In the year 1800, there were around one billion people on Earth. Today there are about 7.4 billion people. By the year 2050, it is likely that there will be 9 billion people on Earth! That’s a lot of mouths to feed!

That means we need to grow 60% more food than we do today. Farmers have to do this with the same amount of land. Producing more food isn’t the only challenge. We need to create more jobs and build communities. We need to educate children and keep them healthy. We need to protect the environment. Agriculture plays a big role in solving these problems.

Science has helped farmers to grow more food on less land. Technology allows farmers to farm better. Did you know that farmers use GPS to put fertilizers on specific areas of a field? New engineering systems can help us reuse waste like manure. Did you know that cattle manure can make biogas that can be burned to create electricity? Farmers use math nearly every day too! Math helps them be efficient at producing food. Did you know that farmers figure out how much food each animal gets? This keeps the animals like cows healthy.

Scientists, farmers, and engineers are all involved in making modern agriculture better. They want to sustainably feed the world!

What is Sustainability?

It is important to be sustainable to make a positive future.

Meeting economic needs is one part of sustainability. That means creating jobs and making money in business.

Meeting social needs is a second part of sustainability. That means that all people have access to things like food, education, and health care.

The third part of sustainability is meeting environmental needs. Environmental needs are things like reducing greenhouse gases, protecting wildlife habitats, and having clean water.

Farmers try to consider all of these factors when they produce our food, fiber, and fuel.
All of the plants we eat have nutrients in them. These plants get their nutrients from the soil. Did you know that soil holds things like nutrients, water, and air that helps plants grow?

When we grow lots of plants year after year, the nutrients in the soil can become depleted, or reduced. Farmers are careful to put those nutrients back into the soil. They put nutrients back using fertilizer.

Three of the main nutrients plants need are nitrogen (N), phosphorus (P), and potassium (K). Major nutrients that plants need are called macronutrients. Farmers will apply them in very specific amounts. They want their plants to have enough nutrients, but not too much.

Giving Back

Food! Glorious Food!

Fits Like a Glove

Food packaging makes up almost 25% of the waste in the United States. That is almost 39 million tons of garbage per year. We can help reduce this waste. Individual food packets like ketchup are part of the problem. Instead, use the bulk condiment dispenser for your next hamburger!

Fifty years ago most meat, including beef and chicken, was bought in large cuts. Most people didn’t know how to use all of it. They threw the fat, bones, and some of the meat away. Modern packaging of meat has reduced waste. Cuts of meat are now the right size for consumers. Meat is then packaged in containers that reduce waste.

Many food packages are now being made out of biodegradable material. This material – including plastics – breaks down naturally. They are better for the environment.

Sorting Out the Bad Apples

Ever wonder how good, delicious, ripe fruit is separated from the bad? When you buy a pint of blueberries they are all the same size. They are all ripe but not too ripe.

There is a lot of technology used in sorting food. Most companies use an electronic ‘eye’ to sort fruit. The eye can sort fruit by color. This means that unripe fruit doesn’t get through. The machine can sort fruit by size and weight. That way all fruit is the same size. The machine can even sort fruit by softness. That means that over ripe berries that are too soft or moldy berries don’t get through.

Making the Grade

More eggs are produced in Iowa than in any other state! Having high quality eggs is important. Egg quality is determined by the size of the egg and the quality of the shell. The yolk and the white also are graded. Eggs are graded AA, A, or B.

Eggs are first candled. The eggs are passed by a light so you can see through the shell. The yolk should be round and in the middle of the egg.

The egg shell can’t have any cracks. A tiny probe tape the egg up to 16 times. This produces a sonic sound. If there is a crack, the little hammer will make a ‘thud’ sound. If the shell is perfect, the machine will make a high pitched sound.

This is all done by machines. It took a lot of innovation for humans to come up with this technology.

It’s Our Duty

Manure is rich in nutrients, primarily nitrogen. Farmers can test their fields to see the nutrient levels in the soil. They can also test the manure for nutrient levels. They can then calculate the right amount of manure to apply to their land.

Farmers also pay attention to how they apply the manure to their land. They don’t want nutrients to wash away when it rains. Because of this, many farmers will inject the manure into the soil. They do this close to planting time. This helps the seed get nutrients when they need it. It also helps prevent runoff.

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<th>CAREER CORNER</th>
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<tr>
<td>Marty Haverly is a research assistant at Iowa State University. Marty does research to find bio-renewable replacements for crude oil. This is important to farmers. Crops grown by farmers can become energy. Renewable energy can make our world more sustainable! Marty is good at problem solving and science. If you like research and engineering, this could be a career for you!</td>
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Diving Deeper

Apples and many other fruits can be reproduced by grafting. One tree could produce dozens of different types of apples! So, what is grafting?
Native Americans were the first people in Iowa to grow corn. They prepared the soil, planted, weeded, harvested, and ground the corn by hand. They used tools made from rocks, bones, and sticks. As time went on farmers created hand-powered machines and tools to make planting, and harvesting easier.

