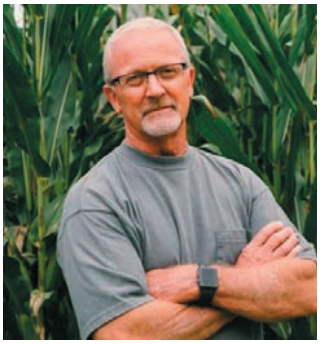
NCGA

SUSTAINABILITY REPORT

U.S. Corn farmers are committed to continuous improvement in the production of corn, a versatile crop providing abundant high-quality food, feed, renewable energy, biobased products, and ecosystem services. As stewards of the land, we understand the responsibility we have for creating a more environmentally and economically sustainable world for future generations with transparency and through continued advances and efficiencies in land, water and energy use.

Andy Jobman, central Nebraska



As a corn farmer, I take my role in social responsibility seriously. I believe that achieving rural ecological resilience and economic resilience, concurrently, are possible. We see this beginning to take shape by the progress and joint efforts being made across the United States when it comes to big-picture sustainability initiatives.

Throughout this report, you will get a science-based view of the evolution of corn's social, economic and environmental successes. Collectively, farmers are playing a key part in mitigating risks related to climate and NCGA is leading the way as we seek to be a part of the solutions to environmental challenges facing our world today. In 2020, corn farmers joined together to establish a Sustainability Commitment Statement to express our dedication to sustainability feeding and fueling a growing world.

To be honest, I believe we are just getting started. We can play an even bigger role as the nation continues to address carbon in our atmosphere. We are a willing and able partner to help sequester it, and corn is the perfect vehicle for our success.

Please take the time to read about the farmers in this report. They come from across the country, demonstrating the various ways corn farmers can, and do, practice sustainability in their operations. Their efforts to defend against soil erosion, improve water quality and water use, and manage resources and nutrients ultimately reveal the dedication to continuous improvement found in modern farming.

Managing resources isn't new to farming. It just looks a little different today than in the past. My father introduced buffer strips to our farm five decades ago. Our farm adopted no-till practices in the 1980s. I guess you could say my family's farm practiced conservation before it was cool. However, I know there are many other farmers out there just like us, many I consider friends, who have collaborated for mutual success in managing resources.

Through technology, academia and agriculture industry advances, corn farmers continue to build upon generations of knowledge, managing at a more granular level with data-based insights than ever before. We adjust rates, tillage and overall practices when necessary and work diligently to deliver results in a meaningful way – meaningful for the environment and meaningful for our own economic viability.

If I've learned anything in my many years of farming, it's that there is never a change to one-size-fits-all answer. One field is managed differently than another within our operation. Our farm is managed differently than one across the country, across the state or even down the road. I believe farmers, as a whole, strive to do the right thing and want to continue to provide food, fuel and fiber for our communities.

I appreciate your time reading through our sustainability story and hope it provides you with just a window into the complexities of and efforts being made in corn farming today.

Sincerely,
John Linder, President
National Corn Growers Association

A Commitment to Evolution

CORN'S SUSTAINABILITY STORY

The corn industry's evolution in sustainability, the documented environmental, economic and social improvements over the last several decades, point back to a farmer's willingness to embrace change. Most notably, it has meant embracing numerous advancements in technology over many decades. Ultimately, technology granted farmers the ability to grow more with less. As the largest sector in American agriculture, corn farmers impact hundreds of thousands of jobs, infuse billions of dollars into the economy and care for our most critical resources, all while seeing substantial improvements in production.

ENVIRONMENTAL

PRODUCING MORE WITH LESS

SOCIAL

PROVIDING A SAFE, SECURE SUPPLY OF FOOD, FEED AND FUEL

ECONOMIC

LARGEST AG SECTOR, CREATING JOBS AND CONTRIBUTING TO THE GDP

SOIL CONSERVATION

Healthy soils are the foundation of all agriculture production and are why corn farmers are committed to leaving their land in a better place than they found it. Adoptions in conservation tillage and other soil conservation strategies have contributed to a reduction in soil erosion.

WATER STEWARDSHIP

Farmers recognize the invaluable role water plays in raising a crop each year. They also recognize that they must actively protect this resource for the benefit of their crops, their communities and the planet.

ECOSYSTEM RESILIENCE

With approximately 90 million acres planted annually, corn is grown in a variety of unique ecosystems. Supporting the health of those ecosystems requires active attention from farmers, who respond by using integrated pest management techniques, establishing wildlife habitat on their lands and more.

ENERGY EFFICIENCY

Technology that makes farmers more productive has also helped to reduce the amount of energy, and subsequent emissions needed for corn production. Corn farmers also provide a carbon reduction strategy through the production of ethanol and the support of the Renewable Fuel Standard.

MINIMAL WASTE

With corn's flexibility and number of uses, little from each kernel goes to waste. From animal feed to ethanol production to bioplastics, the components of each kernel of corn find a home in a variety of ways and uses, leaving little behind.

A COMMITMENT

TO THE FUTURE

Corn farmers' commitment to these pillars of sustainability have paved the way for improvements in a number of key indicators over a span of several decades. Between 1980 and 2015[1], corn farmers have:

BETWEEN 1980 AND 2015

DECREASED THE AMOUNT OF LAND REQUIRED TO PRODUCE A BUSHEL OF CORN BY

41%

EVEN WHILE THE QUANTITY OF CORN PRODUCED HAS INCREASED

REDUCED SOIL LOSS PER ACRE BY

58%

IMPROVED IRRIGATION EFFICIENCIES, LEADING TO PER BUSHEL DECLINES IN IRRIGATION WATER USE OF

46%

IMPROVED ENERGY USE EFFICIENCY PER BUSHEL BY

41%

REDUCED GREENHOUSE GASS (GHG) EMISSIONS PER BUSHEL BY

31%

NCGA'S GOALS

While proud of their past success, corn farmers are not ready to stop there. They stand ready to meet the needs of the future and to continue to embrace the change that has brought them this far. Looking to 2030, corn farmers are committed to:

LOOKING TO 2030

INCREASE LAND USE EFFICIENCY BY

12%

REDUCE SOIL EROSION BY

13%

INCREASE IRRIGATION WATER USE EFFICIENCY BY

15%

INCREASE ENERGY USE EFFICIENCY BY

13%

REDUCE GHG EMISSIONS BY

13%

[1] *Field to Market: The Alliance for Sustainable Agriculture, 2016. Environmental and Socioeconomic Indicators for Measuring Outcomes of On-Farm Agricultural Production in the United States (Third Edition)*

Krista Swanson, northern Illinois

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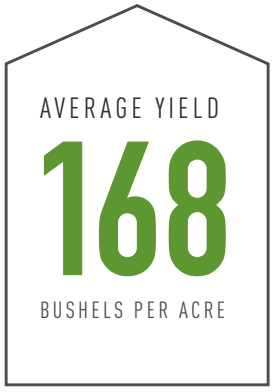
300,000
CORN FARMERS
Bryan Biegler, southwest Minnesota

ENVIRONMENTAL SUSTAINABILITY

Environmental sustainability is a guiding principle for the U.S. corn industry. Farmers have demonstrated a dedication to continuous improvement in how they manage resources and how production impacts the land, water and air over the last several decades.

