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

The Ag Mag is distributed three times per 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 Web at www.ag.ndsu.edu/agmag/agmag.htm or through the North Dakota Agriculture in the Classroom Web site at www.ndaginclassroom.org.

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.

The Ag Mag creators need your feedback to improve the magazine and teacher guide. Teachers, please go to www.surveymonkey.com/s/AgMagSurvey to complete the seven-question survey. Your feedback will help make the Ag Mag and teacher’s guide even better tools for your teaching.

The North Dakota Agriculture in the Classroom Council’s mission is to cultivate an understanding of the interrelationship of agriculture, the environment and people by integrating agriculture into K-12 education.

Technology in Agriculture

Technology is the practical application of science. It involves the use of tools, machines, materials, techniques and power sources to make people’s lives easier and more productive. People in all phases of agriculture – farmers, food processors, grocery retailers and many others – use technology to produce food, fiber, fuel and other products efficiently.

In North Dakota, you can see agricultural technology every day – combines, tractors, computers and checkout scanners are examples.

But some of the technology is not visible, such as plant and animal breeding techniques, and the processes used to make your food and many of the products you use.

Idea: Talk to students about the technology in agriculture they see around them and how people use technology to produce, process and market food. Ask students if they recognize some of the machines and tools in agriculture – tractors, planters, computers – and if they know what they are used for.

Idea: When people first started farming, they did all the work by hand. Talk to students about what this might have been like. Have you planted a garden? Imagine doing this all day every day. What tools would you invent to make planting and tending a garden easier?

Idea: Visit a farm, implement dealership or food processing plant to look at technology. Attend a farm show or ask a farmer, implement dealer, elevator manager or food processor to visit the class.
**Answers to Tools and Machines**

- Air wrench – tightens or loosens bolts with power
- Combine – combines cutting, threshing (separating grain from chaff or husks) and cleaning grain while it moves across the field
- Milking machine – milks cows
- Truck – hauls grain and other farm inputs and products
- Computer – finds and stores information
- Bottle filler – fills cans and bottles with food and other products
- Pasta press – shapes pasta and noodles
- Cash register/scanner – checks out products at the store and tracks inventory
- Refrigerator/freezer – keeps things cold

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**Answers to Technology**

**Then to Now**

- 4 small tractor
- 7 satellite in orbit
- 1 hoe
- 6 track combine
- 3 horse-drawn plow
- 2 walking cultivator
- 5 four-wheel drive tractor

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**From Hand Tools to Big Machines**

If a farmer planted 5 acres per hour with a horse-drawn planter in 1900, how many acres did he plant in an 8-hour day?

\[ 5 \text{ acres/hour} \times 8 \text{ hours/day} = 40 \text{ acres/day} \]

Today’s farmer can plant 50 acres per hour with a tractor and seeder. How many acres can he plant in an 8-hour day?

\[ 50 \text{ acres/hour} \times 8 \text{ hours/day} = 400 \text{ acres/day} \]

How many more acres can the farmer plant in a day now compared to 1900?

\[ 400 - 40 = 360 \text{ acres} \]

Research: How many square feet are in an acre? 43,560 square feet, about the size of a football field.
Agriculture in Space

Background: Global Positioning Systems (GPS) use satellites in space that send signals to receivers on farm equipment. GPS tracks the exact position of a tractor by identifying its precise coordinates (longitude and latitude) and then plotting the position on an electronic map. Farmers use GPS to help them apply different amounts of seed, fertilizer or pesticides to different parts of a field. They program the implement’s application controllers so that when the implement is entering a certain area of the field, the controllers change the amount of seed, fertilizer or pesticide the implement is applying.

Farmers also can use GPS to guide their tractors so they don’t overlap when applying fertilizer or other products. GPS can steer the tractor for hands-free driving, or it can activate flashing lights on the dashboard to tell the driver if the equipment is drifting off the row.

Telematics is an electronic technology that captures data from farm equipment and transfers the information to the Internet in real time. Electronic sensors in the equipment monitor engine operation, fuel consumption, combine efficiency, planter accuracy and other actions. Cellular technology transfers the data to office computers or directly to the farmer’s cell phone. Equipment dealers, agronomists and other professionals also may use the farmer’s information to correct technical problems without traveling to the field. In addition, the data may be stored for easy record keeping.

Idea: Give students a hands-on opportunity to learn about GPS by conducting a scavenger hunt. The following trunks with supplies and teaching guides are available through your county office of the NDSU Extension Service.

Garmin eTrex Legend GPS Trunk includes 10 hand-held GPS units, leader’s resource binder, GPS Basics PowerPoint, instruction books, PC interface cables to connect GPS unit to computer and 10 laminated instruction sheets on how to facilitate an elementary scavenger hunt.

