

7 PILLARS

of AGRICULTURAL LITERACY

Understanding the intersection between agriculture and society.

	The Relationship Between Agriculture and the Environment		The Relationship Between Agriculture and Animals		The Relationship Between Agriculture and Lifestyle		The Connection Between Agriculture and Technology		The Relationship Between Agriculture and the Economy
Land and Water Stewardship Family Responsibility Environmental Decision-making	Food Safety Inspection Energy Sources Shared Values Ethics Production Methods	Animal Welfare Animal Safety Animal Housing Systems	Food Cost Nutrition Processing Healthy Living	New Developments Impact of Technology Biotechnology Environmental Impact	Careers Impact on US Economy Hunger Role in Global Economy				

FOUNDATIONAL KNOWLEDGE

Definition of Agriculture | History | Taxonomy | Identification | Production Awareness

Common Questions About Agriculture—Answered!

Questions by Pillar

The Relationship Between Agriculture and the Environment

Do farmers waste water?

Water is necessary to grow plants that provide food, fiber and shelter for the world. Agriculture production in the U.S. accounts for approximately 80% of the nation’s “consumptive water use.”ⁱ “Consumptive water use” is the term that describes water used and not returned to the original source. However, when we use water in our home, or when an industry like agriculture uses water, about 90 percent of the water used is eventually returned to the environment where it replenishes water sources and can be used for other purposes. But of the water used for irrigation, only about one-half is reusable. The rest is lost by evaporation into the air, evapotranspiration from plants, or is lost in transit.ⁱⁱ While agriculture requires significant water to grow crops and raise animals, unused water returns to the ecosystem. Farmers are focused on conserving water for several reasons: 1) Farmers know water wasted could mean a lack of the resource for future crops. 2) Water is expensive. Water wasted is money lost. 3) Farmers are cultivators. They use precise technology to know exactly how much water a plant needs to grow. Too much could mean poor production. 4) Many farmers rely on Mother Nature for water.ⁱⁱⁱ

Do farmers use more pesticides and fertilizers when they use GM (genetically modified) seeds?

Using GM seeds that are selected for the right environment can actually decrease the amount of pesticides a farmer must use. Let’s take a look at what’s going on in the industry today. One of the most common GM varieties is called Bt seed — it allows a crop to release a protein from the bacterium *Bacillus thuringiensis* (Bt) that acts as a natural pesticide to certain insects. Use of pesticides with Bt crops has drastically decreased. Another common GM variety enables a plant to resist the herbicide glyphosate. For example, Roundup® is a common glyphosate product. Roundup® Ready Corn, a GM product, can still grow when Roundup® is applied. For these crops, herbicide use has increased because farmers can apply the herbicide on all of their land. glyphosate, however, is one of the mildest herbicides. It has toxicity 25 times less than caffeine. The ability to use glyphosate more frequently has enabled farmers to decrease use of more toxic herbicides. In the last 20 years, the use of GM seeds has reduced pesticide spraying by 8.1%. Because of this, the environmental impact associated with pesticide use on biotech crops has decreased by more than 18%.^{iv} Learn more with the Food Evolution documentary!^v

Do cows cause global warming?

Environmental Protection Agency (EPA) reports indicate that cattle production is not a top contributor to greenhouse gasses. The agriculture industry accounts for 9% of total U.S. greenhouse gas emissions.^{vi} For comparison, transportation accounts for 28%, and electricity generation accounts for 28% of total U.S. greenhouse gas emissions. Advances in the industry helped American farmers and ranchers reduce their carbon footprint. Methane emissions from U.S. beef cattle have declined 34% since 1975.^{vii}

Can the world support more vegetarians than meat eaters?

Unfortunately, the answer is not as simple as a mere calculation. The United States uses more than one-third of its land for pasture.^{viii} For more than 100 million people in arid regions, grazing livestock is their only source

of livelihood. Half of the land area in the U.S. cannot be used for growing crops and is used as grazing land instead. If cattle, sheep and goats were not grazed on this land, it would be of no use for food production.

Does it require more inputs (e.g., labor, seeds, etc.) to produce food today compared to the past?