Can you identify what task each of the tools below may have been used for?

1. Can you find something that made the job of picking and husking ears of corn easier?
2. What tool could be used to cut down whole corn stalks?
3. Removing corn kernels from the cob was hard work. What tool could help in this job?

Today’s farmers use combines to harvest corn. This one machine does the job of a corn knife, corn husking hook, and corn sheller.

At the front of a combine is the head. Farmers switch heads to harvest different crops. A corn head has points that go between the rows of corn. As the combine moves through the field, the head cuts the corn stalks down and removes the ears. Spinning parts then move the ears of corn to the center of the head. The feeder takes the ears inside the combine.

In the threshing area, the ears are pushed against a spinning cylinder. The corn kernels fall off the cob. The corn falls through holes in large sieves and is moved into the grain tank. When the grain tank is full, the auger takes the corn out to a wagon or truck.

The husks and cob (chaff) do not fit through the holes in the sieves. A spinning spreader throws the chaff out behind the machine onto the field.

Did you know?

In the early 1900’s, farmers could harvest about one acre of corn per day. They picked the corn by hand and hauled it from the field with horses and wagons. Today, farmers can harvest more than 100 acres of corn per day. They use combines and haul it out of the field with trucks.

Did you know?

Fields are measured in acres. An acre is about the size of a football field. Harvested corn is measured in bushels. A bushel is about the size of a small laundry basket.
Have you ever wondered why your hair is that color? Or why you’re that tall? It has to do with genetics.

Your body is made up of tiny cells. Each cell has long strands of DNA. That DNA codes all of the things that make you, you. DNA controls things like your hair color, your height, and your skin tone! These things are called traits.

Your DNA is extra cool, because it’s half from your mom, and half from your dad. No one else (except an identical twin) has the same DNA as you!

The same thing happens with plants and other animals. Scientists look for traits that make plants and animals that grow healthy and strong.

For thousands of years, farmers have selected seeds from their best plants to re-plant the next year. Then in the 1930s, hybrids became popular. Hybrids are two different varieties of the same crop that are crossed together. This makes a better, stronger plant! This is also called cross breeding, or artificial selection.

Today, scientists have learned to do more than cross breeding. They can use good parts of DNA to help solve problems that plants have. All living things have DNA made from the same material. This makes transgenic organisms, or organisms with DNA from two species, possible.

One of a Kind

When your grandparents were young, they got up to change the channel on the TV. They washed cars by hand. Technology makes these tasks much easier today. Technology is on farms too! Robots feed dairy cows. Tractors steer themselves. Computers even mix chemicals and animal feed with machines. Visit a farm and you will find technology everywhere!

Only the Best

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Robot Farmers?

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Dairy Droids

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Techie Turkey Farms

Thanks to robots, dairy farming is becoming less time consuming. Robotic milking machines milk cows without the farmer present. At a robotic dairy, cows decide when they want to be milked. As a cow enters the milking parlor a sensor reads an ID tag on its collar. An automated system cleans her teats and attaches the milking cups. She is given a special snack to eat while the robot works. The system automatically stops when she is out of milk. Some dairies use robots to feed cows when they aren’t being milked too.
As the Earth’s population continues to grow, do you think more or less land will be available to raise crops and livestock? That’s why it’s important for farmers and agriculturalists to be innovative. We need to find the best ways to raise more food on less land while caring for our natural resources.

One way farmers save land and protect water is by raising livestock inside. Farmers can do this by using monoslope or hoop buildings. Monoslope buildings are large barns with a slanted roof and walls on two sides. They are designed to create a nice breeze for the cattle. Hoop buildings look like a tunnel. Many farmers use them to raise animals like pigs and cattle.

Raising animals inside doesn’t just save land and water. It is also easier for farmers to care for them. The animals are protected from predators when they are inside. Farmers can feed them easily, clean their pens, and control extreme temperatures. It is also easier to find and help sick animals.

Have you ever seen a plant that was eaten by a bug? Did you know scientists have found solutions to problems like that using genetic engineering? Scientists have solved issues like plant disease because of genetic engineering, too.

Farmers care a lot about how healthy their plants are. Sometimes, bugs can eat their plants. This can cause the plants to die. Farmers can spray insecticides to kill the bugs, but that can be expensive and harmful for people.

But scientists found a tiny bacterium in soil that solved the farmers’ problem! This bacterium has a gene that kills specific kinds of bugs. Scientists found a way to take that gene out, and put it in plant DNA. This helps keep the plants safe without spraying extra insecticides.

This technology can now be used in many kinds of plants. Corn farmers, soybean farmers, and even cotton farmers use it to grow healthy crops.