THE FACTS
about modern agriculture

Research- and science-based
AMMUNITION
to fight misinformation

TENNESSEE FARMERS COOPERATIVE
Provided by: CO-OP

10 SIMPLE ANSWERS to 10 GMO QUESTIONS

most often asked by consumers

10 If livestock eat genetically modified grain, will there be GMOs in the meat?

No. "Genetically engineered DNA, or the novel proteins encoded therein, have never been detected in the milk, meat or eggs derived from animals fed genetically engineered feedstuffs." *Alison Van Eenennaam, Ph.D., Department of Animal Science, University of California, Davis*

09 Are GMOs contributing to the death of bees and butterflies?

No. "GMOs are not contributing to the death of non-pest species of butterflies." *Dominic Reisig, Assistant Professor of Entomology, North Carolina State University*

08 Why are companies against labeling GMO foods?

Because there's no good reason to. "These foods are as safe and nutritious as their non-GMO counterparts as determined by recognized authorities around the world including the American Medical Association, the U.S. National Academy of Science, the World Health Organization and the UN Food and Agriculture Organization." *Cathleen Enright, Ph.D. in biochemistry, executive director of the Council for Biotechnology Information*

07 Are GMOs causing an increase in pesticides?

No, just the opposite. "Planting of *Bt* crops has significantly lowered the use of insecticides in cotton and corn." *Andrew Kniss, associate professor of weed ecology and management, University of Wyoming*

06 Why aren't long-term health studies conducted on GMO plants?

They are. "Biofortified website contains a list of more than 1,000 studies on biotechnology, including long-term feeding studies... FDA scientists do thoroughly review the research conducted by the developers of biotech products and information available in scientific journals. This is the standard process for all regulatory agencies world-wide." *Wendelyn Jones, director, Global Policy and Scientific Affairs, DuPont*

05 Are GMOs contaminating organic food crops?

No. "No organic farmer has ever lost his certification due to inadvertent GMO presence in his crop. There are many ways in which a GM trait can appear in an organic crop other than pollen drift from a nearby neighbor." *Don Cameron, general manager of Terranova Ranch, Fresno, Calif., California Dept of Food and Agriculture*

04 Are GMOs increasing the price of food?

No. "The simple answer to this question is no. Actually, GMOs have contributed to reducing the real cost of food." *Graham Brookes, Agricultural Economist, PG Economics*

03 Are big companies forcing farmers to grow GMOs?

No. "None of the seed companies force farmers to buy any particular product." *Brian Scott, farmer in northwest Indiana*

02 Are GMOs causing an increase in allergies?

No. "No commercially available crops contain allergens that have been created by genetically engineering a seed/plant. And the rigorous testing process ensures that will never happen." *Lisa Katic, R.D., K Consulting*

01 Do GMOs cause cancer?

No. "There is absolutely zero reputable evidence that GMO foods cause cancer." *Kevin Folta, chairman, Horticultural Sciences, University of Florida*

AGRONOMY

CONFUSED ABOUT YOUR FOOD?

YOU'RE NOT ALONE.

46% of moms believe:

"Organic food is healthier."

They're wrong.

A comprehensive review found **no difference** in the health benefits of organic and conventional food. [2][3]

69% of moms believe:

"Most farms are owned by giant, non-family corporations."

Wrong again.

98% of the 2.2 million farms in the U.S. are **family farms**. [2][4]

3 out of 4 moms believe:

"'Organic' means my food is grown without pesticides."

Way wrong.

Organic food is produced without using most conventional pesticides. However, there are more than 50 synthetic **pesticides** that **may be used** in organic crop production if other substances fail to control the target pest. [2][5][6]

AGRONOMY

This is what they're saying.

"By avoiding GMOs, you contribute to the tipping point of consumer rejection, forcing them out of our food supply."

Jeffrey Smith, Founder, Institute for Responsible Technology [7]

"Personally, I believe GM foods must be banned entirely, but labeling is the most efficient way to achieve this. Since 85% of the public will refuse to buy foods they know to be genetically modified, this will effectively eliminate them from the market just the way it was done in Europe."