The solutions are never one-size-fits-all. Each farm has different variables at play, and farmers are working to manage their respective farms based on geography, soil and field characteristics and management practices. Through a number of agronomic and technological advances, U.S. corn farmers continue to become even more precise in their data and production management, making them a proactive partner in climate conversations and positively impacting environmental sustainability.



PRODUCE **33%** OF THE WORLD'S CORN

ON ONLY **10%** OF THE LAND DEDICATED TO CORN PRODUCTION GLOBALLY

PROTECTING AND ENHANCING THE

SOIL

Healthy soil is more productive.

While that statement is perhaps an oversimplification of a very important aspect of farming, it is 100% true. Healthier soil improves nutrient and water holding capacity, while also having the potential to reduce fertilizer needs for farmers – adding not only to productivity, but profitability, as well.

Changes in Corn Production since 1980[2]

TOTAL CORN FOR GRAIN PRODUCTION INCREASED BY

119%

CROP YIELD INCREASEDBY

61%

DECREASED THE AMOUNT OF LAND REQUIRED TO PRODUCE A BUSHEL OF CORN BY

41%

REDUCED SOIL LOSS PER ACRE BY

58%

For today's corn farmers, it means they are leaving the soil in a better place than where it started. With farms often being multigenerational, the emphasis on taking care of the land and the mantra to leave it better than before is not lost on the older or the next generation of farmers. Farmers historically have shown the ability to gain efficiencies, especially over the last several decades, while also improving soil health. And, they're not done yet.

[2]Source: Field to Market Indicators Report, 2016

TECHNOLOGY ACCESS MOVES

FARMS FORWARD

From supply chain management to manufacturing efficiencies, the technology age has influenced how organizations do business. Farms are no different in technology options, although soil improvement is a living, customized process per region, field and even acre. Access to customized intelligence has given farmers the ability to learn more about their individual field environments and make precise management decisions through geospatial and in-field technology.

It should be noted that while technology has afforded many efficiencies, it also comes at a price. Farm adoption of technology is as much an economic decision as environmental and each farm's cost of doing business looks a little different. Here are some of the changes that have helped farmers make progress in management decisions related to their land in the modern era.

BIOTECHNOLOGY

The numbers don't lie. Genetically modified organisms opened a number of positive soil-improvement opportunities for corn farmers. The reduction in soil loss over the last 35 years was a direct response to reduced and no-till adoption, which biotech seeds enabled by offering additional weed management options. Farmers are able to produce more with less – less soil erosion, fewer pesticide applications – because of GMOs.

45%

OF U.S. FARMERS ADOPTED MACHINE SECTION CONTROL, A PRECISION TECHNOLOGY THAT FINE TUNES SEED, FERTILIZER AND SPRAYING APPLICATIONS.

PRECISION AGRICULTURE

Precision agriculture has unlocked a world of data for farmers that was once unimaginable. This data, when combined with equipment and software advances allow farmers to be more exact in their management decisions from fertilizer and herbicide application to tillage depth, seeding rates and row spacing. Farmers have been able to reduce overlap and identify best placement and rates of inputs thanks to precision agriculture adoption.

VARIABLE-RATE TECHNOLOGY

Cross-referencing tools like yield maps and soil sampling results, farmers use agriculture technology to their advantage in fertilizer and chemical applications. Variable-rate application systems allow farmers to apply fertilizer and chemicals at prescriptive levels based on data-driven, individual needs within a field or acre, considering how the variables all interact with each other.

COVER CROPS

Keeping living roots in the soil is an important aspect of soil health. Corn farmers continue to explore and understand the benefits of cover crops from both a soil-holding and a soil-building standpoint. Farmers plant cover crops for a multitude of reasons. Most visibly, cover crops hold on to the soil during the wind and snow of the winter, reducing erosion. But, there is a lot going on under the soil, as well. By keeping microbial life active in the soil, farmers are using these microorganisms to increase carbon sequestration, organic matter and nutrient availability.

Farmers planting cover crops help enhance biodiversity, create wildlife habitats, attract honey bees and beneficial insects, and increase soil infiltration leading to less flooding.[3]

REDUCED TILLAGE

Another opportunity farmers use to protect the seed biome is their approach to tillage. Seed technology has given farmers the ability to manage weeds with little to no tillage and plant seeds in cooler soils – two of the primary reasons why farmers used tillage in the past. Over the last several decades, advanced tillage technology has introduced a dozen different tools for farmers to use with varying rates of precision to manage how variables like depth and width of tillage impact their soil health and productivity.

[3]*Source: Midwest Cover Crops Council*

REDUCTION AND ADOPTION:

THE FUTURE OF SOIL MANAGEMENT

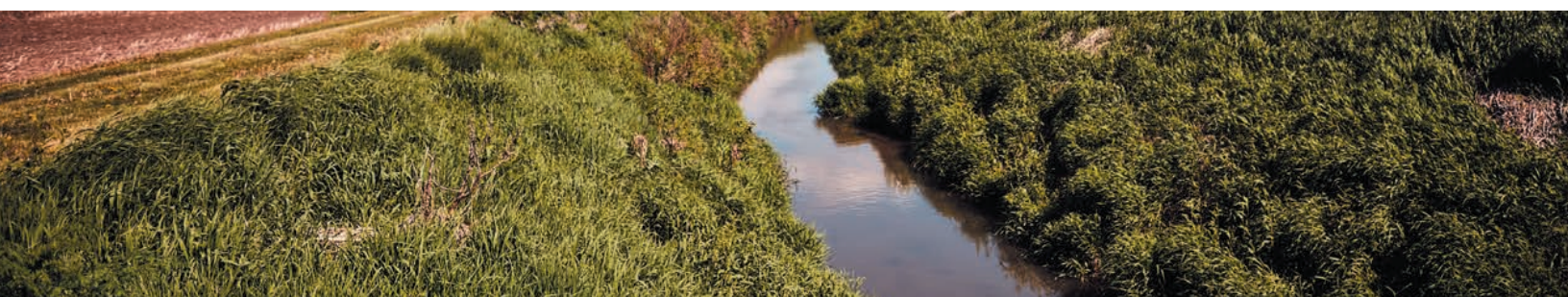
Farmers recognize they are part of a bigger ecosystem. As carbon becomes a greater focus throughout the world, U.S. corn farmers are also investgating ways to be part of the solution.

