Minnesota, Indiana, Nebraska, Ohio, Missouri and South Dakota.) Ask students to research why corn grows so well in these areas. Is it the soil, climate, planting methods? (After it's planted, corn grows when soil temperatures go above 50 F, and it loves summer temperatures of 75 to 85 F during the day and 65 F at night.)

Health

Idea: Ask students to bring boxes and bags of corn snack foods. Have them star those snacks they feel are most nutritious and check the ones they feel are less nutritious. Have students analyze the nutritional value and calorie count of each snack on the list.

Glossary

Biodegradable - Capable of being decomposed by biological agents, especially bacteria.

Bushel - A unit of volume or capacity in the U.S. Customary System, used in dry measure and equal to 4 pecks, 2,150.42 cubic inches, or 35.24 liters.

Decompose - To become broken down into components; disintegrate; rot.

Ethanol - An engine fuel alternative made primarily from fermented corn.

Export - To send or transport (a commodity, for example) abroad, especially for trade or sale.

Ferment - Any of a group of chemical reactions induced by living or nonliving agents that split complex organic compounds into relatively simple substances.

Fertilizer - Natural and synthetic materials spread on or worked into soil to increase its capacity to support plant growth.

Fructose - A very sweet sugar, $C_6H_{12}O_6$, in many fruits and honey and used as a sweetener and preservative for foodstuffs.

Import - To bring or carry in goods or materials from a foreign country for trade or sale.

Octane - A measure of any of various mixtures used as a fuel and solvent.

Petroleum - A thick, flammable, yellow-to-black mixture found naturally in the earth that is used as raw material for a wide variety of derivative products, such as natural gas, gasoline, naphtha, kerosene, fuel and lubricating oils, paraffin wax, and asphalt.

Renewable - A resource, such as solar energy or firewood, that is inexhaustible or replaceable by new growth.

Resource - An available supply that can be drawn on when needed.

Sources for Further Study or Curriculum Materials:

National Agriculture in the Classroom teacher and student resources — <https://agclassroom.org>

National Corn Growers Association — www.worldofcorn.com

The Popcorn Board — www.popcorn.org

North Dakota Corn Utilization Council and North Dakota Corn Growers Association — www.ndcorn.org

SMART Exchange <https://exchange.smarttech-prod.com> and search for “corn”

North Dakota Ethanol Council — www.ndethanol.org

Suggested Reading for Kids

Alder, David A. Cam Jansen and the Mystery of the Stolen Corn Popper. New York: Viking Kestrel, 1986.

Aliki. Corn is Maize, The Gift of the Indians. New York: Harper Collins Publishers, 1976.

Cooper, Jason. Corn: Farm to Market... Florida: Rourke Publications, 1997.

Fowler, Allan. Corn on and off the cob. Chicago: Children's Press, 1994.

Hunter, Sally M. Four Seasons of Corn: A Winnebago Tradition. Minneapolis: Lerner Publications Co., 1997.

Landau, Elaine. Corn. New York: Children's Press, 1999.

Politi, Leo. Three Stalks of Corn. New York: Scribner, 1976.

Robson, Pam. Corn. Connecticut: Children's Press, 1998.

Santucci, Barbara. Anna's Corn. Grand Rapids: Eerdmans Books for Young Readers, 2002.

Stevens, Jan Romero. Carlos and the Cornfield. Flagstaff: Northland Publishing, 1995.

Videos

All About North Dakota Corn! (4:15) — Students learn about kinds of corn and its uses through a combination of videos and animation, <https://www.youtube.com/watch?v=Ej9LNpSFEIk>

North Dakota Corn: Speich Farm and Ranch Tour (6:18) — Visit the Speich family farm near Milnor, N.D., North Dakota Corn - Speich Farm and Ranch Tour, <https://www.youtube.com/watch?v=Udze9PBIGB8>

Dakota Spirit Ethanol Plant Tour (2:23) — Learn about the processes that make ethanol at this Spiritwood, N.D., plant, <https://www.youtube.com/watch?v=UYdMfaXO1sc>

Columbia Grain Tour (6:01) — Follow corn from harvest at Oakes, N.D., to an export facility in the Pacific Northwest, https://www.youtube.com/watch?v=qqdcSS_Nldo

North Dakota Corn Harvest Aerial Video (3:18) — See corn harvest on a Forman, N.D., farm from the air, <https://www.youtube.com/watch?v=-0Pajva3WcI>

Corn Ag Mag: Winter 2021 Standards and Benchmarks

English Language Arts and Literacy Content Standards for Reading Informational/Nonfiction Text

Gr.3, RI.2 Determine the main idea of a text and recount the key details to explain how they support the main idea.