U.S. farmers and ranchers are actually producing more with less. For example, total U.S. corn yield (tons per acre) has increased more than 360% since 1950.^{ix} Globally, this statistic varies drastically with direct correlation to advancements in mechanical and biological technology available.

Do farmers use more or less land now, compared to the past?

In the U.S., an estimated 14.3 million acres of farmland has diminished between 2012-2017.^x According to the USDA, there was a 1 million acre decline in just one year.^{xi} This is caused in part by growing urban areas and by increased technology that allows more food to be grown on less land. Globally, however, total farmland acreage continues to increase as developing nations strive to feed a rapidly growing population. Nations with less technology must use more land to produce the food they need.

Is buying organic food better for the environment than buying food produced conventionally?

Ultimately, environmental sustainability comes down to the farmer, whether they produce goods organically or conventionally. Good farmers manage erosion, water use, control runoff and work to replenish the nutrients of the soil. There are many factors that affect environmental impact. Let's look at land use and transportation. An article published in the journal *Nature* by researchers from Canada's McGill University and the University of Minnesota found that, on the whole, organic production produces 25% less food on the same land as conventional production.^{xii} This is an average, however, and some organically produced crops are comparable in productivity to conventionally produced crops. Transporting products also impacts the environment. All goods must be transported from the farm to a retailer, and often many stops in between. An organic or conventional farmer across the country may have a very sustainable farm but transporting their goods to you can have an impact on the environment.^{xiii}

How does farming and ranching impact wildlife habitat?

All people have the opportunity to harm or improve wildlife habitat. Farmers and ranchers value wildlife conservation and are working hard to improve habitat, while providing food, fiber and fuel to a growing population. In 2016, farmers, ranchers and other landowners have enrolled almost 24 million acres in the Conservation Reserve Program to protect the environment and provide habitat for wildlife.^{xiv} Since the program started, more than 2 million acres of wetlands have been restored.^{xv}

Does human activity cause all soil erosion?

Soil erosion happens naturally, whether or not humans are present. Water, weather and animals impact erosion as well. The Grand Canyon is a great example of natural erosion caused by water! Human activity can increase or decrease soil erosion. Farmers and ranchers know the importance of soil. Topsoil contains important nutrients that allow crops to grow. To prevent erosion, many farmers use conservation practices like planting cover crops in the winter or using conservation tillage practices. Conservation tillage was used on roughly 70% of soybean (2012), 65% of corn (2016), 67% of wheat (2017), and 40% of cotton (2015) acres.^{xvi}

Is our food supply safe in the U.S.?

Yes. American farmers and ranchers are the starting point in our nation's food chain, which produces the safest food supply in the world. The U.S. Department of Agriculture (USDA) and the U.S. Department of Health and Human Services (HHS) are home to the primary federal food safety agencies. HHS is home to the Food and Drug Administration (FDA) and the Centers for Disease Control (CDC). The Food Safety and Inspection Service (FSIS) is housed at USDA. FSIS is "responsible for ensuring that the nation's commercial supply of meat, poultry and egg products is safe, wholesome and correctly labeled and packaged." The FDA focuses on both fresh and processed food products. In addition to the federal agencies, many states have their food safety agencies and laws that govern the production of safe and wholesome foods within their respective states. The CDC's role is to prevent "illness, disability and death due to domestic and imported foodborne diseases." The CDC typically becomes involved when a food safety concern or outbreak has arisen.^{xvii}

Where does energy come from?

Energy is like food — we need it every day, but we don't often think about where it comes from or what it takes to produce it. To keep the lights on (and other important functions) every day, we can't depend on one single source of energy. In fact, energy used to make electricity in the U.S. comes from a variety of sources. Fossil fuels account for 81% of electricity, with natural gas and coal producing 61.8%. Natural Gas produces 31.7% of our electricity, and nuclear power produces 18%. Hydropower is responsible for only 7.5%, followed by other renewables including biomass, geothermal, solar and wind. Solar electricity is a rising trend; however, it only produces 1.3% of our electricity.^{xviii} An article by Direct Energy summed it up well, "The diversity of the United States' production of electricity mirrors its diversity as a nation."^{xix} The United States depends on a variety of resources to provide energy. When the sun is not shining, we don't get much electricity from solar energy. When the wind is not blowing, wind energy is minimal. Balance provides consistent energy availability.

