NORTH DAKOTA
Ag Mag
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A Magazine about Agriculture for North Dakota Students

corn

You probably know about popcorn and corn on the cob, but did you know corn also is used for livestock feed, fuel for engines, food sweetener and many other products? Let's learn more about corn!

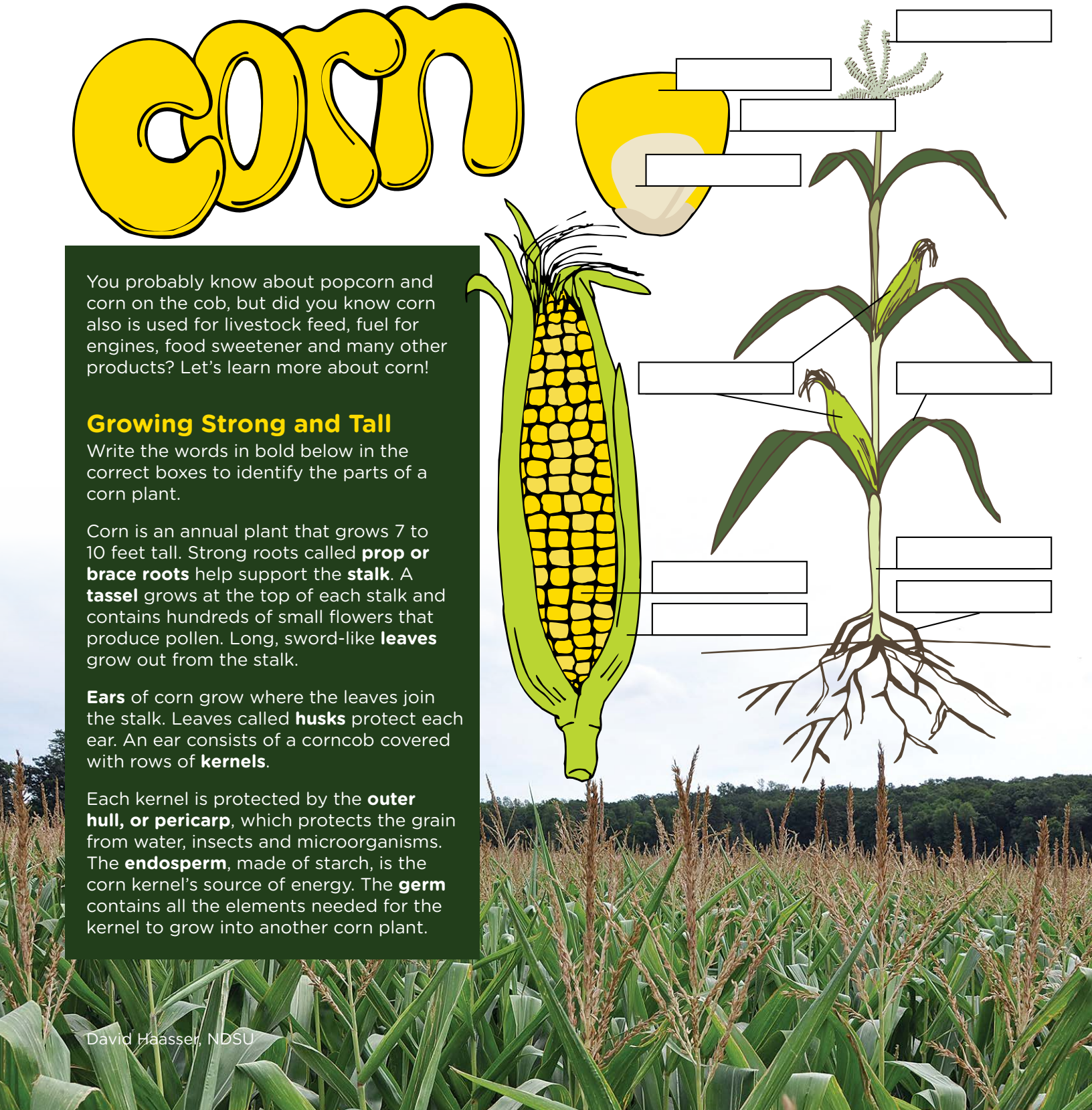
Growing Strong and Tall

Write the words in bold below in the correct boxes to identify the parts of a corn plant.

