Illinois Ag Mag

An agricultural magazine for kids

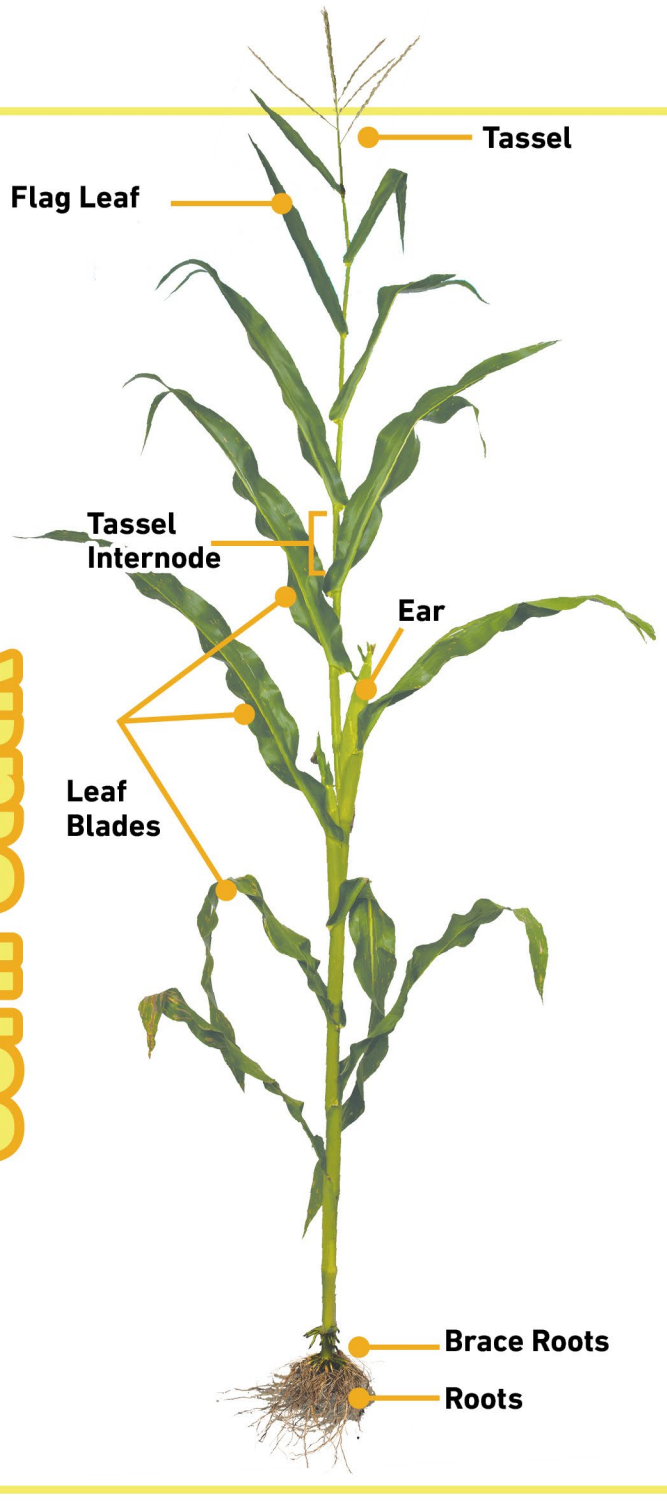
Corn

Competitive Solutions

The Midwest, and Illinois in particular, has the right soils and the right climate to grow corn. Hot days that cool off at night are just what the corn plant needs. Most of our soils do not need irrigation in most years to produce abundantly. Soybeans are a perfect crop for alternate years. This gives Illinois a competitive advantage in corn production. Each year around 11 million acres of Illinois farm land are devoted to growing corn, and our corn offers solutions for a number of unique challenges around the world.

Most corn you see growing in Illinois is field corn, harvested after it is fully mature and had time to dry out. After corn is harvested it is soaked and milled so the germ, oil, starch, and hull can be separated. These items are made into things like cornstarch, cooking oil, sweeteners, and ethanol, and are used in over 4,000 products you use every day. Read on to see how Illinois corn can help provide solutions to many challenges.

Corn Stalk



From Planting to Harvest and Beyond

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?

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.

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.

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.

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

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.

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

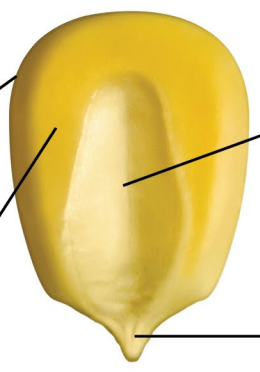
The corn is used for animal feed, fuel, and many other products.

What's Inside that Seed?

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

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.

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.



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.

FAMILY FARMS: A Tradition...