Who is responsible for food safety?

Farmers and ranchers take food safety seriously. The food they raise is subject to extensive food safety regulations and inspections, and technology allows food to be traced back to the farm that produced it. Farmers and ranchers have a vested interest in food safety — the food they produce is not only for consumers, it is for their family. The incidence of foodborne illness has dropped dramatically in the last 100 years. While food safety starts on the farm, it does not end there. The companies that process agricultural commodities into food take care to ensure their products are safe. We must also do our part at home and at school to prevent foodborne illness. Here are a few important tips: cook foods to proper temperatures, use separate cutting boards for uncooked meat and ready-to-eat foods, store leftover food in shallow containers and refrigerate within two hours.^{xx}

Is natural and organic the same thing?

Natural and organic are not interchangeable terms. According to the Food Marketing Institute, "the term natural applies broadly to foods that are minimally processed and free of synthetic preservatives." According to the USDA, "Organic is a labeling term that indicates that the food or other agricultural product has been produced through approved methods that integrate cultural, biological and mechanical practices that foster cycling of resources, promote biological balance and conserve biodiversity." Organic processors go through a strict regulated certification process that involves reporting on how products are produced, processed and distributed. While the term "natural" is only vaguely defined, usually by the company producing the product, the term "organic" is clearly defined and subject to stringent federal regulations regarding its use.^{xxi}

Do farmers have higher than average rates of cancer because they apply chemical pesticides?

Farmers actually have lower overall cancer rates than the general population. The National Cancer Institute conducted an “Agricultural Health Study.” The study began in 1993 and continued through 2011. The study concluded that farmers in many countries, including the U.S., have “lower overall death rates and cancer rates than the general population.” This is due primarily to lower smoking rates among farmers and a very active lifestyle. The research also showed, however, that rates for certain types of cancer are higher in agricultural workers. Leukemia, Non-Hodgkin lymphoma and skin cancer are some examples. Research has not been conclusive on the cause of this increased rate, however, there is cause to believe that an increased exposure of UV rays as well as environmental elements may be the cause of an increase in skin cancer among farmers.^{xxii}

Are natural pesticides less toxic than synthetic pesticides?

This general statement is a common misconception. Several naturally occurring pesticides are highly toxic, even carcinogenic. Copper sulfate is highly toxic and shown to cause liver disease. Rotenone is a plant extract found in some species within the pea family. It has received significant attention because of studies indicating a potential link to Parkinson’s disease. All pesticides, natural or synthetic, are reviewed and regulated by the Environmental Protection Agency (EPA).^{xxiii}

Does organic production use pesticides or synthetic fertilizers?

Synthetic fertilizers are not allowed in certified organic products, but select pesticides are allowed. The USDA National Organic Program (NOP) oversees organic certification. Organic producers must follow a strict process for production and processing of products. But organic does not mean “without pesticides.” Natural pesticides and synthetic pesticides are allowed in some cases. The NOP requirements provide a list of synthetic substances that may be used in organic production as long as these do not contaminate crops, soil or water. Chlorine and hydrogen peroxide are examples of some allowable synthetic substances allowed in organic production.^{xxiv}

What does a “natural” label mean?

According to the U.S. Food and Drug Administration (FDA), “FDA has not developed a definition for use of the term natural. However, the agency has not objected to the use of the term if the good does not contain added color, artificial flavors or synthetic substances.” There are many naturally occurring toxins and carcinogens. Nicotine, opium, heroin, morphine and cocaine all come from plant sources. Arsenic, radon, lead and strychnine are all natural. The term “natural” should not be considered a label to help the consumer make a decision.

The Relationship Between Agriculture and Animals

What is the goal of antibiotic use in livestock?

The Food and Drug Administration has approved antibiotics of responsible use in food animals to treat disease in animals that are sick, control disease for a group of animals when some of the animals are sick and to prevent disease in animals that are at risk for becoming sick.^{xxv} Ranchers give antibiotics according to the instructions on the label and under the direction of a veterinarian. They don’t like to use antibiotics unless it is absolutely necessary, because antibiotics are expensive, and they take time to administer.