Corn is an annual plant that grows 7 to 10 feet tall. Strong roots called **prop or brace roots** help support the **stalk**. A **tassel** grows at the top of each stalk and contains hundreds of small flowers that produce pollen. Long, sword-like **leaves** grow out from the stalk.

Ears of corn grow where the leaves join the stalk. Leaves called **husks** protect each ear. An ear consists of a corncob covered with rows of **kernels**.

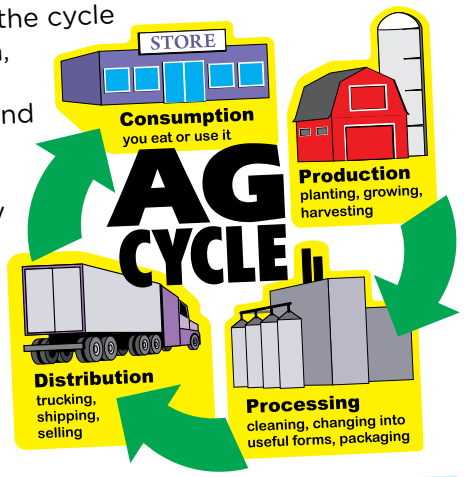
Each kernel is protected by the **outer hull, or pericarp**, which protects the grain from water, insects and microorganisms. The **endosperm**, made of starch, is the corn kernel's source of energy. The **germ** contains all the elements needed for the kernel to grow into another corn plant.



David Haasser, NDSU

Agriculture!

It's more than farming and ranching. It's the cycle of production, processing, distribution and consumption of our food, fiber, forestry and fuel products.



Corn Production

Maize is Thousands of Years Old

Corn has been grown in North and South America for thousands of years. American Indians called the grain *maize*, and it was so important to their survival that some tribes had festivals at planting and harvest times.

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American Indians used all the parts of the corn plant. They ate corn, but also made beds and toys from the husks, burned the cobs for fuel and fed corn to their livestock.

Chief Massosoit taught European settlers how to grow corn, and the settlers came to depend on it. At the first Thanksgiving, the Pilgrims and the Indians gave thanks for the corn harvest — as the American Indians had always done.

Europeans took corn back to the Old World, and corn spread quickly throughout the rest of the world.

Gardening with the Three Sisters

Use these words to fill in the blanks: healthy, stalk, seeds, leaves, diameter, circular, soil

Native Americans planted corn 1. ☐ with bean and pumpkin or squash seeds. These three crops were known as the Three Sisters. In Iroquois legend, the Three Sisters are believed to be the gift from the sun god, who created corn, beans and squash to keep the first people of the earth 2. ☐. The Three Sisters were planted together in a 3. ☐ mound garden, reflecting the never-ending cycle of nature. Each mound was 3 feet in 4. ☐ and had 4 to 6 corn plants in the middle. The beans provided nitrogen for the 5. ☐. The corn provided a 6. ☐ the bean plants could climb. The pumpkins' 7. ☐ shaded the ground to keep weeds from sprouting.

