When you picture corn in your head, you likely imagine fresh, yellow, corn on the cob. This type of corn, also called sweet corn, belongs in the vegetable food group. Scientifically, because corn is a structure to bear seeds, corn is a fruit. However, in agriculture, corn is called a cereal grain. This is because corn is a grass harvested for its kernels. Most corn is field corn and, unlike sweet corn, is harvested after it is fully mature and had time to dry out. Field corn is soaked and milled so the germ, oil, starch, and hulls can be separated.

These items are then made into cornstarch, cooking oil, sweeteners, cereal, beverages, and over 4,000 other products we use every day. When we eat dried corn, like corn meal, cereal, corn flour, or popcorn, it falls in the grains part of our diet. So...corn is a vegetable, fruit and a grain!

Is corn a vegetable, fruit, or grain?

Illinois farmers rank second in the country in corn production. Over 12,000,000 acres of field corn are planted each year in Illinois, which produce approximately 2 billion bushels of little golden kernels. One bushel of corn weighs 56 pounds, meaning Illinois farmers haul nearly 112 billion pounds of corn out of their fields each year. Now that is a lot of corn! So how do those little kernels go from the field to the products you use every day?

**PLANTING:** Farmers plant the corn seeds, or kernels, in the ground using a piece of machinery called a planter. A tractor pulls the planter through the field as it drops the kernels one by one into the ground. Corn is planted in the spring when the soil is warm enough to germinate the seeds, but not so early that the young plants are likely to be damaged by frost.
What’s Inside That Seed?

Corn seeds are called kernels. One ear of corn averages 800 kernels in 16 rows.

**Endosperm**—Holds the energy and protein the new plant will use to begin to grow. This area is full of starch, which is used the most in corn processing.

**Pericarp (seed coat)**—Outside cover of the seed. It protects the inside of the seed from cold temperatures, moisture and insects until the seed is ready to germinate.

**Germ**—Only living part of the seed. It will become the new plant. It has all of the genetics, vitamins and minerals for a new plant to be created. There is also oil inside of the germ, which is the most valuable part of the corn kernel when it is processed.

**Tip Cap**—Where the kernel was attached to the cob. As the kernel grew on the cob, it took in water and nutrients from this area.

**Pollinating:**
Once the corn plant tassels, pollen from the tassel lands on the silk on the ear and travels down to make one kernel of corn. On average 800 grains of pollen land on 800 different silks which develop into the 800 kernels on an ear of corn.

**Maturing:**
Most corn plants produce just one ear of corn. In the fall, after approximately 120 days of growth, the plant matures and is ready for harvest.

**Harvesting:**
Corn is harvested with a machine called a combine. The combine separates the kernels from the ear and the rest of the corn plant.

**Storing:**
After the corn is harvested, it is taken to a storage facility called a grain elevator. There it is dried, stored, and prepared for sale.

**Transporting:**
When the corn is sold, it is loaded into semi-trucks, and eventually freight trains or barges and shipped all over the United States and the world.

**Processing:**
The corn is used for animal feed, fuel, and many other products.
Did you know that 95% of all corn farms in America are family owned? In fact, those family farms produce 90% of all corn grown in the United States. Family farmers throughout Illinois and around the United States are committed to raising crops that are nourishing and healthy for not only your family, but theirs, too. To do this, they are devoted to taking care of the land on which these crops are raised. This is important not only because of the responsibility farmers feel to take care of the environment, but also because they want to ensure the land on which they farm is there for future generations.

To keep family farms running and to guarantee they are around for years to come, every member of the family is involved. Whether it is driving the combine, picking sweet corn, running a roadside fruit and vegetable stand or delivering meals to the field, each family member has a job. Farm kids learn about hard work, dedication and family loyalty from an early age. This helps prepare them to come back to the farm to continue the legacy of their family. Therefore, so many farms have been around for several generations. Modern day family farms carry on the traditions of their ancestors, but continue to grow and learn about technology and practices that make their farm more efficient and sustainable while being good stewards of the land. This ensures their farm will continue to raise safe healthy food for our growing population.

One Bushel of Field Corn Can Produce One of the Following Four...

- 31.5 pounds of starch
- 33 pounds of sweetener
- 22.4 pounds of PLA fiber/polymer
Ethanol is a high-performance fuel made from corn. Most gas stations sell gasoline that is mixed with ethanol. How do you know which gasoline at the station has ethanol in it? Just look for the sticker on the fuel pump that says “10% ethanol.” Some vehicles, referred to as Flex-fuel vehicles, use fuel mixed with 85% ethanol, or E85. These vehicles have a yellow gas cap to let the driver know that they can use gasoline mixed with more ethanol. Today, ethanol makes up 10% of the U.S. gasoline supply.