Dr. Joseph Mercola, Mercola.com [8]

"We are going to force them to label this food. If we have it labeled, then we can organize people not to buy it."

Andrew Kimbrell, Executive Director, Center for Food Safety [9]

"With labeling it (GMOs) will become 0%... For you the label issue is vital, if you get labeling then GMOs are a dead-end."

Vandana Shiva, environmental activist [10]

"The burning question for us all then becomes how—and how quickly—can we move healthy, organic products from a 4.2% market niche, to the dominant force in American food and farming? **The first step is to change our labeling laws.**"

Ronnie Cummins, Director, Organic Consumers Association [11]

THEY HAVE A CLEAR AGENDA. WE HAVE **THE FACTS.**

"I'm going to start with the most politicized issue: Is there any evidence that genetically modified food is directly harmful to people who eat it? There's a one-word answer to this: **no**. If you aren't prepared to take my word for it (especially that particular word), things get a bit more complicated. The most persuasive evidence is that millions of people have been eating genetically modified foods for the past 20 years without any obvious ill effects. If anyone exhibited acute symptoms after eating GM food, we would have seen it."

GRIST Blog, Nathanael Johnson, July 8, 2013 [12]

The National Academies, the American Medical Association, the World Health Organization, the Royal Society and the European Commission are all on the same side. Although it's impossible to prove anything absolutely safe, and all of those groups warn that vigilance on GMOs and health is vital, they all agree that there's **no evidence** that it's dangerous to eat genetically modified foods. Even the Center for Science in the Public Interest is on board, and it has never been accused of being sanguine about food risks.

The Washington Post, Tamar Haspel, Oct. 15, 2013 [13]

The scientific evidence on genetically engineered food, which has been around for two decades, indicates that it is as safe for human consumption as any other food. A California bill that would require the labeling of bioengineered food—whose DNA has been modified in the laboratory to introduce certain traits—caters to a scare campaign that is **not based on solid evidence**.

Los Angeles Times Editorial Board, May 5, 2014 [14]

The application of current biotechnological tools to agriculture offers a wide array of benefits, benefits that are only beginning to be seen. There is the potential to create crops that are easier to grow, better for the environment and more nutrient-rich. Smart genetic modification is one important tool available to sustain the world's growing multitudes. Making good on that promise will require both an openness to the technology and serious investment in GMOs within wealthy countries. The prospect of helping to feed the starving and improve the lives of people across the planet should not be nipped because of the self-indulgent fretting of first-world activists. As with any field, there's room for reasonable caution and study using real science. But **there is nothing reasonable about anti-GMO fundamentalism**. Voters and their representatives should worry less about "Frankenfood" and more about the vast global challenges that genetically modified crops can help address.

Washington Post Editorial Board, June 1, 2014 [15]

New technologies often evoke rumors of hazard. These generally fade with time when, as in this case, no real hazards emerge. But the anti-GMO fever still burns brightly, fanned by electronic gossip and **well-organized fear-mongering** that profits some individuals and organizations. We, and the thousands of other scientists who have signed the statement of protest, stand together in staunch opposition to the violent destruction of required tests on valuable advances such as Golden Rice that have the potential to save millions of impoverished fellow humans from needless suffering and death.

Science Magazine, Joint Op-Ed, Sept. 20, 2013 [16]

AGRONOMY

So, WHAT is a GMO?

GMOs (genetically modified organisms) are the product of a specific type of plant breeding where precise changes are made to a plant's DNA to give it characteristics that cannot be achieved through traditional plant breeding methods. [17]

Selective breeding

Plant breeders look for, select and cross-breed the best performing plants in the field, similar to how farmers have naturally improved the crops they grow since farming began. [17]

Advanced breeding

Breeders identify and tag desirable characteristics (traits) within a plant genome. They use this information to pick which plants to cross-breed and create better performing crops. [17]

GM plant breeding

If a plant needs a trait that can't be achieved through advanced breeding, a gene can be turned off or moved, or a gene from another source can be inserted. [17]