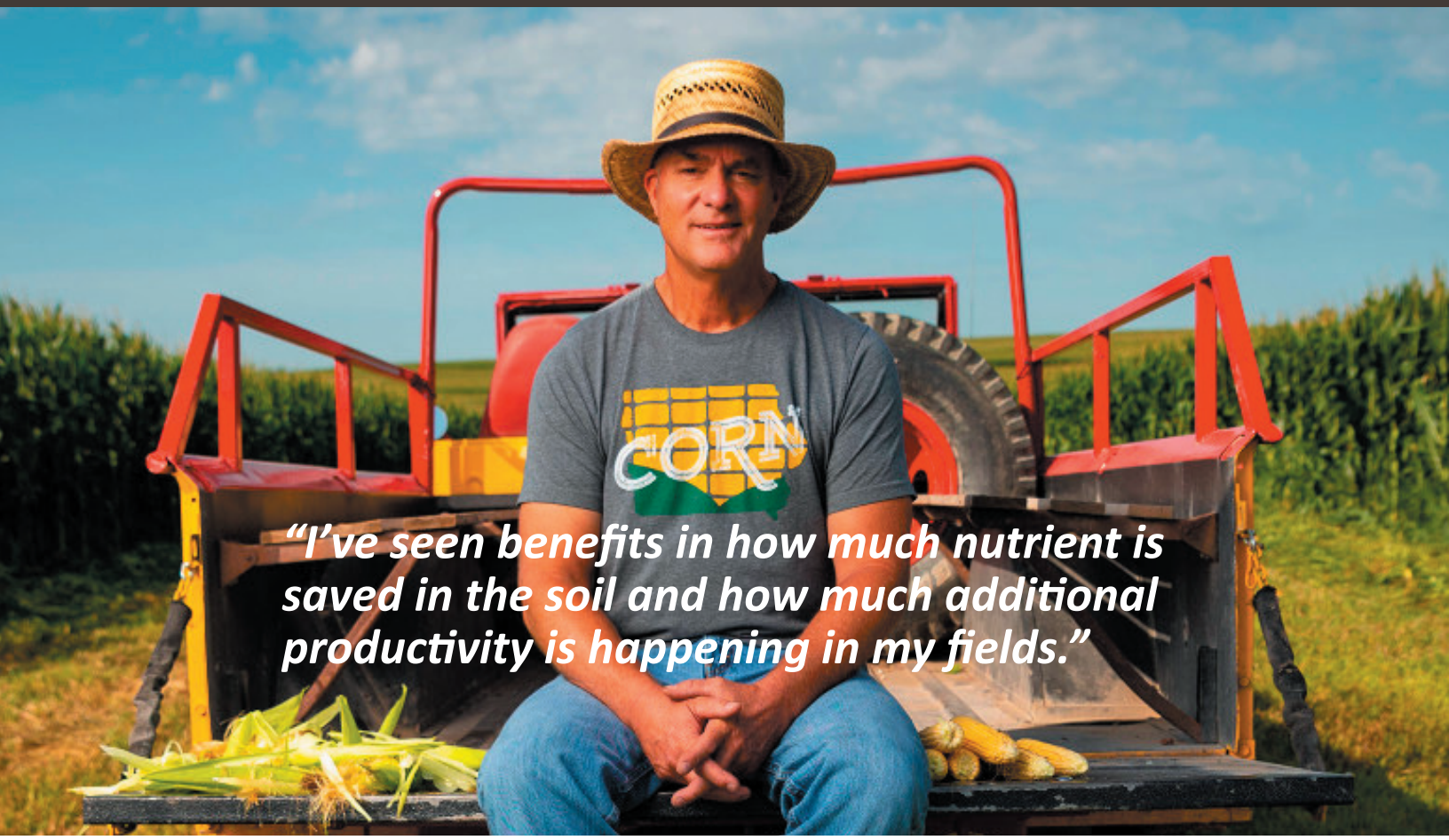
A number of programs are in place to identify production practices and new seed technologies that could help farmers quantify carbon from existing and new practices, as well as developing the genetic capabilities to trap carbon.

Cover crops, no-till and strip tillage are all practices that have proven to keep carbon in the soil, but research continues to expand those capabilities and identify other practices with measurable results.

Practices such as livestock grazing on cover crops are gaining attention as a way to keep carbon in the soil, feed livestock economically and return nutrients to the soil naturally.

For fields throughout the Corn Belt, the benefits of new technology and practices vary. Farmers are working with living systems with many uncontrollable variables. And, they must evaluate what works within the given conditions in their fields and the short- and long-term economic impacts.





IOWA FARMER SEES ADDED VALUE IN SOIL MANAGEMENT

Mark Mueller considers himself blessed to farm with some of the best soils in the world, something this northeastern Iowa farmer does not take lightly. When it comes to soil management, Mueller's curiosity drives him to seek out knowledge and practices that add long-term value for his operation.

"There is value to be found in leaving the soil as undisturbed as possible, but you can't expect it to happen overnight," says Mueller. "I've seen benefits in how much nutrient is saved in the soil and how much additional productivity is happening in my fields, but it's hard to quantify those in terms of dollars and cents, as they are less tangible than normal costs a farmer is seeing on a balance sheet."

Mueller has been practicing no-till on his farm for nearly 20 years, while also participating in soil health studies for the better part of the last decade. If he has learned one thing in that time – there's no one-size-fits-all solution for soil health and corn farming, even on one operation. His management approach includes a variety of practices that work for him and his farm, including contour buffer strips, cover crops and expanded crop rotations with corn, soy, rye seed and alfalfa. As for his poorer soils? Mueller proactively manages those, as well.

"I have a number of acres with poorer soils already committed to the conservation reserve program (CRP)," adds Mueller, who also plans to add a wetland to his operation in the coming months. "Our county continues to see more rainfall, and wetlands are nature's way of naturally cleaning the water. It seemed to be the right time to make that change."

For Mueller, his contributions to soil health do not stop within his own operation. His work with the Soil Health Partnership looks to quantify the economic and tangible benefits over cover crops and soil management for other farmers across the country.

ESSENTIAL TO LIFE, CORN

WATER QUALITY

Farmers recognize the invaluable, life sustaining force of water. It is not only essential to their life and operation, but to their local communities. Water's ability to dissolve and transport molecules makes it both a blessing, and a curse. That's why water management is such a major focus of corn production today. Farmers know that where water flows in a field, whether it is flowing to or from, can impact their own production and input costs, as well as their local water supply and waterways both nearby and far downstream, all the way to coastal waters in many instances.

On-farm conservation practices have a number of benefits, including the aforementioned impacts on soil health. However, conservation and management are not a one-size-fits-all solution. Every field environment presents its own unique characteristics, and what works for management in one region may not work in another. In fact, environments can be so technically different that a practice that works in one part of a field, may not work in another.

Through adoption of conservation practices, farmers have made great gains in reducing soil erosion and mitigating nutrient losses, thus reducing farm-related sediment and nutrient challenges to water quality. However, they aren't done yet. Technology and new on-farm practices have opened doors for continued improvements to proactively managing water quality.

EXPLORING GRADUAL, YET IMPORTANT PROGRESS

In business, you can often make a change and see the benefits of those efficiencies almost immediately. For farmers and water quality improvements, it is a more gradual change. Due to the cyclical conditions of farming, those in corn production only have one opportunity each year to make adjustments to their practices. In addition, changes in water management may take decades to measure and can vary greatly due to conditions outside of a farmer's control, like the amount of rainfall seen in a given year. These limitations haven't stopped farmers from exploring opportunities for improvement. As with any new technologies on the farm, they must weigh short-term economic implications and long-term environmental gains in every step of the process. Here are a few practices that are making waves in water quality around the country, where feasible given varying environments.

GRASSED WATERWAYS

Farmers address concentrated water flow in fields by maintaining grassed waterways helping prevent soil erosion and nutrient loss.

BIOREACTORS

Some farmers have installed bioreactors to redirect tile water to an underground collection of woodchips, which remove nitrates from the water naturally through micro-organisms.

PRAIRIE STRIPS

Prairie strips are buffer areas of native prairie grasses planted in the contours and edges of the field to reduce water and nutrient runoff and reduce soil loss.

WATER QUALITY TREATMENT WETLANDS

Some farmers, working alone or with their drainage districts, are installing water quality treatment wetlands, which are able to absorb or treat nutrients and prevent their movement downstream.