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Today's Corn Farmers Use Modern Equipment

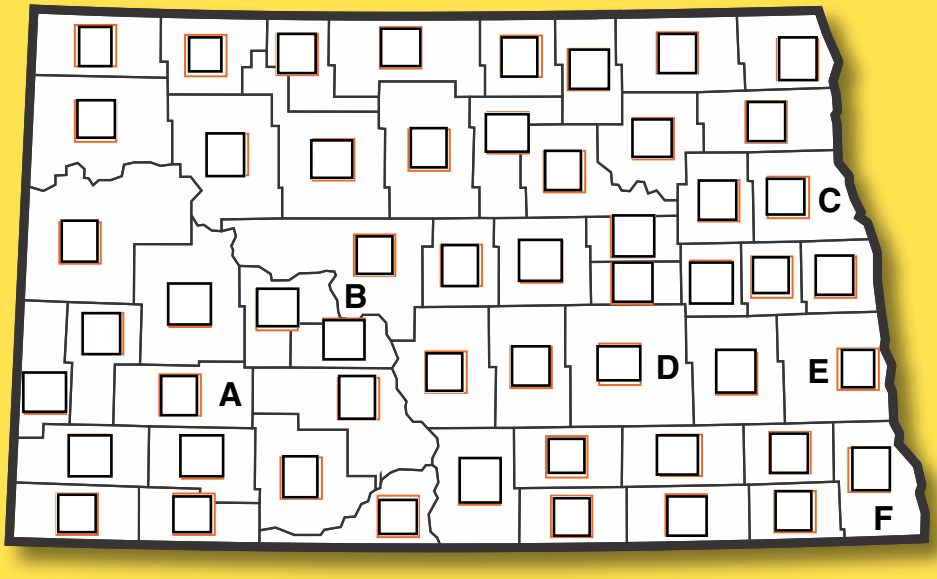
Select the correct word to accurately complete each sentence.

1. Corn is planted in the spring using a planter. The machine drops the (☐ **kernels** or ☐ **kernals**) 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 machine 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.

Find North Dakota's Corn Belt

On the map, select all the North Dakota counties that produced more than 10 million bushels of corn for grain in 2019.

Burleigh	Grand Forks	McLean	Sargent	Stutsman
Cass	LaMoure	Richland	Steele	Traill



Cornstarch Play Putty

1 1/2 cups cornstarch
2 cups water
1 cup salt
1/2 cup flour
2 teaspoons cream of tartar
1 tablespoon corn oil
Food coloring, if desired

Mix all ingredients in a saucepan and cook over medium heat, stirring constantly, until the mixture forms a dough. Turn on to waxed paper until cool enough to handle, and then create fun shapes.

Have Fun with CORN

Math Challenges

Derek ate 4 ears of corn on the cob. His sister ate 3, his older brother ate 3 and his younger brother ate 5. How many ears of corn did Derek and his sister and brothers eat? 1.

The contestants in the school's corn-eating contest ate 55 ears of corn. The English teacher ate 10. The science teacher ate 13. The gym teacher ate 6. The geography teacher ate 9. The principal won the contest. How many ears did the principal eat? 2.

Farmer Jones and her family all grow corn on their family land. Farmer Jones planted 77 acres of corn. Her brother planted 140 acres. Their uncle planted 65 acres. Grandpa planted 90 acres. How many acres of corn are planted on the family farm? 3.

During the summer, 30 acres of the Jones' land are flooded by rain, and the corn on that land is ruined. How many acres can the family harvest in the fall? 4.

One bushel of corn weighs 56 pounds. At harvest, one acre of land can produce about 120 bushels of corn. How many bushels of corn will be produced on 10 acres? 5.

On 100 acres? 6.

Extra challenge: How many pounds of corn will have been produced on those 100 acres? 7.

One bushel of corn weighs 56 pounds, and four barn mouse families want to share it equally. How many pounds of corn will each barn mouse family get? 8.

One bushel of corn can produce sweetener for 325 cans of pop. How many cans of pop can be sweetened with 120 bushels of corn? 9.

Extra challenge: How many six-packs of pop can be sweetened with 120 bushels of corn? 10.