GMOs help farmers:

- Prevent crop disease
- Control insects
- Manage weeds
- Change nutritional profile

[17]

There are eight GMO crops available in the U.S. today:

- Cotton
- Alfalfa
- Papaya
- Corn (field & sweet)
- Squash
- Soybeans
- Sugar

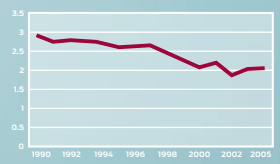
[17]

GMO foods are **nutritionally and chemically identical** to food grown from non-biotech crops. And GMO foods are still exhaustively assessed for safety by groups like the FDA and the USDA. [18]

Pesticide Use

Pesticide use since 1990

Herbicide use since 1990



The growing use of hybrids with insect-resistant and herbicide-tolerant traits has greatly reduced the need for synthetic applications of herbicides and insecticides.

Between 1990 and 2005, farmers saw a sharp drop in insecticide use over this 15-year period and a more gradual decrease in herbicides.

Use of pesticides continues to trend downward. [19]

AGRONOMY

NUTRIENT USE EFFICIENCY

Year	Corn Grown (BUSHELS)	Nutients (N, P, K) (PER BUSHEL)
1980	6.64 billion	3.2 lb.
2010	12.45 billion	1.6 lb.

From 1980 to 2010, the use of the key crop inputs of nitrogen, phosphorus and potassium have been cut in half, per bushel of corn grown.

This represents an 87.5 percent increase in production with 4 percent fewer nutrients. [20]

87.5% INCREASE IN PRODUCTION

In 2009, biotechnology helped farmers reduce CO_2 emissions by **39 billion pounds.**

That's the same as removing 7.8 million cars from the road for the entire year. [21]

37% Amount of land to produce one bushel of corn

69% Soil loss per bushel above a tolerable level

27% Irrigation water use per bushel

37% Energy used to produce one bushel

30% Emissions per bushel

IMPACT REDUCTIONS

CORN PRODUCTION, 1987–2007

Land use **-37%**
AMOUNT OF LAND TO PRODUCE ONE BUSHEL OF CORN

Soil loss **-69%**
SOIL LOSS PER BUSHEL, ABOVE A TOLERABLE LEVEL

Irrigation **-27%**
IRRIGATION WATER USE PER BUSHEL

Energy **-37%**
ENERGY USED TO PRODUCE ONE BUSHEL

Climate **-30%**
EMISSIONS PER BUSHEL

[20]

AGRONOMY

GMOs benefit farmers

PRODUCING MORE WITH LESS

GMO seeds are overwhelmingly embraced by American farmers. Roughly 90 percent of corn, cotton, and soybeans grown in the U.S. are improved using biotechnology to help farmers manage devastating insects, weeds, and weather conditions. Farmers are also choosing biotechnology to grow crops such as alfalfa, papaya, sugarbeets, squash and canola. Technology allows farmers to produce more food, using less land and fewer chemicals, while conserving soil, water and on-farm energy.

Today's traits are only the first in a pipeline that focuses on delivering high yields in tough environmental conditions. Additional GMOs with novel genetic mechanisms for advanced drought tolerance are being developed, as are crops that can tolerate extreme heat, sunlight, and high levels of salt in the soil.

22

GMOs benefit our food security

Currently, nearly 2 billion people on our planet are malnourished. According to the United Nations, the global population will reach over 9.6 billion in the year 2050, which places an imperative on finding ways to meet daily human caloric needs in an environmentally sustainable way.

According to many experts, including those with the State Department who are most closely tied to food security, it will be necessary for farmers to produce as much food in the next 50 years as was produced in all previously recorded history. Science, innovation, and precision will be required to produce this amount of food without destroying the environment.

According to a report by the Wilson Center and USAID, unanticipated food price rises frequently provide a spark for unrest and conflict among groups competing to control the natural resources needed for food production. Social, political or economic inequities that affect people's food security can also exacerbate grievances and build momentum toward conflict.