STREAM BUFFERS

In some areas, farmers plant native vegetation near streams to trap sediment from surface runoff, which helps reduce phosphorus entering the waterway, while also filtering nitrogen, stabilizing stream banks and creating habitats for wildlife.

NUTRIENT MANAGEMENT BASED ON PLANT RESPONSE

Nutrients are only useful if they are available when the plant needs them. Farmers use nutrient stewardship practices, also known as the 4R's, to optimize their nutrient use: maximizing plant uptake and minimizing field loss.

RIGHT SOURCE

Farmers assess the field needs, based on soil makeup and the individual crop being grown. The goal is to ensure a balanced supply of essential nutrients.

RIGHT RATE

Farmers match the amount of fertilizer to the crop needs, assessing variables such as inputs and harvest that impact availability in the soil to ensure the right amount.

RIGHT TIME

Timing is everything. For the nutrients to work properly, farmers ensure they are available when the plant needs them through split applications and watching temperatures.

RIGHT PLACE

Fertilizer is very site-specific, meaning farmers need to take into consideration variability within their fields from soil, nutrient, water flow, etc. They use precision agriculture for accuracy in applications.

TECH SUPPORTS REDUCTIONS IN RUNOFF

New technology brings opportunities for farmers to reduce sediment and nutrient loss, ultimately improving water quality. These modern, more broadly used practices have made significant impacts to the industry.

PRECISION AGRICULTURE

The evolution of precision ag continues to make a difference in how farmers do business. Farmers can operate more precisely with information given through satellites, yield maps and equipment with the ability to apply inputs at variable rates.

COVER CROPS

The benefits of cover crops to water quality are two-fold. First, the cover crop helps keep the soil in place, reducing sediment loss. Various cover crops also return nutrients to the soil, requiring less supplemental nutrient application from farmers.

MICROBIALS

While relatively new on the market, farmers have access to tools that help plants take up more nitrogen. Naturally-occuring microbes applied in-furrow at planting affix to the plants roots and help it take up nitrogen all season long, preventing nutrient degradation, leaching or runoff into waterways.

SEED TECHNOLOGY

The addition of genetically modified crops, like Roundup Ready technology, opened doors for farmers to farm with less: less tillage and fewer chemical applications. These advances helped farmers reduce sediment loss within their given environments.

NITROGEN

FOCUS LEADS FUTURE TECHNOLOGICAL ADVANCEMENTS

Nitrogen, like water, is essential to all living things. Corn is no exception. Studies of production practices show that farmers, as a whole, generally apply nitrogen fertilizers at university-recommended agronomic rates and use stabilizers for added gain. Thus, new nitrogen solutions are looking beyond application rates and stabilizers, directing efforts to efficiency of the nutrient and its environmental impact. Both private and public entities are exploring avenues previously untouched in hopes to develop ways to improve soil nitrogen and add efficiencies in application.

Nitrogen-Fixating Corn Hybrids

One example of such an advancement is corn capable of nitrogen fixation. More than a decade ago, scientists discovered corn that naturally fixes nitrogen through a gel secreted in its roots. The corn was an ancient hybrid grown in Mexico and a public-private collaboration has been formed to expand the findings of this research. To date, the hybrids have been grown by academia in California, Wisconsin and Mexico, while having conversations with the seed industry to expand development.

Nitrogen-Fixing Seed Treatments

Many other plants, such as legumes, return nitrogen to the soil. Researchers have discovered that this happens due to a relationship between the legumes and microbes, helping define the need for a microbial seed treatment. Capitalizing on that identified relationship, farmers may have an option in the not-to-distant future to fix more nitrogen from the start.

TEXAS COUPLE MANAGES WATER WITH LONG-TERM VIEWS AND FLEXIBILITY

Cole and Kyla Hamilton know that the perfect plan will always need adjustments, so they prepare their resource management around it. The couple has incorporated cover crops and extended crop rotations into their farm for nearly 13 years to help proactively manage water, or lack thereof.

"We started farming with my family back in 2005 and we've brought a lot of change in that time," says Cole, who is a fourth-generation Texas farmer. "We started incorporating cover crops and grains in our rotation to keep something on the soil at all times and really focus on the overall soil health."

The sandy soils of the South Plains region of Texas are not known for their water retention, but the Hamiltons have made progress by getting building blocks in place for improved soil fertility. They can see the progress themselves during dry years like 2020.

"Having something growing on dry land during a drought tells us we are doing something right, that the soil is holding enough moisture to sustain plant life," says Kyla. "These changes don't happen overnight, but we are making the strategic decisions to set the farm up for the long-term."

Their farm includes corn, cotton, wheat and a variety of cover crops grown on both dry and irrigated land. They develop a 2-to-3-year management plan with rotations, but also build in flexibility to manage toward the uncontrollable variables, like rainfall.

"Managing the farm is different today than it was even 20-years ago, with extended periods of drought," adds Cole. "It really takes considering all the variables when making management decisions, from our on-farm wells that support irrigation to the seed, fertilizer and pest management decisions for dryland crops. It's about making the right short-term and long-term decision for our farm."

IRRIGATION

The broad landscape of U.S. corn production lends itself to a number of benefits for those who depend on it as a feed, food or fuel ingredient. While one part of the country may be hit with a major weather event, another may have a record year. That type of risk management is also why a percentage of growers use irrigation to deliver consistent production.

Just over 14 percent of corn acreage uses irrigation in production, however that percentage is an important part of consistency in supply. Irrigation technology has advanced substantially over the years and as farmers adopt these technologies, the efficiencies in how much water is being used in irrigation are realized.

Changes in Corn Production since 1980[4]

[4]*Source: Field to Market Indicators Report, 2016*

SOIL SENSORS

Sensors placed in-ground provide precise soil moisture readings to indicate whether or not a field needs irrigation.

GPS

The use of satellites and field mapping allow farmers to easily identify challenge areas, prepare plans for management and make changes as needed.

REMOTE IRRIGATION CONTROL

Farmers have the ability to turn irrigation systems on and off from anywhere on their farm helping to more efficiently use the water.

WEATHER DATA

Monitoring field-specific weather data – both current or forecasted – helps determine irrigation needs within fields and manage more proactively.

VARIABLE-RATE/ ZONED IRRIGATION

With the ability to manage based on zones, farmers can vary the rate of irrigation within fields based on environmental-specific needs.

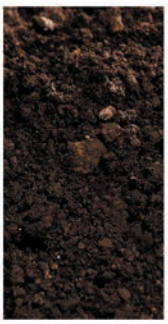
SCHEDULING

Farmers can schedule irrigation based on real-time data in their fields helping inform when, where and how much.

Adding Resilience Within an Ecosystem

From Integrated Pest Management (IPM) to restoring natural habitats, there are a number of ways corn farmers actively preserve their resources. In terms of big-picture resource use, corn farmers have improved their efficiencies considerably during the last several decades. These major shifts in efficiencies were made possible through technological advancements and adoption of a number of practices already covered throughout this report. Reduced tillage, seed advancements, variable-rate applications, water management strategies and microbials are just a few of the many practices that have made an impact in resource management. The concept of growing more with less is poised to continue with the continued advancements in technology from inside and outside the agriculture sector.