Corn Processing

WATCH VIDEO

North Dakota's Corn Processing

Ethanol, a fuel made from corn, is produced at:

- ☐ **Blue Flint Ethanol**
  Underwood, 73 million gallons per year (mgy)
- ☐ **Dakota Spirit AgEnergy**
  Spiritwood, 75 mgy
- ☐ **Hankinson Renewable Energy**
  Hankinson, 145 mgy
- ☐ **Red River Biorefinery**
  Grand Forks, 16.5 mgy
- ☐ **Red Trail Energy**
  Richardton, 63 mgy
- ☐ **Tharaldson Ethanol**
  Casselton, 175 mgy

Write the correct letter in the box in front of each plant to identify where they are on the North Dakota map on page 3.

These six plants produce about 547.5 million gallons of ethanol per year. A rail tank car holds about 30,000 gallons, so how many rail cars would be required to move all of North Dakota's annual ethanol production? 1. _____

If each tank car is 50 feet long, how long is the train? 2. _____

How many miles is that? 3. _____

The **ProGold** plant at Wahpeton makes high fructose corn sweeteners, corn gluten feed and corn gluten meal. The plant also separates corn germ, which is sold for corn oil production.

Corn Means Business

Identify the following agricultural careers by fitting them into the **crossword puzzle**.

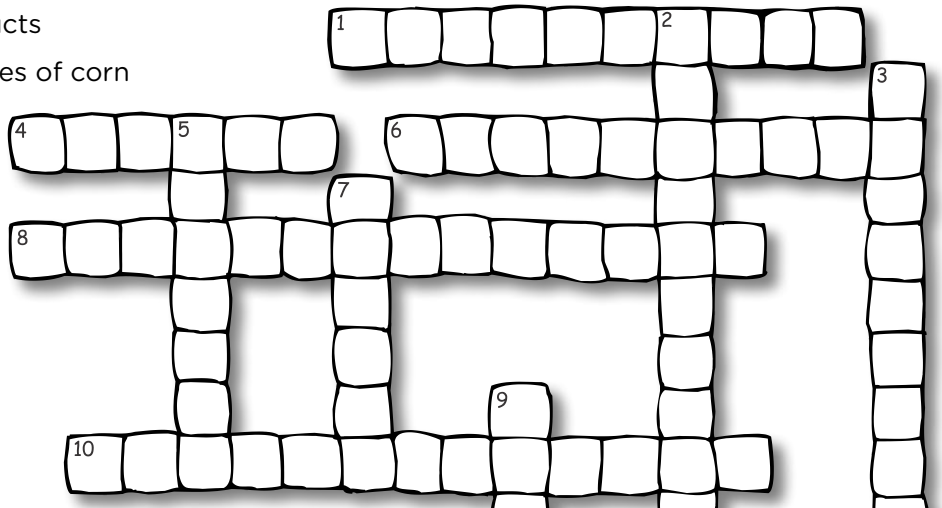
accountant	extension agent	miller
agronomist	farmer	researcher
botanist	grocer	seed dealer
chemist	mechanic	truck driver
equipment dealer	meteorologist	

Across

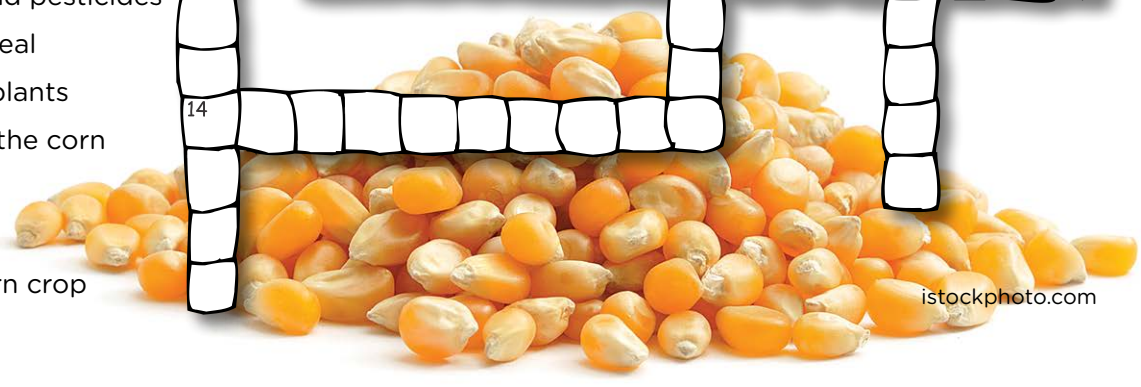
1. supplies hybrid seed to the corn farmer
4. a person who sells corn food products
6. scientist who investigates future uses of corn
8. provides current information from university research to the corn farmer
10. forecasts the weather
13. sells the tractors, planters, tillage equipment and combines
14. keeps the financial records