So why is it important for us to use this fuel made from corn? Ethanol is better for the environment and the economy. Here’s how:

- Ethanol is a renewable resource. When we need more fuel, we grow more corn. Can you name other renewable resources?
- Gasoline is made from crude oil, which is not a renewable resource. Producing 20 barrels of ethanol requires just 1 barrel of crude oil. So, making ethanol helps Earth’s limited supply of crude oil last longer, and reduces the need to import oil from other countries.
- Ethanol reduces greenhouse gas emissions by up to 48% when compared directly to gasoline.
- The ethanol industry supported over 350,000 U.S. jobs in 2015.
- Ethanol reduces gasoline prices saving American families approximately $1,200 in gas bills each year.
- Biorefineries return about 1/3 of every processed bushel of corn, to be used as more nutritious livestock feed, distillers’ grains or corn gluten.

Corn-Based Products...

Sweet corn is the kind of corn that is grown in gardens and is sold on the cob in the grocery store and at farmer’s markets and roadside stands. You will also find this type of corn in the canned and frozen veggie aisles at the store.

Popcorn is another type of corn that we eat. Illinois ranks 3rd in the nation for popcorn production. Popcorn is also the official Illinois snack food. There is a little bit of water in every kernel of popcorn. When the kernel is heated, the water heats and builds up pressure. The pressure makes the water take up all the available space. When enough pressure builds up, the kernel pops and turns inside out.

Field corn, or dent corn, is a special type of corn that has a hard outer-shell and is full of starch. 94% of the corn grown in the United States is field corn. There are over 4,000 uses for corn products and more are being found every day. Corn is used in everything from livestock feed to cereal, wallpaper, skateboards, cosmetics and even plastic! Today, some brands of carpet, as well as the stuffing in pillows and bed comforters, are made from corn plastic that has been spun like cotton.
Illinois and the United States are great places to grow corn. We actually grow more than we can use. We sell this extra corn to other countries. This is called exporting. The Illinois and Mississippi Rivers play a very important role in the exporting of Illinois corn and other commodities. Corn can be loaded onto large, flat boats, called barges, and shipped south, down the river to New Orleans, cheaper and more environmentally friendly than if it was hauled by semi-trucks or trains.

Along the Illinois River, between Lake Michigan and the Mississippi River, barges pass through a series of eight locks and dams. Dams help maintain water levels as depths and elevations change. Locks are like elevators which help barges and other ships navigate these dams. Locks force water in or out, underneath the barge, to raise or lower it to the proper level. These locks are important as the elevation at Lake Michigan is about 578 feet higher than at the Mississippi River.

Once in New Orleans, the corn is loaded into large ships and sent around the world. The United States produces about 34% of the world’s corn, and exports to countries all over the globe.

Like other plants, corn requires water to grow. At its earliest stage, the corn seed will begin to absorb moisture from the soil in which it is planted. This is the seed’s cue to germinate. Then the roots sprawl out into the soil in search of more moisture to satisfy the needs of the plant as it grows larger.

Illinois receives about 32-48 inches of rain per year. This is more than enough to grow a healthy corn crop. Any excess moisture becomes a part of the water cycle through soil drainage, evaporation or a process called evapotranspiration. Through this process extra water is evaporated from the leaves as water vapor, which goes back into the atmosphere.

Most farm land in Illinois is tiled to provide proper drainage for crops to grow. Farmers carefully monitor the nutrients they add to the soil, and work to keep these nutrients helping the crops and away from streams and rivers.

This is all part of the water cycle. Can you describe the parts of the water cycle?
**Use Corn to Make Your Own...**

**Corn Putty**

1. Place 1 cup of cornstarch in a bowl.
2. Add ¼ cup + 1 tablespoon of water to the cornstarch.
3. Add a few drops of food coloring to the bowl.
4. Blend mixture with a fork. It should flow when the bowl is tipped but feel solid when you touch it. If it is too thick, add a little water. If it is too runny, add a little cornstarch.
5. Play with it like clay, then watch it become liquid again.

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**SOLID/LIQUID**

**Corn plastic** is a more environmentally friendly plastic than that made from petroleum. Producing corn plastic generates less greenhouse gases and no toxins since it is made from corn. It is also completely biodegradable. Biodegradable means that it breaks down into little pieces that become part of the soil, instead of adding to our landfills. Styrofoam and petroleum-based plastic products are not biodegradable.