Since 1980[5]



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[5]*Field to Market Indicators Report, 2016*

BIODIVERSITY DRIVES HABITAT DEVELOPMENT

Corn is part of a bigger ecosystem. And, establishing high-quality pollinator habitat has become one of the focuses of the corn industry at-large as a way to contribute to that ecosystem's future. As landowners, farmers are uniquely positioned to be part of a growing effort to ensure bee and monarch butterfly populations thrive. Planting native plants on non-farmed or low-performance acres helps to increase biodiversity and aid pollinators. Farmers plant pollinator-friendly plants along buffers near water bodies; fallow fields; conservation acres; field and road barriers; ditches and wetlands. The benefits of these habitats are multifaceted, with honeybee and monarch populations benefitting from the additional source of food and nutrients and farmers benefitting from the soil and water benefits demonstrated through habitat development.

Integrated Pest Management

THROUGH EVALUATION, PREVENTION, AVOIDANCE, SUPPRESSION, MONITORING

Similar to soil health and water management, how to properly manage resources varies widely from region to region. Farmers routinely assess situations in the field, from known threats to what makes economic sense for their farm and then rely on technology, their own history with the fields, agronomic experts and best management practices to make decisions.

IPM must factor in a range of variables, and each field has its own history and set of challenges. Farmers assess a number of factors, including the genetics planted, soil test results, planting date, field conditions, previous pest infestations, fertility plan and more when planning their IPM strategy to ensure their plan is successful both short-term and long-term.

Common IPM Tools Include a

PREVENT

Annual seed selection is critical as farmers choose hybrids known to be genetically superior in fighting pests within the environments in their fields. They also rotate their corn crops with other crops that help to suppress pests and vary row spacing and plant populations to limit pest populations' ability to thrive. Cover crops have proven effective in preventing pest growth, as well.

EVALUATE

Using the information from the continued monitoring of fields, farmers evaluate how to handle pests from both an economical and environmental standpoint. Precision technology allows farmers to be more specific in any of the applications they choose, helping to pinpoint the exact location of problems. A farmer's management plan will likely include both proactive and reactive management options, given the types of pests present.

AVOID

With advance planning, farmers have a number of ways to avoid pest threats in a field, including timely planting and avoiding late maturing hybrids that are more susceptible to increased pest pressures in late summer. Farmers also use crop rotations by planting a crop that will not host the problematic pest in order to reduce its population.

SUPPRESS

Corrective action for pests can come in many forms from cultural and physical to biological and chemical controls. Completing cost-benefit analysis prior to any form of suppression helps farmers consider economic thresholds and efficacy of control, as well as environmental and human health implications prior to making a decision. Because pests are often resilient, farmers rotate control mechanisms to avoid development of pest resistance.

MONITOR

Scouting is the process farmers use to monitor fields throughout the season. Specific scouting methods have been developed for various pests and crops, including insect sticky traps and aerial imagery, but farmers still use the most basic of scouting: walking fields. Whether a farmer walks the fields himself or uses a crop consultant, scouting provides farmers with information on general field conditions, including crop stage and changes in pest infestations.


davis

WHOLE SYSTEM APPROACH FINDS STAYING POWER ON NEBRASKA OPERATION

Brandon Hunnicutt has his eyes on continuous improvement when it comes to managing resources on the farm. From his approach to limited tillage to the drip irrigation and moisture sensors he's installed, Brandon proactively handles water, soil and pest control in his operation.

"We manage differing growing systems that require a variety of practices to be successful," says Hunnicutt , a farmer in south-central Nebraska. "Whether growing crops for commodity, organic or seed production, we are looking at the productivity and opportunities to manage resources proactively for the long-term."

"It's really about preserving our resources and the technologies we have today, while adding back to the environment where we can."

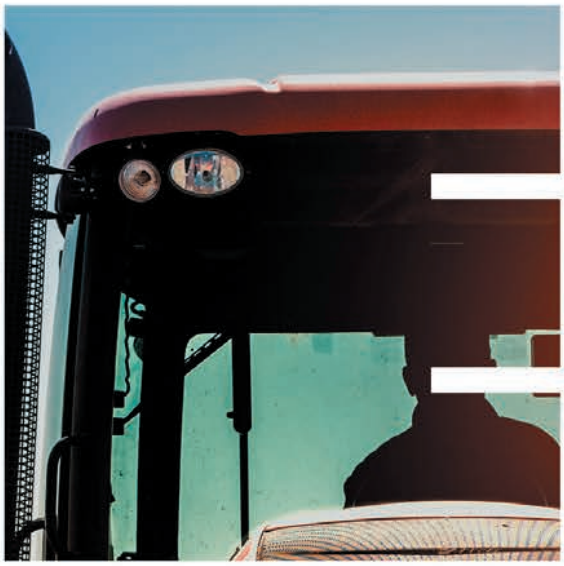
Hunnicutt 's adopted technology and practices help him continue to expand productivity, while using fewer resources. For example, his cover crops add nutrients back to the soil, which means he needs less fertilizer to grow a crop. His soil moisture sensors provide him the information he needs to only use irrigation when needed. His pollinator habitats help attract beneficial insects and bees.

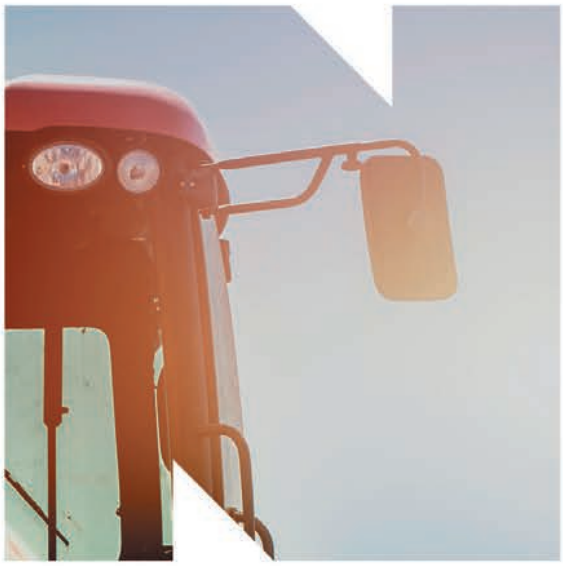
"It's really about preserving our resources and the technologies we have today, while adding back to the environment where we can," says Hunnicutt . "Our approach to managing pests – weeds, insects, diseases – includes rotating sites of action consistently. Plus, we plant a variety of cover crops to diversify what is being used and returned to the soil."

In addition to pollinators and cover crops, Hunnicutt remains commited to adding other practices on his farm that allow him to be more precise in resource management.

"We use variable-rate seeding to manage between the less productive and more productive areas," adds Hunnicutt . "Plus, we use variable-rate fertilizer and chemical applications to only apply what is needed in specific locations."

Hunnicutt's commitment to evolving his operation isn't slowing down anytime soon. What's next? Expanding habitats and finding additional ways to use less resources, while maintaining productivity.





FINDING EFFICIENCIES LEADS TO ENERGY SAVINGS

Farmers' adoption of technology over the past several decades has led to energy savings when it matters most. Technology has made it possible for farmers to not only improve their micro-energy use directly on farm, but also energy use at the macro level by tracking reductions back through the lifecycle of the products they use and produce.