Is beef a healthy protein option?

Some cuts of beef can be as lean as a 3-oz. skinless chicken thigh. A 3-oz. serving of beef provides 10 essential nutrients including vitamins B6 and B12 and about half the daily requirement of protein. The National Institute of Health states that B6 is related to metabolism and immune function as well as brain development during pregnancy. B12 helps blood cell and DNA development. Interestingly, no plants have naturally occurring B12.

Are ponies young horses?

A young horse is known as a foal. Horses come in many different breeds, including those classified as ponies. Ponies are small breeds of horses that, because of their size, appear much smaller when fully grown than larger breeds of horses. A horse's height is measured in hands from the ground to the withers (the area on top of a horse between its neck and back). A hand represents 4 inches. The term horse is generally applied to one that is 14.2 hands (4 feet, 9 inches) or taller. A mature horse shorter than 14 hands is considered a pony by the industry.

What is animal welfare?

Animal welfare refers to the conditions in which an animal is raised. Animal welfare is important to ranchers because animals that are properly cared for will be healthier and more productive. According to the Animal Agriculture Alliance, "Producers take their ethical obligation to providing the best quality care to their animals very seriously."^{xxvi} This Alliance has defined a list of Animal Care Principles for producers that includes "access to food and water, health and veterinary care, appropriate environmental and living conditions, implementing science-based husbandry practices, using proper handling practices and providing comfortable and sanitary transportation to avoid stress."

Do ranchers harm the environment by grazing animals?

When properly managed, grazing animals can help the environment. "America's farmers and ranchers are considered everyday environmentalists," shares the Cattlemen's Beef Board. Ranchers work with the environment by practicing rotational grazing, using innovative technologies to produce more product with fewer natural resources and partnering with environmental agencies to monitor and improve the environment. Allan Savory of the Savory Institute shares that, "Instead of fearing overgrazing and taking livestock off land to rest it, most grazing lands should have more livestock added because their movement and their waste and their relentless chomping stimulate grasses to grow." "When grasslands restore themselves," he adds, "they sequester carbon; so, increasing the density of cattle and other grazing animals not only restores the environment, it protects against climate change."^{xxvii}

How many pounds of grain does it take to produce 1 pound of beef?

In the 1960s, information from the USDA was misinterpreted, leading people to believe it took 16 pounds of grain to produce 1 pound of beef. In reality, it takes 2.5 pounds of grain to produce 1 pound of beef we eat in the United States. For the first six to eight months of a calf's life it is primarily consuming mother's milk with a nibble of grass and hay to stimulate their rumen development. An average calf is 600 pounds before it begins to eat grain. 50-70% of a beef animal's feedlot diet is forages and feed that humans can't eat. These factors all contribute to the fact that it takes on average a mere 2.5 pounds of grain to produce 1 pound of delicious beef!^{xxviii}

Do brown cows produce chocolate milk?

No. All cows produce white milk. There are a number of breeds of dairy cattle — Holstein, Jersey, Brown Swiss, Ayrshire, Guernsey and Milking Shorthorn to name a few — none of which produce chocolate milk. Chocolate

milk is man-made. Chocolate, from the tropical cacao tree, is mixed along with sugar into the white milk cows produce to create chocolate milk.

Are beef animals consuming grain that could be used to feed humans?

If we take into consideration the entire lifetime feed intake of cattle, only 7% of their diet is made up of grain. The other 93% of the animal's lifetime diet will consist largely of feed that is inedible to humans.^{xxxix} For every 0.6 pounds of human edible protein cattle consume, there is a return of 1 pound of human edible protein in the form of beef. And 86% of what livestock eat globally is not in competition with human food.^{xxx} Cattle are ruminant animals, meaning they have a four-chambered stomach. This unique stomach system is found in other farm animals like sheep and goats. These animals have the ability to graze pastures and eat forages that humans and other animals with non-ruminant stomachs cannot digest due to the fiber content. Cattle diets also consist of feed that has been converted from grain milling and processing waste. Cattle are able to convert this into a high-quality protein for their diets.

Could more people be fed if crop land was used for food for human consumption instead of livestock or livestock feed?