Gr.3, RI.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.

Craft and Structure

Gr.3, RI.4; Gr.4, RI.; Gr.5, RI.4 Determine the meaning of general academic and domain specific words and phrases in a text relevant to a grades 3,4 and 5 topics or subject areas.

North Dakota Mathematics Content Standards

Operations and Algebraic Thinking:

Understand properties of multiplication and the relationship between multiplication and division.

3.OA.5 Apply properties of operations as strategies to multiply and divide (without the use of formal terms).

3.OA.8 Solve two-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity.

Number and Operations in Base Ten:

3.NBT.2 Using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction, fluently add and subtract within 1000.

5.NBT.5 Fluently multiply multi-digit whole numbers using strategies flexibly, including the standard algorithm.

Social Studies Content Standards

Economics Standards: Exchange and Markets

E.3_5.2 Describe how goods and services are produced and distributed.

National Economy

E.3_5.5 Describe and analyze how North Dakota's location, culture, and natural resources influence its economic decisions and development.

Geography Standards

Geographic Representation

G.3_5.3 Use maps, satellite images, photographs, and other representations to explain relationships between the locations of places, regions, and their environmental characteristics.

North Dakota Science Content Standards

From Molecules to Organisms: Structures and Processes

Performance Standard 3-LS1-1 Develop models to describe that organisms have unique and diverse life cycles but all experience birth, growth, reproduction, and death.

LS1.B: Growth and Development of Organisms - Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles.

LS1.A: Structure and Function - Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.

Earth and Human Activity

ESS3.A: Natural Resources - Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not.

Energy

PS3.D: Energy in Chemical Processes and Everyday Life - The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water).

Health Education Content Standards

Standard 3: Demonstrate the ability to access valid health information, products, and services.

3.5.1 Identify characteristics of valid health information, products, and services

North Dakota Agriculture in the Classroom Activities

This Ag Mag is just one of the North Dakota Agriculture in the Classroom Council projects. Each issue of the Ag Mag focuses on an agricultural commodity or topic and includes fun activities, bold graphics, interesting information and challenging problems. Send feedback and suggestions for future Ag Mag issues to:

Becky Koch
NDSU Agriculture Communication
701-866-6162
becky.koch@ndsu.edu

Another council teacher resource is Project Food, Land & People (FLP). Using the national FLP curriculum, ND Ag in the Classroom provides 600-level credit workshops for teachers to instruct them in integrating hands-on lessons that promote the development of critical thinking skills so students can better understand the interrelationships among the environment, agriculture and people of the world. Teachers are encouraged to adapt their lessons to include North Dakota products and resources.

Project Food, Land & People's 55 lessons include:

- Amazing Grazing
- Cows or Condos?
- By the Way
- Seed Surprises
- Schoolground Caretakers
- Could It Be Something They Ate?
- What Piece of the Pie?
- and many more.

For information, contact:

Jill Vigesaa
N.D. Farm Bureau Foundation
701-799-5488
jill.vigesaa@gmail.com

The ND Geographic Alliance conducts a two-day Agricultural Tour for Teachers. The tour includes farm and field visits, tours of agricultural processing plants to see what happens to products following the farm production cycle, and discussions with people involved in the global marketing of North Dakota farm products.

For information, contact:

Jeffrey Beck
North Dakota Geographic Alliance
701-240-9231
jeff.beck@minot.k12.nd.us

Educators may apply for mini-grants for up to \$500 for use in programs that promote agricultural literacy. The Agriculture in the Classroom Council, working with the ND FFA Foundation, offers these funds for agriculture-related projects, units and lessons used for school-age children. The mini-grants fund hands-on activities that develop and enrich understanding of agriculture as the source of food and/or fiber in our society. Individuals or groups such as teachers, 4-H leaders, commodity groups and others interested in teaching young people about the importance of North Dakota agriculture are welcome to apply.

Examples of programs that may be funded: farm safety programs, agricultural festivals, an elementary classroom visiting a nearby farm and ag career awareness day. Grant funds can be used for printing, curriculum, guest speakers, materials, food, supplies, etc. More ideas and an application are at www.ndffaoundation.com/applications.

For information, contact:

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EXTENSION

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