**3D printers create forms out of PLA fiber. That fiber is made from corn starch!**

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**GROWING TECHNOLOGY**

People have been growing corn crops since the first farmers began the practice over 10,000 years ago. Since then, a lot has changed in the way we grow corn. In 2016, farmers in the United States planted over 94 million acres of corn. To accomplish this, farmers have adopted technologies which make farming more efficient, while also becoming safer and easier-to-navigate.

- **GPS**, or global positioning systems, allow farmers to plot and plant precise rows in their fields. Some GPS systems can guide large farm equipment through a field, accurate to a few centimeters. This is important to the corn grower because it helps prevent overplanting or underplanting, which can decrease yield.
- **Mobile Devices** like tablets and iPads have become a common sight in the cab of farm equipment. They display helpful information like planting and weathering notes. With the help of apps developed specifically for the agriculture community, farmers can calculate, analyze, and share information about their fields, weather conditions, weeds, pests, corn yields, and more.

**NUTRIENTS**

Corn, like all plants, requires nutrients to grow. Soil provides most of the needed nutrients. The three main nutrients needed for healthy plant growth are nitrogen (N), phosphorus (P), and potassium (K), and are absorbed through the roots of the corn plant. To help make sure each corn plant gets the nutrients they need, farmers will sometimes apply extra nutrients, often called fertilizer, to their fields.

It is important for farmers to provide their plants with enough nutrients, without applying too much. Extra nutrients can find their way, through soil erosion or run-off, into creeks, rivers, and the greater water system. Farmers practice different strategies to keep the nutrients they put on their fields, in their fields. Some of these strategies include:

- **Creating buffer strips of land** between crops and the water way, applying fewer crops in the off-season to hold soil in place and restore natural nutrient levels, and by following the 4 Rs of nutrient stewardship.

**4R’s of Nutrient Stewardship**

- **Right Source**: Matches the fertilizer type to crop needs.
- **Right Rate**: Matches amount of fertilizer to crop needs.
- **Right Time**: Makes nutrients available when crops need them.
- **Right Place**: Keeps nutrients where crops can use them.
Kenneth Davis

*Cereals Product Manager • KWS • Champaign, IL*

I organize the development and commercialization of wheat genetics for positioning in the soft red wheat growing area. I work closely with our research team to gather technical information about product performance then arrange testing, seed production and sales with outside distribution partners.

**How are the STEM subjects (Science, Technology, Engineering, Math) important to what you do?**

These subjects are critical to day to day operations in product management, especially math and science. We use fundamental algebra to compare performance and calculate business plans. We also use these systems for organizing budgets. Seed business is firmly rooted in scientific innovation. Our testing methods use a number of field based studies such as fertility treatments, fungicide responses and biology related analysis of plant growth. We also partner with laboratories to conduct deeper scientific analysis of seed and grain quality.

**What changes in the corn industry have you seen in recent years? What trends do you expect to keep going?**

Corn demand worldwide continues to be strong, despite recent surpluses from above average production. I anticipate stable commodity prices for a few years, until new areas of production are penetrated or breakthrough technology enhances product performance.

**What might a student study in school to follow a career like yours?**

Staying focused on the STEM subjects will be important, and having basic abilities to problem solve. At the same time, being involved with agricultural programming outside the classroom helps prepare students for successful college and career paths. For example, engaging with FFA & 4-H, doing community service projects, or volunteering at food banks build good experience for real world challenges.

**What is a major issue that corn, or agriculture in general, is facing that everyone should know about?**

We continue to see large populations of the world living with food insecurity. Building relationships across the value chain is more important than ever before, and developing exciting new products is no longer enough. Appreciating each stakeholder’s contribution to the supply chain will help build bridges to serve areas of the world which can benefit most from our agricultural innovation.

**What is your favorite part of your job?**

Having an opportunity to see the livelihoods of people from different cultures. As an ambassador for technology and agriculture, I am happy to be a facilitator of products and ideas that solve challenges for so many different people.

Justin Durdan

*President • Illinois Corn Growers Association • Utica, IL*

**What is the Illinois Corn Growers Association, exactly?**

The Illinois Corn Growers Association is a group created by farmers to support farmers. The Association has a Board of Directors (18 farmers), as well as staff that run the day to day activities of the Association. I currently serve as President of the Association.

We talk to our elected officials including the governor and the president as well as U.S. and Illinois representatives and senators. We discuss marketing and selling corn to different consumers around the world, introducing laws to help farmers with weather related damage to their crops, and building better roads, bridges and locks and dams to help with the transportation of corn and corn products. We also talk to consumers to help them understand where their food comes from and how it is grown. Our Association is committed to providing information to anyone wanting to know more about farming.