Biotech is a major player when considering the energy savings corn production gained over the last several decades. Biotech seeds reduced the number of applications needed during a crop year, subsequently reducing the energy needed to apply, haul and manufacture various products from origination to farm.

Efficiencies in diesel engines have also positively impacted farmers' on-road and off-road energy use. And, farmers' adoption of renewable fuels contributed to their positive momentum, as well. Farmers throughout the Corn Belt have proven their dedication to renewable energy regularly through the adoption of biofuels, as well as solar and wind energy on their farms.

Changes in Corn Production since 1980[5]

IMPROVED ENERGY USE EFFICIENCY PER BUSHEL BY

41%

REDUCED GREENHOUSE GAS (GHG) EMISSIONS PER BUSHEL BY

31%

[5]*Field to Market Indicators Report, 2016*

Transportation System

PROMOTES EFFICIENCIES

The U.S. corn industry's massive transportation advantages over other countries comes down to not only transportation infrastructure, but agriculture infrastructure, as well. The varying opportunities to ship corn from point A to point B – roads, rail and barge – present energy efficiencies and set the U.S. apart as a global leader.

When you consider that 12.6 percent of U.S. grown corn is exported, the expansive waterway and rail system in the Midwest and across the rest of the Corn Belt make it very efficient to send corn to global destinations in comparison to other countries without the same infrastructure and relying primarily on trucking.

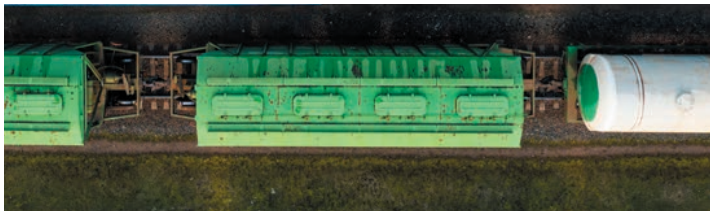
The ag industry's infrastructure also aids in energy savings when considering domestic use. Corn's primary focus of feed is amplified through a well-executed network of close-proximity elevators, processors, feed mills and livestock facilities.

Fuel Efficiencies Per Transportation Mode
Measured in Ton-Miles Per Gallon

TRUCK

145

RAIL



477

BARGE

647

Source: Texas Transportation Institute

Building Integrated
ENERGY MANAGEMENT PLANS

Carbon reductions are top of mind for a growing number of organizations, including local and national policy makers. With availability already nationwide, ethanol can play a significant role in meeting the energy-related goals of the future, today.

The ethanol industry, from the farmers who produce the corn to the plants processing the renewable fuel, has committed itself to continued efficiencies in production. In fact, the most efficient ethanol producers today return 4 units of energy to every 1 unit used to produce their product.

One of the standouts for ethanol is its value with octane. As engine manufacturers are increasingly using turbocharged, higher-compression engines, the demand for high-octane gasoline has surged. Ethanol's blending octane rati ng is the highest value out of any major octane source.

Corn used for ethanol creates more than energy for transportation fuel. The same 56 pounds, or bushel, of corn that produces 2.9 gallons of denatured ethanol, also produces 15.2 lbs of distillers dried grains used in animal feed. The corn industry and livestock industries conti nue to work together to fi nd efficient uses of all products to ensure using corn is not an either/or situati on and instead a mutually benefi cial relati onship. Ethanol's ability to be used in existi ng transportati on infrastructure and within existi ng engines make it a signifi cant player in current and future carbon reducti on eff orts.

CARBON REDUCTIONS THROUGH THE RENEWABLE FUEL STANDARD

The Renewable Fuel Standard's positive improvements for our climate have already been documented. In 2020 alone, the use of ethanol in gasoline reduced CO2-equivalent transportation emissions by 47.3 million metric tons or the equivalent of:

Renewable Fuels Association

Removing 10.1 million cars from the road for one year;

Eliminating annual emissions from 12 coal-fired power plants.

Biobased Products Add More to
CORN'S ENERGY-SAVING ATTRIBUTES

America's energy footprint extends beyond transportation fuel into packaging, manufacturing materials and more. Corn's versatility, in addition to its affordability, abundant supply and sustainability story, make it a viable solution to a number of challenges facing chemical, material and fuel users.

With organizations looking to minimize the impact of packaging or single-use plastics, corn provides a sustainable alternative to petroleum. Corn has proven effectiveness in bioplastics and other bioproducts, while research, development & commercialization continues to expand to create additional efficiencies in use. Even as new uses are developed, there is still plenty of corn to meet the feed, food and fuel needs of corn's customers.

With corn's flexibility and number of uses, little is lost throughout the production, processing and consumption process. Ag technologies have made the use of corn products even more efficient, with little being left without purpose.

There are three types of corn in the U.S.

FIELD SWEET POPCORN

More than 99% of the corn acres in the United States are field corn and used to produce food, feed, fuel and biobased products.

The combine returns the leaves, stems and cobs back to the field, which is called stover. The stover is most commonly used for animal grazing and/or left for soil health benefits, returning nutrients to the soil.

FUEL

One bushel of corn processed in an average dry mill ethanol biorefinery produces 2.9 gallons of denatured ethanol, 15.2 lbs of distillers grains, 0.8 lbs of corn distillers oil, and 1.1 lbs of captured biogenic carbon dioxide. Using corn for ethanol delivers a high-protein feed for animal diets as a co-product of production.

ANIMAL FEED AND PROTEIN

Animal feed makes up the largest segment of use for U.S. corn. In fact, 5.7 billion bushels of corn are used annually as feed and another 1.1 billion bushels are fed as DDGs for animal diets. In the event that an animal needs additional nourishment, corn is also refined into amino acids to supplement diets. Additional development continues with corn as a feed product to optimize the feeding value, while reducing waste.

SWEETENERS, CORN OILS AND STARCHES

Food ingredients make up a relatively small, yet important role for corn. Corn can be used to enhance many flavors, preserve and protect foods, reduce freezer burn and maintain soft texture and moisture, among other uses. Corn starch's translucent nature helps make it a preferred ingredient in commercial food applications, while corn oil provides a healthy, functional and affordable oil for cooking and reducing trans fat in snack foods and restaurant settings.

BIOBASED PRODUCTS

Corn's versatility lends itself to other uses, as well. From corn glucose used for tanning leather to the starch and corn syrup found in concrete, the varying uses for corn continue to grow. Biopolymers made from corn are found in a variety of products, including: paper coatings, fabrics, carpeting, cups, 3-D printing inks and nanotechnology aids in cancer research.

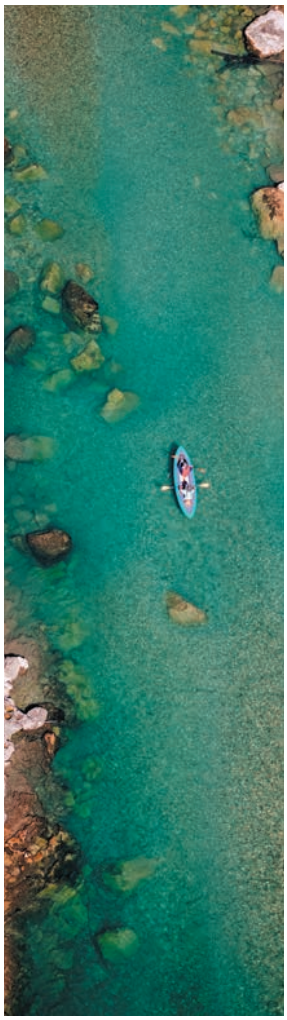
The commitment of nothing going to waste expands passed corn into its largest customer: the livestock industry. Animals are used not only for the meat value, but the value of rendered products that go into a number of food, industrial and fuel uses. Livestock manure is used as fertilizer and returned to the cornfields where the feed began.