Animal agriculture plays an important role in feeding the growing population. Although it may appear that land used for livestock and livestock feed should be used for human food consumption, much of this land is not suitable for growing human food crops. 86% of what livestock eat globally is not in competition with human food.^{xxxi} Many acres used for livestock grazing are made up of forages that can only be eaten by ruminant animals, like cattle, and converted to products for humans to eat. Additionally, animal agriculture provides the components humans need for a well-balanced, healthy diet and contribute a number of by-products including leather, ointments and creams for burns, insulin, paint brushes and sports equipment to name a few.

The Relationship Between Agriculture And Lifestyle

Will we need more farmers to feed the growing population?

There are two issues to break down in this question. First, by 2050 there will be nearly 10 billion people on Earth. This is about 3 billion more mouths to feed than there were in 2010.^{xxxii} But this does not automatically mean we will need more farmers. Technology will play a key role in increasing efficiency to meet the rising food demand. However, it is important to note that America's population of farmers and ranchers is aging. The median age of farmers is 57.5 years which means the U.S. will need to train a new generation of farmers and ranchers to fill the gaps left by those retiring in the next 20 years.

Is high fructose corn syrup the cause of obesity in the U.S.?

High fructose corn syrup (HFCS) is a common sweetener in sodas and drinks. Recently, it has come under fire for impacting obesity, but research suggests that there is no significant difference between HFCS and other sweeteners. Researchers are confident, however, that too much sugar of any kind in a diet can lead to obesity. The American Heart Association recommends no more than 100 calories a day of added sugar for women and 150 calories for men. That's equal to about 6 tsp of sugar for women, and 9 tsp for men.^{xxxiii}

Is agriculture a necessary industry?

Agriculture is a necessity! It creates jobs, helps our economy and provides our basic necessities — food, fiber (like cotton and wool) and shelter (like lumber for homes). By 2050, there will be nearly 10 billion people on Earth. This is about 3 billion more mouths to feed than there were in 2010.^{xxxiv} Increasing food production today while preserving tomorrow's resources will be necessary to meet the needs of our growing population and

demands creativity and innovation.^{xxxv} Farmers of all ages face this challenge and must continue to be advocates for the importance of agriculture and the need for the industry in the future.

Can I eat healthy without spending a lot of money?

Yes. Food in the United States is very affordable. We only spend an average of 10% of our household income on food compared to 30% in India and 53% in Kenya.^{xxxvi} According to the USDA Center for Nutrition Policy, a family of four on a thrifty meal plan can eat at home for about \$130 a week.^{xxxvii} American farmers work hard to provide consumers safe, healthy and wholesome food at these affordable prices. Additionally, consumers can follow tips from www.choosemyplate.gov about healthy eating on a budget.^{xxxviii} These include creating a game plan before grocery shopping, learning to correctly read food labels and researching budget-conscious meals.

Where does our food come from?

According to the USDA Economic Research Service, “In 2016, 87.3% of food and beverage purchases by U.S. consumers, including both grocery store and eating out purchases, were from domestic production. The remaining 12.7% were imported food and beverages such as produce from Chile or wines from France.”^{xxxix} The process of getting food from the farm to the table is called the Food Supply Continuum. This continuum encompasses a number of steps in three main phases: pre-harvest, harvest and postharvest. Included in pre-harvest is the producer or farmer, transportation of the product, and marketing of the product. The harvest phase includes harvesting the meat, fruit, vegetable or food product and processing it into a usable form. The final stage is postharvest, encompassing retailing the product, distributing the product through the food service industry and, finally, reaching the consumer.

What does the label on my egg carton mean?

Here are some common labels:

- Omega-3 Enriched: Ingredients like flaxseed and fish oils are added to hen’s diets to increase omega-3 content.
- Organic: Hens are not in cages and are raised according to the USDA’s National Organic Program guidelines
- Free-range: Hens are raised with access to the outdoors.
- Cage-free: Hens are allowed to roam in open areas

But don’t be confused by the jargon. While an enriched egg may have additional nutrients like omega-3 fatty acid, these eggs still have the same calories, protein and total fat of conventional eggs. When it comes to production method, research suggests the diet of the hens is more important than where they live. Each production system has pros and cons. In order to maintain the egg production needed for the national and global demand, and keep egg prices low, layer houses with conventional cage systems are needed in the egg production process.