**Can you describe your typical work day?**

Every day is different. In the spring, I’m planting corn and in the fall I’m harvesting corn. While the corn is growing in the summer, I’m helping by giving it nutrients and eliminating the weeds that are stealing food, water, and sunlight. When I’m not in the field planting, harvesting or helping the corn, there’s a lot of behind the scenes work to be done. I have to take care of my tractors and other equipment, decide what seeds I will buy and plant the next year, work on my budget, clean up the shed (farming can be a messy job) and lots of other activities.

**Where does the corn from your farm go?**

Most of the corn from my farm is sold to a local ethanol plant. The ethanol that is made from my corn could be in the fuel that you put into your car every time you go to the gas station! I like knowing that my corn is being used to make the fuel in our cars better for the environment. The rest of my corn – about one-third of it – is sold to other states and countries. It is used to feed their cows, pigs, and chickens.

**How has technology changed corn farming in recent years? What changes do you expect to see in the future?**

Technology has made farming very different in the last several years. I think the biggest change is my tractors and equipment use global positioning systems (GPS) to locate exact areas of the farm. This means that I can test the soil in different areas of my farm, see what nutrients the soil is lacking, and put the nutrients in those exact places so the corn has everything it needs. This is so much better because I don’t have to buy extra nutrients and put them on the entire field if only one small section here and there needs them. I’m applying less which is better for the environment and costs me less.
How did you get to your current position?
I have an undergraduate degree in Botany and Masters and Ph.D. degrees in soil science from North Carolina State University. I worked in the Ag Engineering lab as an undergraduate and, after graduating with my Ph.D., I accepted a faculty position at North Dakota State University in their Soil Science Department. In North Dakota, I worked with sugar beets, corn, and soybeans and did a lot of work with reduced tillage systems and cover crops.

What are some big issues corn farmers are currently facing?
Every year, Illinois Corn Growers sends a survey out to our membership to ask them what priority issues they would like us to focus on in the coming year. Over the past 4 years, the biggest issues have been ethanol expansion and markets, exports, water quality and sustainability, river transportation systems, biotechnology, farm programs, and public outreach and engagement.

How do farmers impact the environment?
Agriculture undoubtedly has one of the greatest impacts on the environment of all human endeavors. Anything as fundamental to our existence as eating is bound to leave its footprint on the landscape. We know that farmers today are growing crops more efficiently and with less impact per unit of food produced than at any other time in history. We are continuously improving and evolving our methods of agricultural management so that our impact on the environment is less negative and more positive.

How does the environment impact farming?
The single most significant factor, year in and year out, determining crop yields in our rain-fed, Midwest, row-crop environments, is weather. We can predict, factor, and account for most of the other crop yield-limiting factors – weeds, insects, disease, fertility, seed bed – but we do a pretty poor job, overall, of predicting and responding to how the weather will impact our crops. Of course, the environment also includes bigger issues of long-term climate change, which we must also begin considering. We are documenting more intense rain events resulting in increased soil erosion potential and crop damage than we have had in recent memory. Over the past 10 years, we’ve watched as the Corn Belt moved north, partially due to issues with warming trends. So, essentially, we are in a constant loop in which the environment impacts us and we impact the environment.

Laura Gentry, Ph.D.
Director of Water Quality Service, Illinois Corn Growers Association, Illinois Corn Marketing Board • Urbana, Champaign County

Standards
This Ag Mag complements, and can be connected to, the following educational standards:
Common Core State Standards:
ELA-Literacy – RI.4.2; RI.4.4; RI.4.7; RI.4.10; W.4.7-4.9; SL.4.1; SL.4.4; L4.1; L4.6
Mathematics – 4.MD; 5.MD
Next Generation Science Standards:
Interdependent Relationships in Ecosystems: 3-LS4-3; Energy: 4-ESS3-1; Structure, Function, and Information Processing: 4-LS1; Structure and Properties of Matter: 5-PS1-3; Structure and Properties of Matter: 5-PS1-4
IL Social Science Standards:
Human-Environment Interaction: Place, Regions and Culture: SS.G.3.4; Human Population: SS.G.3.4; Exchange and Markets: SS.EC.2.4; Causation and Argumentation: SS.H.3.4

To learn more about Agriculture, visit us at www.agintheclassroom.org, or contact your county Farm Bureau® office or Agriculture in the Classroom, Illinois Farm Bureau®, 1701 Towanda Avenue, Bloomington, IL 61701.