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, 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.

Corn-Based Products...

All corn is not the same.

Sweet corn is the kind of corn that is grown in gardens and is sold on the cob in the grocery store and at farmers 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 inside 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.

Transportation and the World Market

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. This is 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.

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

31.5 pounds of starch

OR

33 pounds of sweetener

OR

22.4 pounds of PLA fiber/polymer

OR

2.8 gallons of ethanol fuel
17.5 pounds of distillers dried grains
13.5 pounds of gluten feed
2.6 pounds of gluten meal
1.5 pounds of corn oil

CHALLENGE: TOO MUCH TRASH
Solution: Corn Bioplastic

Take a moment to look around your classroom and home and notice how much plastic we use. From packaging to cups to grocery bags, you can find plastic just about everywhere, including our oceans and landfills. The problem is that traditional plastic is made from petroleum-based materials. Petroleum is a non-renewable resource, meaning there is a limited amount of it. Petroleum based products also take centuries to break down, if they break down at all.

Luckily, Illinois farmers are growing an alternative: corn.

Corn is a renewable resource, meaning we can grow more each year. As Illinois farmers aim for global sustainability, it is important to learn more ways to rely on renewable alternatives.

Biodegradable means that the products break down and decompose in months, rather than the centuries that it can take traditional plastic products to degrade. Under the right conditions microorganisms can completely break down biodegradable plastic into water, carbon dioxide, and compost.

Bioplastics produce significantly fewer greenhouse gas emissions than traditional plastics over their lifetime. A recent study determined that switching from traditional plastic to corn-based bioplastic would cut U.S. greenhouse gas emissions by 25 percent.

You can find bioplastic straws, cups, bags, as well as packing materials easily. Want to make your own bioplastic? Check out this recipe.

Cornstarch Plastic

Materials Needed:

- 1 tablespoon of cornstarch
- 1 tablespoon of water
- 2 drops of corn oil
- 2 drops of food coloring
- Resealable sandwich-size plastic baggie

Directions:

1. Add all the ingredients into the plastic baggie and seal the bag.
2. Mix the ingredients by rubbing the outside of the bag with your fingers until the ingredients are thoroughly mixed.
3. Slightly open the baggie, creating a small vent, and place it in your microwave.
4. Microwave for 15-20 seconds on high.
5. Carefully remove the baggie from the microwave and let it cool for a few minutes.
6. Now that it is cooled but still warm, take it out of the baggie and create a fun shape!

Challenge: Air Quality
Solution: Ethanol

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 E•85. 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 one 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 400,000 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.

Challenge: Water Quality
Solution: Best Practices

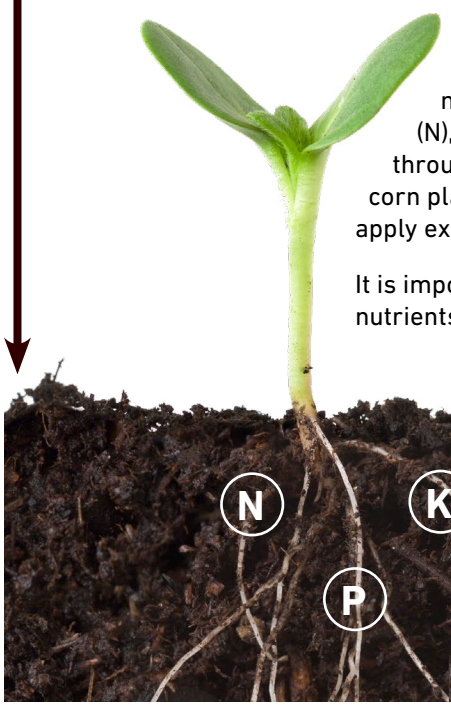
Like other plants, corn requires water to grow. At its earliest stage, the corn seed will begin to absorb moisture from the soil in which it is planted. This is the seed's cue to germinate. Then the roots sprawl out into the soil in search of more moisture to satisfy the needs of the plant as it grows 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 transpiration. Through this process extra water is evaporated from the leaves as water vapor, which goes back into the atmosphere.

This is all part of the water cycle. *Can you describe the parts of the water cycle?*

Most farmland 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 their crops and away from streams and rivers. Farmers are continuing to monitor best practices as they evolve.

CHALLENGE: SOIL HEALTH
SOLUTION: NUTRIENT STEWARDSHIP



Corn, like all plants, requires nutrients to grow. Soil provides much 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 stalk. 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 cover crops in the off season to hold soil in place and restore natural nutrient levels, and by following the 4 R's of nutrient stewardship.

4R Principles 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.

CAREERS

Sarah Hastings

Corn Farmer

Sidney, IL

Size of farm: 1650 acres

Year established: 1980

Primary market: Commercial buyers for feed and industrial use

Describe your background and current farm operation.