Is buying local and organic the same thing?

No. Local is a definition based on location. The Congressional Research Service defined locally grown as “being transported less than 400 miles, or from within the state in which it is produced^{xl},” but retailers, states, farmer’s markets and others can come up with their own definition. Organic is a definition based on production method. According to the United States Department of Agriculture, organic farms follow a set of standards outlined in the Organic Foods Production Act. Products are held to these standards all the way from farm-to-table and are subject to regular on-site inspections. Want to find out more about the National Organic Program? Visit www.ams.usda.gov/AMSV1.0/nop.

Are fresh, raw vegetables healthier and more nutritious than frozen vegetables?

Not necessarily. Research shows that frozen vegetables can even be more nutritious than fresh vegetables! There are two reasons why. First, frozen vegetables are often left to ripen longer than fresh vegetables. As they ripen and mature, they become full of vitamins, minerals and antioxidants. Second, vegetables begin to lose their nutritional value as soon as they are harvested. Freezing slows this process. Scientists conducted a test on frozen and fresh vegetables. They found that vitamin C in fresh broccoli dropped by more than 50% within one week, but in frozen broccoli it dropped by only 10%.^{xli} Those only eating fresh, raw vegetables may be missing out on the full nutritional benefit of eating vegetables from a variety of sources.

Is global hunger caused by a shortage of food?

Not necessarily. In many cases, hunger is not caused by a shortage of food. In fact, the world produces enough food to feed everyone. In most cases, hunger is caused by poverty.^{xlii} Poverty results in the inability to purchase food, safely store food or transport food from where it is grown to where it is needed.^{xliii}

If it says locally grown, does that mean it is from my community?

Not necessarily. This may come as a surprise, but if you're buying or eating locally grown food, it may not be food grown in your community. There is no set determination for the definition of locally grown. Locally grown products may have been grown at a local farm just up the road, in the same county as your farmers market or, possibly, even within the same state. However, in other cases, locally grown may come from 250, 400 or even 1000 miles away from the spot of sale. The Food, Conservation and Energy Act of 2008 defines locally grown as "being transported less than 400 miles, or from within the state in which it is produced."^{xliv} But retailers, states, farmer's markets and other organizations may use their own definition. Want to know where your food comes from? Read the label or ask your local grocer.^{xlv}

The Relationship Between Agriculture and Technology

What are genetically modified organisms (GMOs)?

According to the World Health Organization, GMOs are defined as "organisms in which the genetic material (DNA) has been altered in a way that does not occur naturally." The USDA's National Institute of Food and Agriculture defines plant biotechnology as "a set of techniques used to adapt plants for specific needs or opportunities."^{xlvi} Genetic modification happens in nature just not consistently. GMOs are the product of consistent modification by scientists.^{xlvii}

What is gene editing? How is it different from genetic engineering?

Gene editing allows scientists to make changes to a specific target sequence of DNA within a gene. It modifies the gene in a precise and predictable manner.^{xlviii} Gene editing tools provide a great deal of flexibility in the kinds of genetic changes that can be made. Changes that can be made include simple edits to, or deletions of, one or a few targeted letters in the genetic code. The tools can also be used to insert much longer genetic sequences from the same species or another one — similar to what can be done with older transgenic technologies. The key difference is that these edits and insertions can be made at very precise locations in the plant's genome.^{xlix} Gene editing is more precise than genetic engineering, and technology keeps getting more reliable. It's also relatively cost-effective compared to other methods, meaning more scientists could gain access to it. All of these advantages mean more potential innovation.^l

What is the difference between cloning and genetic modification (GM)?

Genetic modification and cloning are not the same. Cloning provides an exact copy. Cloned genes can only be copied in the same species. Genetic modification (genetic engineering) something scientists do to pick out a specific set of genes and place these genes in an organism where the traits would be helpful. This can happen across species. Take corn, for example. No one likes pests eating their corn. So, scientists found a naturally occurring bacteria called Bt. This bacteria usually lives in the soil, but scientists were able to extract the gene that kills insects from this bacteria. By adding this gene to a corn plant, it can naturally fend off pests.ⁱⁱ

Can farmers save and replant GMO seeds?