Creating a Bigger Picture for

SUSTAINABILITY

SOCIAL

ENVIRON-MENTAL



ECONOMIC

Environmental sustainability is a big part of corn's progress, but it is not the only place corn contributes to the greater sustainability picture. Corn's impacts on a social and economic level are also recognized as an important part of the story. Farmers contribute both on the local and national level by providing a safe, affordable food supply through the production of food and feed ingredients, while adding to the overall economic well-being of their communities by creating jobs and tax contributions.

SOCIAL SUSTAINABILITY

ENSURING SECURITY IN FOOD, FEED AND FUEL

Corn's versatility, along with its ability to grow in a variety of climates, make it a key building block for providing a consistent, resilient and reliable supply of food, feed, fuel and biobased products in the U.S. and around the globe. Corn's broad acreage helps insulate customers from risk of a severe weather event impacting the ability to secure food and feed ingredients. And the dedication to continuous improvement and monitoring helps ensure that supply is safe.

CHOOSING CORN AS A CROP

Farmers plant corn for a number of reasons often not considered at surface level. Corn, as a plant, can handle a range of adverse conditions, from drought and flood to varying soils and temperatures. Corn can grow a strong supply in one season and allows for variability in seasons which happens often in the U.S.

CORN AS A FOOD INGREDIENT

Corn's role in food spans from oils and sweeteners to starches. The list of uses for corn is long, but includes stabilizing products, enhancing flavors, and preserving and protecting canned or frozen foods. Because of its ability to protect sensitive or delicate ingredients, corn also plays a vital role in many medications and vitamins.

CORN AS TURNKEY

From production to emissions, corn's use in ethanol helps to reduce the impacts petroleum has had on the environment today. Ethanol has a demonstrated history of reducing GHG emissions. Technology advancements in the industry show promise for that trend to continue.

CORN IN BIOBASED PRODUCTS

Corn serves a number of purposes in industrial products from bioplastics to the filling in diapers. The same qualities that make it a great food ingredient also make it work in a wide-range of non-food related products. Bioprocessed corn starches create a biodegradable replacement for Styrofoam, corn syrup helps hold moisture in haircare products and polylactic acid can be used to create dissolvable stents and sutures in the medical industry.

CORN AS A FEED INGREDIENT

Corn is a affordable source of nutrition in animal diets. Both corn and distiller's dried grains with solubles (DDGS) add efficiencies in feed rations help livestock producers meet a growing appetite for meat consumption, affordably. Corn also plays an active role in pet and aquaculture diets.

FOOD SAFETY

The corn industry, as a whole, has worked hard to meet and exceed the standards set forth by the U.S. Food and Drug Administration (FDA) and U.S. Environmental Protection Agency (EPA) when it comes to food safety. Here are a few of the things top of mind regarding corn as a food ingredient:

Mycotoxins – Given specific weather conditions, mycotoxins, such as aflatoxin, fumonisin and deoxynivalenol, can be present in corn at harvest. Wet millers will reject diseased or otherwise unacceptable grain. In the event it enters the plant, FDA acknowledges wet-milling as an effective process for removal.

Integrity in Process – Corn used for wet-milling is sampled and graded according to USDA's U.S. Grading Standards and plants implement controlled access and security measures to increase safety. Processes within the plant and in the transportation of the materials also meet FDA's Good Manufacturing Practices (GMP), OSHA's Process Safety Management (PMS) program and rigorous internal quality controls.

Pesticides – Farmers follow modern pesticide management guidelines set forth by the EPA for use in field and post-harvest stored corn. Practices are highly regulated and closely monitored by both the EPA and state regulatory agencies. For millers, the series of washing, refining, filtration and evaporation are designed to reduce residual pesticides are at non-detectable levels in finished products. This process is monitored by the FDA.

PEOPLE & COMMUNITY

Farmer and farm worker safety is also of utmost importance to corn operations. Farmers abide by Acts of Congress and adhere to rules imposed by the EPA, the department of labor and state regulatory bodies.

The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA)– Outside of providing EPA the authority to oversee pesticide distribution, sale and use, FIFRA also requires pesticide users to complete training at the state level and acquire a pesticide applicators license.

Occupational Safety and Health Administration (OSHA) – OSHA has specific standards for agriculture operations that cover everything from hazardous materials and toxic and hazardous substances to environmental controls, equipment safety and occupational health.

Worker Protection Standards (WPS) – EPA established a number of standards for those who work within the agriculture industry to protect agricultural workers and pesticide handlers. Farmers follow a number of procedures to keep employees safe including providing personal protective equipment that is clean and in good operating condition.

Fair Labor Standards Act (FLSA) – Farm labor looks a little different on each farm. The FLSA establishes rules on minimum wage, overtime pay, recordkeeping and youth employment standards. Farmers abide by keeping a record of compliance with the law and understanding how the law applies to their operation.

ECONOMIC SUSTAINABILITY

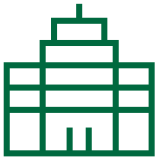
DRIVING LARGE-SCALE CONTRIBUTIONS TO THE U.S. ECONOMY

Agriculture, including the corn industry, plays a vital role in the U.S. economy and in supporting rural America through job creaton, tax contributions and dollars spent. Corn not only supports jobs directly related to the production of corn, but also supports transportation, hospitality, pesticide and chemical manufacturing, real estate and more. As a whole, the U.S. agriculture and food sectors account for nearly one-fifth of the country's economic activity, directly supporting 23 million jobs. For corn, it starts with the rich soils and the more than 300,000 farmers producing corn across the United States, but the impact is felt far and wide. Corn's economic footprint expands to the processing and feed mill industries, food manufacturing and grocers, industrial manufacturers and refining industries. While the jobs supported and economic contributions of agriculture are not tracked by individual commodity, corn does represent the largest generator of cash receipts out of all U.S. crops. Corn contributes significantly to the jobs, wages and taxes generated by the industry as a whole.