I grew up helping on my grandparents' farm near Bloomington, IL. They raised sheep and cattle and I got the experiences there vaccinating ewes, cleaning out barns, and baling hay. Now, I live on a family grain farm with my husband and my son in Champaign County. I feel lucky to do most of the day-to-day work on our farm, including planning for a new year, planting, scouting for pests, harvesting, and selling our crop. I also own a grain handling and storage business with my husband. I spend much of the winter catching up on paperwork, paying bills and meeting with customers to plan out their grain storage needs for upcoming years. After planting season in the spring, I am out building grain bins so that farmers around me can store their own crop on their own ground. This helps them get a better price for their crop because they can hold onto their grain until they feel the time to sell is best.

How do you see your corn solving unique challenges from around the world?

The corn that I grow is used for many things. Sometimes it ends up making ethanol - a fuel for your vehicles that helps keep our air clean and our lungs healthy. Sometimes it feeds cattle, pigs, and chickens, and grows nutritious food for people all over the world. Sometimes my corn is shipped straight to other countries for them to feed their own animals to make food for their people. I really enjoy being a part of a system that grows food where we can and gets food to the people around the world who need it. My corn can also be used to create many, many fun things, including a replacement for plastic. Corn-based plastic will melt away and not harm our environment or our animals and wildlife and I'm very proud to be a part of that global solution to too much plastic.

Describe how your family farm takes care of the environment.

On our farm, we prioritize taking care of our soil. First, we try not to till the soil unless we have to because leaving the soil alone can help reduce soil erosion and prevent fertilizer leaving our fields in heavy rain or weather events. Leaving the soil also protects the valuable microbes and earthworms that live there! I work hard to make sure my soil is healthy so it can grow the very best crops for my family and yours, and families around the world. I also use GPS to map my fields and collect data that will measure how my soil is and how my plants are growing. This way, I can plant only what the soil in each area can sustain and I apply fertilizer and pesticides according to the need in each area. This is sometimes called "prescription farming," and it's better for the environment because I can give each small area of my field the exact food and protection it needs.

How are you positioning your family farm for generations to come.

My son is still very young so it's impossible to know if he will farm here someday. I am also young enough to pray that I have many years of farming this land ahead of me! However, we are always thinking about whoever farms this land after us and trying to leave our farm at least as good or better than it was when we received it. What we do know is that in order to produce enough feed and fuel for the world, this land will need to be farmed, and I want it to be healthy and vibrant and able to grow crops to benefit all the people of the world of the future.

Laura Gentry, Ph.D.

Director of Water Quality Service

Illinois Corn Growers Association, Illinois Corn Marketing Board

Urbana, IL

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.

Sam Ordonez Jr., Ph.D.

Research Scientist & Corn Breeder

Corteva Agriscience Champaign Research Center

Champaign, IL

Describe your job.

I develop corn hybrids to address the needs of our local farmers in order to increase their productivity and contribute to overall food security. As a corn breeder, I develop corn germplasm and genetics for hybrid corn product development for the Midwest. I use new breeding technologies and prediction tools to continuously increase genetic gain.

How are STEM Subjects important to what you do?

Plant breeding and genetics requires a solid foundation of science, technology and math to be successful. I deal with large data sets and use several statistical analyses on a regular basis to make decisions. We use drones to collect data and machines to harvest and process our seeds. I use scientific methods and statistics routinely in my experiments and trials.

How do you see corn as a solution to a specific problem.

With steady increase in global population, food demand for meats (chicken, pork, and beef) and dairy products continues to increase. To meet this demand, we need a stable supply of feeds to raise and feed these livestock and poultry, so we as consumers have enough to eat. Corn is the number one feed source globally, accounting for 95% in the US feed grain (USDA). Take note, other than feeds, corn has several uses: ethanol, human consumption (food), and industrial uses. Corn being the most profitable crop with higher yields coupled with technology improvements and production practices, makes it very ideal to grow not only in the U.S., but worldwide.

What would you suggest to students who might want to pursue a career similar to yours?

Study hard, be passionate and work hard for it, but at the same time enjoy doing it. Keep that curiosity going, explore, read, learn and experience. Develop a good foundation and habit for learning. Be curious and ask a lot of questions.

What is your favorite part of your job.

I like the seasonality of my job. It comes in cycles, and you are not doing the same thing every week. There are long days in the summer and fall, walking in corn plots and taking notes and some short days during the winter times. We follow the corn growing season, where we make breeding plans, create experiments, plant seeds, take notes, pollinate, harvest, and make advancement decisions. Also, the ability to contribute to food security and reduce hunger is what motivates me to work hard every day.

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; RI4.7; 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

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