GMO seeds, like any others, can be saved and replanted. This misconception is a result of so-called 'terminator genes' that were researched in the 1900s to make seeds sterile, but they never made it into production. However, when farmers purchase GMO seed, they enter into contracts with seed companies and sign an agreement to purchase new seed each year and not save seed from their crops to plant the following year. This is a result of two factors, neither of which is related to the ability of the harvested GMO variety to sprout if planted. First, the contract's provisions are binding and represent a business decision on the part of the farmer and the seed company's desire to protect their variety and, certainly, to encourage future sales. Second, most commercial growers don't save seed because the generation of harvested seeds will not uniformly contain all of the desired genetic traits of the original seed.

Can eating a genetically modified fruit or vegetable change a person's genes?

Eating GMO products does not impact our genes. Our bodies digest the proteins and absorb the amino acids in food. The body cannot tell where a protein comes from and treats all proteins alike. This misconception may stem from the issue of allergic reactions. When a gene from one organism is transferred to another, there is a chance that a person could have an allergic reaction to the gene that was placed in the new organism. The World Health Organization explains that the "transfer of genes from commonly allergenic foods is discouraged."ⁱⁱⁱ They clarify that there have been no allergic effects found related to GM foods in general.

Are genetically modified organisms (GMOs) the only organisms with genes?

No. Living or once living things contain genes, whether they are genetically modified or not. "Gene" is the root word for genetics. Genes are located on chromosomes. They control the traits of an organism such as height, productivity, drought tolerance or pest resistance.

What kind of technology do farmers use in the field to help the environment?

GPS (global positioning systems) is a common technology used by farmers. With GPS, farmers can track every location on the farm and know what the soil needs at that exact location. Soil moisture meters and crop sensors are also trending technology that helps farmers more efficiently dial in the inputs they must use, like water and fertilizer, to grow crops. Sensors placed directly in the field can send information to a farm office showing how much water is in the soil and what the nutrient level is for key nutrients like Nitrogen. This technology can also communicate in real time with tractors and other equipment so that each area of a field gets just the right amount of water or fertilizer applied.

How is technology in agriculture changing?

Tractor technology is changing! Auto-steer and GPS (global positioning systems) help make farming more efficient. Tractor technology is also helping the environment. Manufacturers have developed “tier 4 engines” that are practically smokeless. They get better fuel efficiency and clean exhaust! Some tractor manufacturers are even testing out autonomous tractors. These are tractors that drive without a human being in the driver’s seat! As horsepower increases in tractors, the size of equipment goes up. This can have negative effects on soil compaction. Autonomous tractors would be smaller, more efficient and able to run around the clock. It’s too early to tell about if or when the widespread adoption of autonomous tractors will happen, but it is exciting to think that new tractor technology could improve efficiency, reduce soil compaction and help alleviate the stresses of a dwindling ag workforce...while still planting and harvesting food for the world!^{liii}

What is RFID technology?

Radio frequency identification (RFID) is a technology that has been used to identify and track livestock animals. You’ll find RFID in action on dairy farms for example, where cows often have high-tech collars that help the farmer track how much the cow is eating and how much milk she is producing. Researchers suggest that this “tagging technology” could be expanded to crops, so that an individual crop could be traced more efficiently from the farm to the table, using a simple computer chip. RFID has already made it into the hay-baling market where farmers use the technology to track large bales of hay and keep track of important characteristics such as weight and moisture level.

The Relationship Between Agriculture and the Economy

Is the primary focus of the USDA agricultural programs?

Farm and commodity programs equal only 18% of the 2018 USDA budget. Conservation and forestry accounts for 7% of the total USDA budget. Rural development, research, food safety, marketing and regulatory, and departmental management accounts for 6% of the budget. The primary focus of the USDA’s budget lies with the food assistance and nutrition programs. These account for nearly 69% of the budget.^{liv} These programs include the Supplemental Nutrition Program or SNAP (formerly known as Food Stamps); Women, Infants and Children or WIC; and school lunch/breakfast programs. USDA also has many programs that provide benefits to all Americans, ranging from environmental enhancement through its conservation and forestry programs to assisting rural communities provide critical services such as water, sewer treatment, electricity and telecommunications as well as building schools, churches and rural businesses through its rural development programs.