If we do not embrace agricultural and food science and innovation, what does that mean for U.S. foreign and military policy 10, 50, or 100 years from now?

22

GMOs benefit consumers

AFFORDFABLE FOOD

GMOs Keep Food Affordable. They require less water and fewer chemical applications than conventional crops, and they are better able to survive drought, weeds, and insects. With larger, more reliable harvests, studies show that certain food products (corn, soybeans, and derivatives) would cost 6 to 10 percent more if biotechnology was not available.

GMO Labeling – A $500 Hit on Families. According to a recent study by economists at Cornell University, mandatory GMO labeling will raise food costs for American families by an average of $500 per year. That is because farmers and food producers would need to build an enormously expensive new supply chain system to track GMO crops from seed to store shelves, incurring costs that would be passed along to American consumers.

22

GMOs benefit the environment

FEWER CHEMICAL APPLICATIONS

Data show that, since the year 1996, GMO crops have reduced pesticide applications on farms by 8.8%.

IMPROVING WATER QUALITY

Herbicide tolerant GMO crops allow the widespread use of "no-till" agriculture, which decreases soil erosion in the U.S. by at least one billion tons per year. This, in turn, improves water quality by decreasing sedimentation and runoff of nitrogen and phosphorous.

REDUCING GREENHOUSE GASES

"No-till" and reduced-till farming practices improve carbon storage, cut on-farm fuel consumption in the U.S. from five gallons per acre to one gallon per acre, and reduce agriculture's overall greenhouse gas footprint. In 2012, environmental improvements associated with the global use of GMOs were equivalent to removing 11.9 million cars from the road for one year.

22

GMOs combat climate change

Biotech crops provide alternative renewable fuel sources for transportation, and they can be engineered to withstand environmental challenges such as flooding, salty soils or drought conditions.

23

AGRONOMY

WHAT DO YOU (THINK YOU) KNOW ABOUT ANTIBIOTICS?

an·ti·bi·o·tic
a naturally occurring, semi-synthetic or synthetic substance that exhibits antibacterial activity (i.e. it kills or inhibits the growth of bacteria).

DISEASE PREVENTION:

Humans
When patients are getting their teeth cleaned, a dentist can prescribe an antibiotic in order to keep tender-mouth patients from developing an infection.

Livestock
Turkeys and chickens are given antibiotics to prevent serious and fatal bacterial intestinal infection.

DISEASE CONTROL:

Humans
When a college student is diagnosed with meningitis, all students who have been in contact with the student are offered a short-term oral medicine to control further disease spread.

Livestock
One animal becomes clinically ill and the entire herd/flock will be given an antibiotic to stop the disease from spreading to other animals.

DISEASE TREATMENT:

Humans
Children develop ear infections and then are given an antibiotic to fight the infection.

Livestock
A pig may have contracted a respiratory infection and is treated.

WHAT ABOUT GROWTH PROMOTION?

Currently, livestock producers can use feed antibiotics—as approved by FDA—to allow animals to grow more efficiently using less feed. However, these uses—called growth promotion—are being eliminated by FDA with the cooperation of the agricultural community.

SO, THERE'S A NEW POLICY

Under a new FDA policy, **antibiotics used in human medicine will not be used for growth promotion.** This policy, being implemented with the cooperation of the agricultural community, will phase out the use of medically important antibiotics for growth promotion and phase in veterinary oversight for all remaining uses of antibiotics in food animals. It is anticipated that by December 2016, all uses of these antibiotics in farm animals will only be to prevent disease and treat sick animals, under the care and prescription of a licensed veterinarian.

talk vs. truth

The talk:

80% ✗

of the antibiotics used in the United States are given to livestock

The truth:

People and their pets use ✓

10X MORE ANTI-BIOTICS

than our nation's livestock. [25]

THE BOTTOM LINE?

Livestock producers use antibiotics for the same reason as the rest of us: to keep their animals, and our food, safe and healthy.