Geocaching Trunk includes six GPS units, geocaching instructions and books on geocaching. Geocaching is a fun sport that spans across the world. Groups that use this trunk need to supply their own prizes and protective plastic or metal boxes for the cache. Learn more at www.geocaching.com.

Idea: Research the coordinates (latitude and longitude) of your school and other North Dakota, U.S. and world locations.

Answers to Name That Tool

Idea: Develop an agricultural technology timeline. Archeological investigations in North Dakota document the presence of both hunting and gathering, and farming people dating back to 2000 B.C. Have students research what major ag technologies should be included on the timeline. Include tools, machines, plants and animals. Also, discuss and include the forms of farm power in order: people, animal, steam engine and gasoline engine.
Plant Technology

Idea: Discuss how people first gathered wild plants for food, then cultivated gardens and began selecting plants for bigger seeds and sweeter fruits. There’s evidence that 10,000 years ago people realized if they planted seeds from the biggest and best plants, they would produce more bigger and better plants.

Idea: Show students how plants produce seeds by pollination. Using a flower, show students how pollen from one plant is transferred to another plant, creating a seed that is a mix of traits of the parent plants. Use the “Buzzy, Buzzy Bee” lesson from the Project Food, Land & People Resources for Learning that has students pretend to be honey bees and apple trees to learn about plant pollination.

Biotechnology

Biotechnology, the newest way to develop new plants, takes pollination to a new level.

Idea: Introduce the concept of biotechnology by exploring the two words that are combined in its name:

Biology – the science of plants and animals

Technology – tools, machines, materials, techniques and sources of power; the application of science

Rather than manually crossing pollen from one plant to another, scientists who are using biotechnology take DNA from the cell of one plant and transfer it into another plant’s cell. The genetically modified cell grows and produces a whole new plant with characteristics of both parents.

Scientists are especially excited about the potential of biotechnology because the two plants don’t have to be alike to produce a new seed. They can in theory move some of the genes from a wheat plant to a corn plant or from a carrot to spinach. They can even move genes from bacteria or an animal into a plant. Already scientists have developed a rice variety that contains high levels of vitamin A, which helps prevent blindness; a tomato that keeps its just-picked flavor and texture longer; corn that is resistant to certain insects; and soybeans that aren’t damaged by herbicides that kill weeds in the same field.

Idea: Ask students to brainstorm a totally new fruit or vegetable that would combine two or more traits they like about their favorite foods – a banana that is crunchy like an apple or carrots that already have the dip in them or broccoli that tastes like watermelon. How would they go about developing such plants?

Idea: Use the Project Food, Land & People lesson “Banking on Seeds” to explore the role seeds play in the world and to compare the uses of seeds.

Idea: To experience biotechnology, conduct these in-class activities:

Have Your DNA and Eat It Too – Students build an edible model of DNA while learning basic DNA structure and the rules of base pairing. University of Utah, http://teach.genetics.utah.edu/content/begin/dna/eat_DNA.html

The Incredible Edible Cell – Students produce a cell model from various food items. Each food item represents a specific part (organelle) of the cell. When the lab is completed, the cell model is edible. National Health Museum, http://www.accessexcellence.org/AE/ATG/data/released/0251-NickHoffman/

Fruit Cup DNA Extraction from Kiwi – Use household equipment and store supplies to extract DNA from kiwi in sufficient quantity to be seen and spooled. Iowa State University, http://www.biotech.iastate.edu/lab_protocols/DNA_Extraction_fruit_cup.pdf

Answers to Plant Parts

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Protecting Plants

Technology also helps farmers protect plants from bugs, diseases and weeds. Farmers usually try to use natural methods to control pests, but sometimes chemicals are required. The chemicals that rid plants of these pests are called pesticides. Have students match the specific chemical to how it protects plants. Discuss how the first part of the word describes what kind of plant pest the products protect plants against.

Fungicides – Protect plants from diseases
Herbicides – Protect plants from weeds
Insecticides – Protect plants from insects

Integrated Pest Management (IPM) emphasizes other tools to reduce plant pests. Pesticides are generally considered after other options have been explored and only when economic thresholds have been exceeded. Other options include cultural control, such as selecting resistant varieties and rotating crops, and biological control, such as introducing insects that feed on pest insects or insects that eat weeds. These options often are less expensive for the farmer and protect the environment better than using pesticides.

Idea: Use the Project Food, Land & People lesson “Investigating Insects” to allow students to become entomologists by observing insects.

Better Livestock

One of farmers’ and ranchers’ technologies is embryo transfer. They remove the embryos from a superior animal and place them in surrogate females, where pregnancy continues normally and the females give birth to offspring with the characteristics of the superior animal. Rather than one superior animal, the farmer ends up with several.