Down

2. person who deals with crop production and soil management
3. hauls the corn from the farm to the processing plant or elevator
5. scientist who develops new and effective herbicides and pesticides
7. grinds the corn into meal
9. scientist who studies plants
11. repairs and maintains the corn farmer's machinery
12. responsible for planning, cultivating and harvesting the corn crop



Source: Captain Cornelius Magazine, National Corn Growers Asssociation



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Corn Distribution

The Grain Elevator: A Hub of Activity

At huge storage facilities called grain elevators, corn and other grains are bought from farmers and stored in temperature- and humidity-controlled bins and silos to prevent spoilage.

Have you ever seen a grain elevator? There are many in North Dakota, and they are usually next to railroad tracks. Why do you suppose that is?

The corn is sold to mills or factories for processing. Each step of processing adds more value to the basic raw corn.

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Corn on the Move

Here are the steps of how just one corn product – cornstarch – moves through the production, processing, distribution and consumption cycle. Number these sentences in the order in which they happen. The first and last ones are filled in for you.

- [ ] The trucker delivers cornstarch to the manufacturer who makes biodegradable cups and straws.
- [ ] Your mom purchases biodegradable cups and straws at the store.
- [ ] The farmer harvests the corn.
- [1] The farmer buys corn seed from a seed dealer.
- [ ] The railroad hauls the corn to the cornstarch processor.
- [ ] The farmer sells the corn to the elevator.
- [ ] The elevator stores the corn.
- [ ] The farmer plants the seed.
- [ ] The elevator sells the corn to companies that will process it into cornstarch and other products.
- [ ] A truck picks up paper tableware from the manufacturer and delivers it to stores across the region.
- [12] The elevator sells corn seed to the farmer for a new crop in the spring.
- [ ] You and your friends enjoy lemonade from cups made from a biodegradable, renewable resource.

Where Does U.S. Corn Go?

43% is fed to livestock

35% is made into ethanol

13% is exported to other countries

9% is made into sweeteners and other products

Source: www.worldofcorn.com, 2019

Corn Consumption

Ethanol: A Renewable Energy Source

Use these words to fill in the blanks: gasoline, Ford, pollution, renewable, gallons, dependent, pumps, performance

In 2019, about 14.5 billion 1. _____ of fuel ethanol were consumed in the U.S. For E15 fuel, which is a blend that's 15% ethanol and 85% petroleum-based 2. _____, that would be 967 million 15-gallon gas tanks.

Henry 3. _____ 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. _____, drivers can select their own blends of gas and ethanol.

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

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Career Corner

Jason Strand — Race Car Driver and Farmer, Portland, ND

Not many race cars have ears of corn painted on them, but Jason Strand is proud of his E85 Racing.

Jason's modified race car runs on E85, a fuel blend that's 85% ethanol and 15% petroleum gas. "Ethanol is better for the motor. It gives me more horsepower, makes the engine run cooler and is more efficient," he says. "A couple other drivers run ethanol, but not many. It takes a lot of time and research to figure things out with the fuel – for example, the carburetor is manual instead of electronic and I have to spend a lot of time tuning the engine." But Jason believes the benefits are worth it.