FACT ✓ For more than 40 years, the Food and Drug Administration (FDA) has approved the use of antibiotics in livestock and poultry. Veterinarians work with farmers to use these products in a manner that provides consumers with the safest food possible. [26]

FACT ✓ Banning or severely restricting the use of antimicrobials in animals may negatively impact a veterinarian's ability to protect animal health and prevent suffering from disease, which can lead to poor animal welfare. [27]

FACT ✓ **Research has shown that as rates of animal illnesses increase, so do rates of human illness.** [28]

FACT ✓ Because antibiotic resistance is a public health concern, several layers of protection have been put in place to ensure that animal antibiotics do not affect public health. The Centers for Disease Control and Prevention, the FDA, and the Department of Agriculture, along with the veterinary community, animal health companies and farmers, have an effective process in place to protect human health. [26]

FACT ✓ Animal antibiotics make our food supply safer and people healthier. Antibiotics are a critical tool to prevent, control and treat disease in animals.

LIVESTOCK

talk vs. truth

The talk:

X

U.S. beef contains dangerous amounts of hormones

The truth:

✓

3 OZ. OF BEEF

contain **71,000 times** *less* estrogen than is produced by an average man

and **252,600 times** *less* than is produced by an average woman, *every day.*

[30]

✓

POULTRY

The National Chicken Council's animal welfare guidelines cover every phase of a chicken's life from hatching to processing. It is illegal to use growth hormones in poultry production.

[29]

Less than 2% of Americans feed the rest.

[31]

✓

SWINE

In the past 50 years, the carbon footprint per pound of dressed pig carcass has been reduced 35 percent, from 3.8 kg/CO_2 eq. to 2.5 kg/CO_2 eq. today.

[32]

✓

CATTLE

U.S. farmers and ranchers raise 20 percent of the world's beef supply with just 7 percent of the world's cattle. The beef community has achieved a 7 percent improvement in environmental sustainability from 2005 to 2011.

[33]

Livestock production provides a way of life for future generations and a food source for a hungry world.

LIVESTOCK

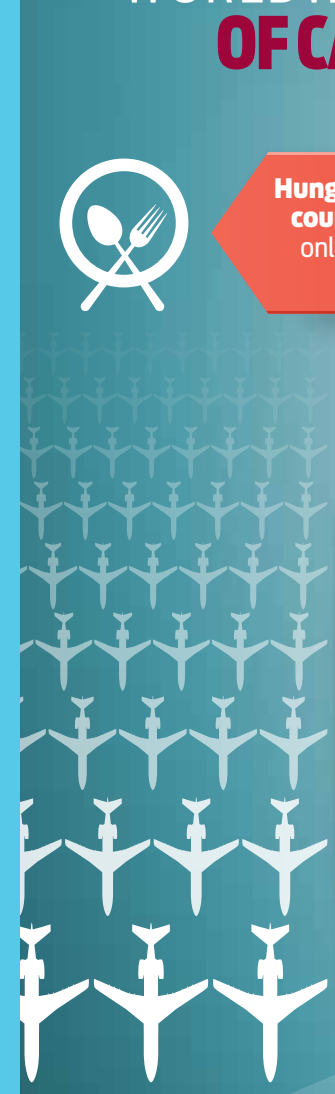
The truth:

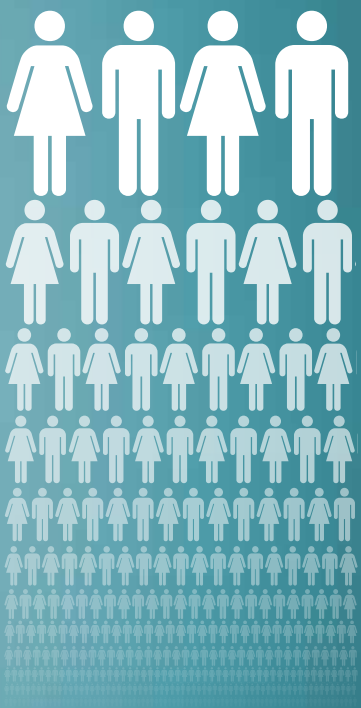
HUNGER KILLS MORE PEOPLE WORLDWIDE THAN **ALL FORMS OF CANCER COMBINED.**[34]

Hunger isn't just a problem in third world countries. In San Diego, 1 in 4 kids get their only decent meal at school. In Kansas City, it's 1 in 5. In Boston, 1 in 8.[35]

By the year 2050 the global population will be 9 billion.