Does the United States import more agricultural products than we export?

Agriculture has a positive trade balance, which means we send out (export) more than we bring in (import). In 2019, the United States agriculture exports accounted for \$135.54 billion with soybeans, beef, veal, pork, poultry and fresh and processed fruits and veggies topping the list.^{lv} In 2019, the United States ag exports account for \$128.718 billion with soybeans, beef, veal, pork, poultry and fresh and processed fruits and veggies topping the list.^{lvi} United States agriculture imports total \$127.6 billion with coffee and cocoa, fresh and processed vegetables, and grains and feeds accounting for the majority.^{lvii}

Do agricultural exports help the economy?

According to the USDA Economic Research Service, \$140.5 billion worth of American agricultural products were exported around the globe in 2017. China and Canada are the largest trading partners of the U.S.; together accounting for 46% of all U.S. agricultural exports.^{lviii} Changes in trade agreements directly affect the amount of

trade between the U.S. and other countries, so it's important that individuals who negotiate these trade agreements understand the impact it has on U.S. farmers and ranchers along with all U.S. consumers.

Is agriculture a luxury or a matter of national security?

American agriculture is a matter of national security. We have made astounding advancements in agriculture since colonial times. During colonial times one farmer fed four others. Today, one farmer produces food for 166 others.^{lix} American agriculture is vital to our country! Consider the impact to not only the United States, but globally, if our food supply was interrupted or contaminated. The 2015 House Agriculture Committee Chairman K. Michael Conaway shared, "Agriculture and national security are intertwined in many different ways — whether it is insuring that food is available to meet nutritional needs for both those within our own borders and those around the world, ensuring that food coming into our borders is disease- and pest-free, or guaranteeing that farmers and ranchers have the needed policy tools in place to continue producing food and fiber."^{lx}

Does my food price go up because farmers want to make more money?

When you see an increase in price at the grocery store, don't assume it's going into the pocket of your local farmers. For the most part, farmers are price takers not price setters. When their crop or animal is ready to sell, they have to sell at the current price. On average, only 15 cents of every retail dollar return to farmers and ranchers.^{lxi} And as food prices increase, the amount of money making its way back to farmers doesn't always correlate. In fact, in many cases farmers and ranchers see an increase on their end in the form of the cost of inputs. These inputs include land, equipment, fertilizer, chemical, seed, buildings and facilities, maintenance, labor, fuel, heating, feed, taxes, insurance and more. And as these expenses continue to rise, farmers and ranchers continually strive to increase their yields and efficiency so they can remain competitive and profitable in the long term.

Does most of the money I pay for food go back to the farmer?

Not necessarily. According to the USDA Economic Research Service, off-farm costs such as marketing, processing, wholesaling, distributing and retailing food products accounted for 85 cents of every retail dollar spent on food in 2019.^{lxii} That leaves an average of only 15 cents returning to farmers and ranchers. Over the years, this number has been on the decline. In 1980, farmers received 31 cents out of every retail dollar spent on food in the United States. And, while this number continues to decline, the farmers' expenses to produce food for our country continues to rise.

If a farm is large, does that mean it is a corporate farm?

Just because a farm is large in number of acres, does not mean it is a corporate farm. Individuals, family partnerships or family corporations own 98% of all U.S. farms and ranches.^{lxiii} Non-family corporations own just 2% of America's farms and ranches. In recent years, some of these family farms have chosen to incorporate to take advantages of taxes, business structure, family home protection, etc.^{lxiv}

Are we losing family farms because corporate farms are taking over American Agriculture?

America's farms are still family farms. Family farms do incorporate for the same reasons that other businesses incorporate — taxes, structure, family home protection, etc. And yes, some family farms are becoming larger to take advantage of efficiencies of scale and to spread out their overhead costs. However, they are still considered family farms. Today, about 98% of U.S. farms are operated by families — whether individuals, family corporations or family partnerships.^{lxv}

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