Working on his race car requires using math to figure the weights of the car and the fuel required, and geometry to develop aerodynamic angles for his car. He also uses mechanical skills like welding as he figures out how to fix the car. "I'm always working with numbers," Jason says.

Jason also is proud of E85 Racing since he's a farmer himself. He and his father raise corn, edible beans, soybeans and wheat west of Portland, N.D. They also do custom work for other farmers – seeding (planting) and combining (harvesting) their crops for them.

To help educate the public about the benefits of ethanol, Jason has partnered with the N.D. Corn Utilization Council as a sponsor of his racing since 2008. Jason hopes that every time fans see his E85 car with the ears of corn on it zipping around the track, they'll think about the benefits of using ethanol in their own vehicles.

CRP Photography

Popcorn

Iroquois Indians popped corn in pottery crocks with heated sand.

The colonists may have created the first breakfast cereal when they added sugar and milk to their popped corn.

Popcorn Crunch

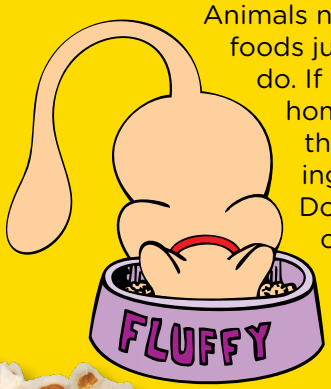
Try This Corn Recipe

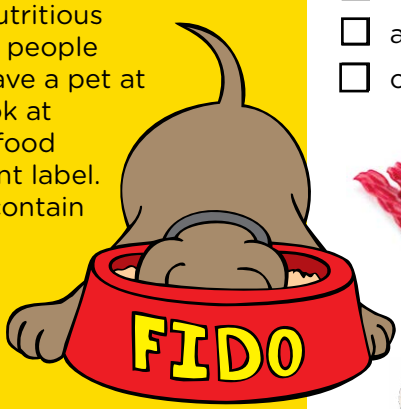
3 quarts popped popcorn
1 cup nuts
1/2 cup butter or margarine
1/2 cup light corn syrup
1 teaspoon vanilla, optional

With an adult's help, preheat oven to 250 degrees F. Place popcorn and nuts in a large ovenproof mixing bowl. Keep warm in oven. Lightly oil a cookie sheet or coat with cooking spray. In a saucepan, melt butter over low heat. Mix in corn syrup until well blended. Stir in vanilla. Remove popcorn mixture from oven. Set oven at 350 degrees F. Pour butter-syrup mixture over popcorn-nut mixture and mix well. Spread in thin layer on cookie sheet. Bake 10 to 15 minutes or until crisp. When cool, break apart and eat. Makes 3 1/4 quarts.

Fido and Fluffy Like Corn, Too

Animals need nutritious foods just like people do. If you have a pet at home, look at the pet food ingredient label. Does it contain corn?





Processed Corn has Many Uses

We consume corn in many different products. Below are all corn products that we use or eat. Check all the corn products that people eat.

- ☐ cereal
- ☐ fructose
- ☐ ethanol
- ☐ tortilla chips
- ☐ plastic bags
- ☐ cornbread
- ☐ livestock feed
- ☐ corn oil
- ☐ licorice
- ☐ batteries
- ☐ cups and straws
- ☐ marshmallows
- ☐ ice cream
- ☐ soft drinks
- ☐ chewing gum
- ☐ road deicer
- ☐ shoe polish
- ☐ packing peanuts
- ☐ engine fuel filters
- ☐ baby diapers
- ☐ antibiotics
- ☐ clothes

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Find the answers to the activities in this Ag Mag and learn more about corn at www.nd.gov/ndda/ag-classroom.

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Living Ag Classroom Now Online

Living Ag Classrooms couldn't be held in person across North Dakota in Spring 2021. However, you can watch videos, download worksheets and learn about North Dakota agriculture in other ways at the **Virtual Living Ag Classroom**.