We will need 70% more food and 70% of that food will have to come from efficiency-enhancing technology.[37]





Every day, nearly 25,000 people die from starvation and mal-nutrition.

That's like 130 Boeing 727 jets filled with people falling out of the sky *every day*.[36]

Agriculture is becoming more efficient. The carbon footprint of a gallon of milk has decreased by 63% since 1944. One cow produces as much milk today as five cows did in 1944.[34]

FACT

According to EPA data, all of agriculture contributes 7 percent of America's greenhouse gas emissions, while livestock production accounts for just 3 percent.[38]

FACT

One 8-ounce serving of cabbage contains 5,411 nanograms of estrogen, over 1,000 times more estrogen than in the same-size steak from a steer given a growth-promoting hormone implant.[40]

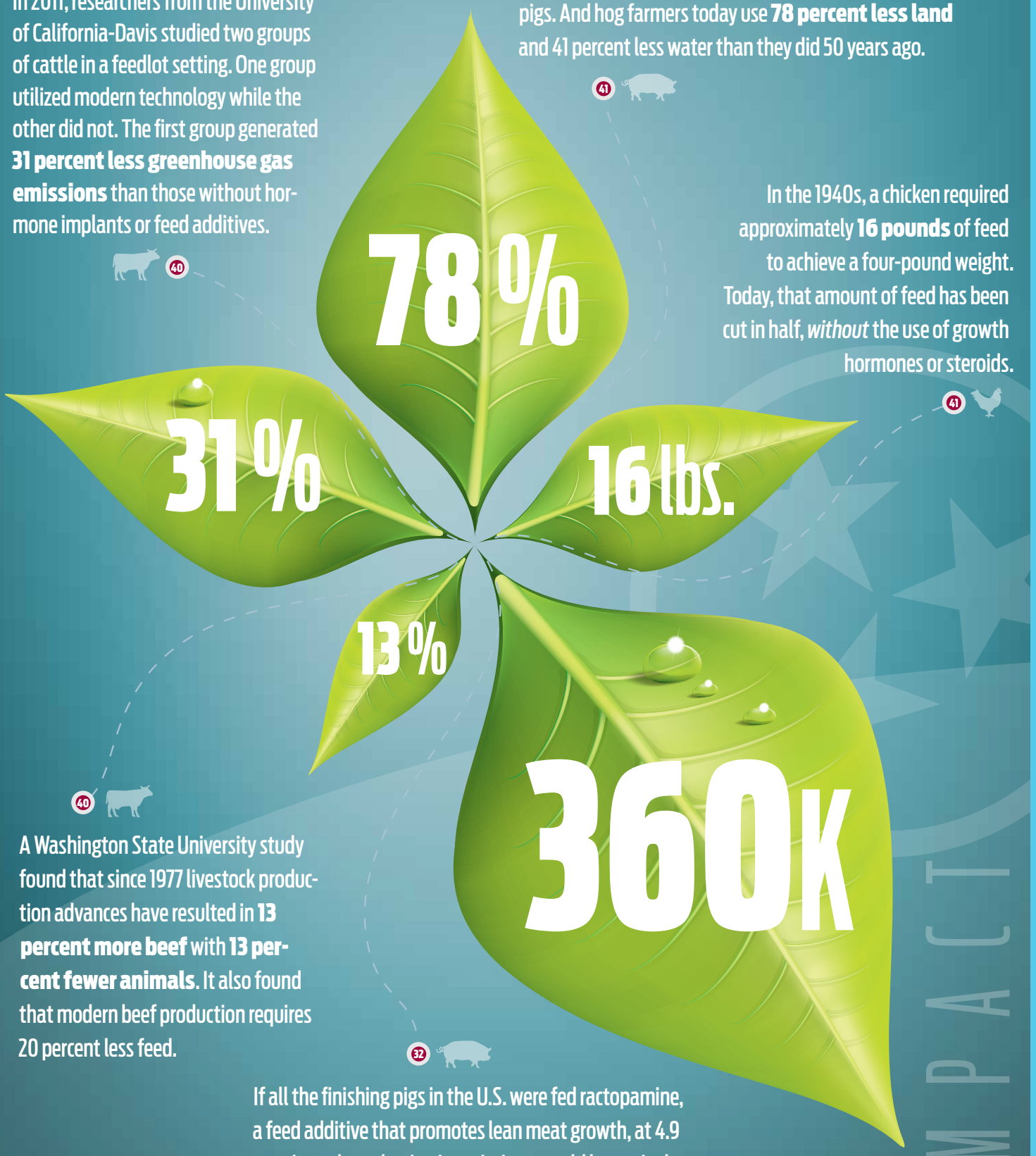
FACT

Without productivity-enhancing technologies in beef production, U.S. farmers and ranchers would need to raise 10 million more cattle and harvest 3 million more to produce the same amount of beef currently available. This would take an additional 81 million tons of feed, 17 million acres of land and 138 billion gallons of water.[39]

FACT

It takes 34 percent less land and 14 percent less water to produce one pound of beef today than it did in 1977.[34]

IMPACT



In 1959, it took eight pigs—including breeding stock—to produce 1,000 pounds of pork. Today, it takes just five pigs. And hog farmers today use **78 percent less land** and 41 percent less water than they did 50 years ago. [41]

In 2011, researchers from the University of California-Davis studied two groups of cattle in a feedlot setting. One group utilized modern technology while the other did not. The first group generated **31 percent less greenhouse gas emissions** than those without hormone implants or feed additives. [40]