Answers to Embryo Transfer
If a prize-winning cow produces one calf per year, how many calves will she have in 5 years? 5
If 10 embryos from the prize-winning cow are transferred to 10 other cows each year, how many calves from the prize-winning cow will there be in 5 years? 50 calves from the surrogate mothers

Animal Technology

Idea: Introduce the concept that animals are different from each other, just like people are different from one another. One cow may be tall, another short; one pig may be light skinned and another dark; one sheep may produce a lot of milk and another not as much.

As with plants, farmers learned a long time ago that their strongest, biggest, healthiest animals had the strongest, biggest and healthiest offspring, too. By carefully selecting the best male and female animals for breeding, they increased the number of healthier and stronger animals. These animals produced more milk, meat or eggs for people than weaker animals.

Answer to Cloning
Cloning is another new technology in animal science. Farmers are using cloning on a limited basis. A clone grows not from a fertilized egg, but from a cell. Clones may look different, but they have identical nuclear DNA.
Why Technology in Agriculture is Important

Idea: Discuss world population trends and the need to be able to produce more food. The world currently has about 6½ billion people. In 20 years, the population is expected to grow to almost 9 billion. Ask students to imagine what their classroom would be like if the number of students in the class increased at the same rate the population is growing. Rather than 25 students in the room, there would be 37 or 38. Where would they all sit?

In the past, the demand for more food has been met through technology. Will we be able to do so in the future? Ask students what kind of inventions we might need in the future to produce all the food the world needs.

Ask students if they can think of some negative side effects of technology. There are several. Technology, for instance, is partly responsible for the reduction in the number of farmers needed to produce food. Technology also introduces man-made substances into nature. It raises ethical questions about whether people should create new plants from non-related species or clone animals. How would your students solve these problems?

Technology for Food Safety

Idea: Talk about the many ways students and adults can practice food safety. How does technology help keep our food safe?

Idea: Help students learn the difference between food spoilage and food contamination, and more about food safety with the “Could It be Something They Ate?” lesson from the Project Food, Land and People Resources for Learning.

Technology and You

Idea: Discuss with students the variety of careers related to agricultural technology. Have students select a career and research it, writing a short report or presenting the information orally to other students. Or imagine all students are agricultural scientists. Have each student or small teams invent something that would make their lives easier or produce more food.

Idea: Invite a plant breeder, agronomist, agricultural and biosystems engineer, grain elevator manager, crop consultant, farm implement dealer or other ag technology professional to your class to talk about what they do. Staff from North Dakota State University and its county Extension offices and Research Extension Centers across the state are good sources.

Entomologist — Studies insects and other tiny creatures

Chemist — Studies the makeup of plants and animals and how they might be altered, and how products affect them

Geneticist — Studies the genetic makeup of plants and/or animals and breeds for different traits

Food Scientist — Develops new food products after studying nutrition, safety, consumer acceptance, packaging and more

Agronomist — Grows and studies plants and recommends improvements

Answers to More Milk

Before milking machines were invented in 1894, a farmer could milk 6 cows per hour by hand. How long would the milking take if the farmer had 15 cows?

15 cows ÷ 6 cows per hour = 2½ hours

Farmers can now milk a cow in about 5 minutes with a milking machine. If a farmer has 6 milking machines going at once, how many cows can be milked in one hour?

60 minutes/hour ÷ 5 minutes/cow = 12 cows/hour

6 milking machines = 72 cows/hour
Resources


**Cloning** — Surfing the Net with Kids, www.surfnetkids.com/cloning.htm (An excellent site for all topics related to teaching kids)

**Farm Machinery and Technology** — Agriculture and Farm Innovations http://inventors.about.com/library/inventors/blfarm.htm

**World Population** — World Population Clock
www.census.gov/main/www/popclock.html (Site ticks off world and U.S. population)

Surfing the Net with Kids
www.surfnetkids.com/population.htm (Contains several links for kids on world population)

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Kim Alberty – Agassiz Seed and Supply, West Fargo  
Aaron Anderson – N.D. Dept. of Career and Technical Education  
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Steven Edwardson – North Dakota Barley Council  
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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. See past issues at www.ag.ndsu.edu/agmag/agmag.htm. Send feedback and suggestions for future Ag Mag issues to:

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Another council teacher resource is Project Food, Land & People (FLP). Using the national FLP curriculum, N.D. 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.

The Project Food, Land & People course is available online during the spring semester for two credits. See all FLP course registration information at www.ndfb.org/edusafe.

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:

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Since teachers must relate work to education standards, the council worked with North Dakota State University to identify which Project Food, Land & People lessons meet North Dakota’s academic standards for grades K-8. The North Dakota Agriculture in the Classroom Web site at www.ndaginclassroom.org includes links to these standards alignments, educational materials, statistics, resources and activities for students and teachers.

For information, contact:

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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 N.D. 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.ndaginclassroom.org.

For information, contact:

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The N.D. 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:

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