In the 1940s, a chicken required approximately **16 pounds** of feed to achieve a four-pound weight. Today, that amount of feed has been cut in half, *without* the use of growth hormones or steroids. [41]

A Washington State University study found that since 1977 livestock production advances have resulted in **13 percent more beef** with **13 percent fewer animals**. It also found that modern beef production requires 20 percent less feed. [40]

If all the finishing pigs in the U.S. were fed ractopamine, a feed additive that promotes lean meat growth, at 4.9 grams/ton, the reduction in emissions would be equivalent to removing **360,000 cars off the road** for a year. [32]

IMPACT

SOURCES

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2. Percentages based on the 2012 CommonGround Gate-To-Plate Survey. http://findourcommonground.com/wp-content/uploads/CommonGround-Gate-to-Plate-Survey-Infographic.pdf
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7. http://www.responsibletechnology.org/10-Reasons-to-Avoid-GMOs
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Resources for more information

CommonGround
www.findourcommonground.org

Genetic Literacy Project
www.geneticliteracyproject.org

Farm Animal Care Coalition of Tennessee
www.tnfacct.com

Tennessee Agricultural Production Assoc.
http://eppserver.ag.utk.edu/Extension/TAPA/TAPA.html

Tennessee Beef Industry Council
www.beefup.org

Tennessee Dairy Association
www.tennesseedairy.org

Tennessee Cattlemen's Association
www.tncattle.org

Tennessee Farm Bureau
www.tnfarmbureau.org

Tennessee Feed & Grain Association
www.tnfeedandgrain.org

Tennessee Pork Producers Association
www.pork.org

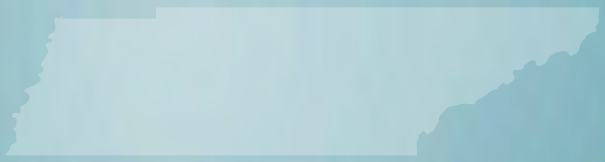
Tennessee Poultry Association
www.tnpoultry.org

Tennessee Sheep Producers Association
www.tennesseesheep.org

Tennessee Soybean Association
www.tnsoybeans.org

Protect the Harvest
www.protecttheharvest.com

U.S. Farmers and Ranchers Alliance
www.fooddialogues.com



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