FEEDING THE ECONOMY: FOOD AND AGRICULTURE[1]

19,301,794
jobs

$683.45 B
wages



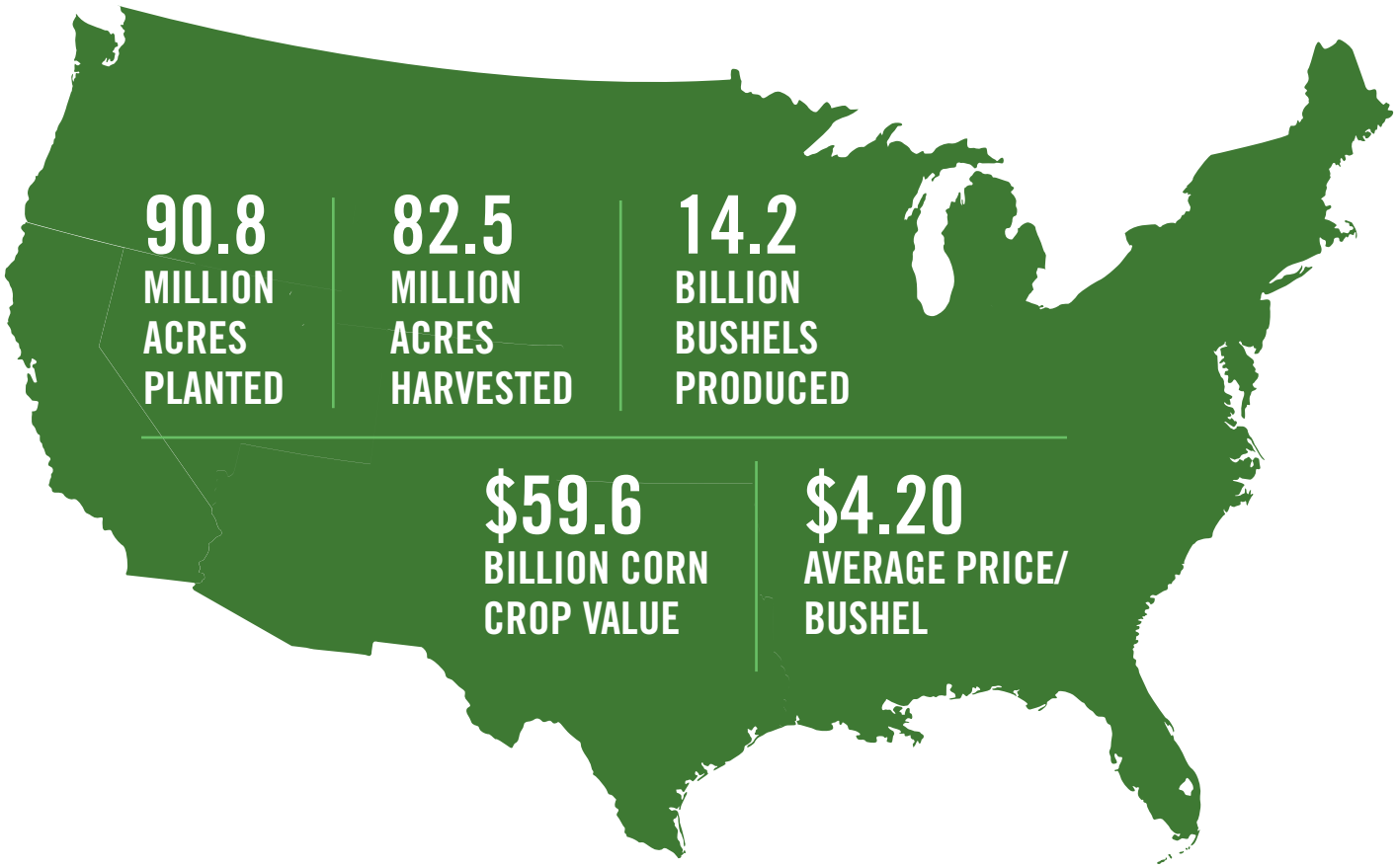
$797.22 B
taxes

direct output

$2.70 T

[1]*The Feeding the Economy food and agriculture industries economy study, 2020*

U.S. CORN AT A GLANCE



EXPORTS CONTRIBUTE TO GDP, JOBS

From an export perspective, corn creates positive impacts on the U.S. trade balance, as the world's leading corn exporter. Corn exports come in the form of whole corn and corn products, including ethanol, food and feed products. However, one not-so-obvious export that corn greatly impacts is meat. A percentage of corn fed to livestock in the U.S. ends up as traded meat products, adding to corn's overall impact to the GDP.

Direct Economic Contributions of U.S. Corn & Corn Product Exports[2]

COMMODITY	JOBS	LABOR INCOME ($ MILLION)	GDP ($ MILLION)	OUTPUT ($ MILLION)
CORN	46,679	$1,992	$3,875	$12,908
ETHANOL	1,218	$160	$408	$2,544
MEAT	14,308	$574	$1,116	$3,718

[2]*USDA NASS, USDAERS, IMPLAN, and IHS Markit*

COMMITMENT TO THE FUTURE

The Swanson Family, northern Illinois

Corn farmers' dedication to land, water and other resources do not stop at the boundaries of their own farm. Through a range of initiatives at the state, regional and national level, farmers collaborate with members of the supply chain, government, academia and nonprofits to continue managing sustainably toward the future, often investing their own collective dollars.

The initiatives are broad in scope, covering everything from on-farm research to supply chain pilot programs. While specific programs may focus on soil, water or nutrient management, the takeaways influence each of those valuable resources. And, they deliver insights to help farmers further their commitment to continuous improvement.

U.S. Corn Farmers Sustainability Statement

U.S. Corn farmers are committed to continuous improvement in the production of corn, a versatile crop providing abundant high-quality food, feed, renewable energy, biobased products, and ecosystem services. As stewards of the land, we understand the responsibility we have for creating a more environmentally and economically sustainable world for future generations with transparency and through continued advances and efficiencies in land, water and energy use.

NCGA'S GOALS

BY 2030

INCREASE LAND USE EFFICIENCY BY
12%

REDUCE SOIL EROSION BY
13%

INCREASE IRRIGATION WATER USE EFFICIENCY BY
15%

INCREASE ENERGY USE EFFICIENCY BY
13%

REDUCE GHG EMISSIONS BY
13%

Initiative Spotlight

SOIL HEALTH PARTNERSHIP

Farmer-led initiatives help drive information to the farm-gate and measure change in a way that translates to actionable solutions. One such initiative was the Soil Health Partnership (SHP), which was born out of a collaboration between its founders: National Corn Growers Association, Bayer, The Nature Conservancy and The Environmental Defense Fund. This project targeted soil health to catalyze sustainable increases in agricultural production by demonstrating the economic and conservation value of improved soil management. Goals were to establish a growing network of on-farm research trials, design and implement a leveraged communications plan, increase farmer adoption of advanced conservation and identify innovative farming practices and systems that promote improved soil health. SHP offered an opportunity for producers to address soil health with organizations within and outside of agriculture to increase awareness, both among farmers and key external audiences, about the importance of soil health to improving the productivity and sustainability of cropping systems.

COLLABORATION IS KEY WITH STAKEHOLDERS

From universities to nonprofits and government organizations to private industry, corn farmers explore ways to leverage resources with other organizations that share similar goals. Collaborations have delivered both regionally and nationally to solve problems and proactively manage what's next.

Watershed Programs – Each watershed is unique, but local corn farmers are active in finding area-specific solutions to challenges presented. From the Mississippi River and its tributaries to large bodies of water like Lake Erie and the Chesapeake Bay, corn farmers are actively bringing research-funding and science-based solutions to the table. The efforts expand beyond large bodies of water, as well, with farmers actively engaging in watershed projects locally.

Nutrient Management Efforts – Many state corn associations work directly with their state Natural Resource and Conservation programs to identify the right nutrient management plans given the environmental conditions within their specific regions. State-specific efforts bring together groups focused on soil, wetlands, conservation and more with corn organizations to help educate and evolve nutrient management efforts and many corn-producing states have dedicated to technical assistance for farmers needing answers.

Edge of Field Measurement – Farmer organizations partner with academia and private organizations to conduct research and testing in-season, as well. Edge of field water testing helps deliver real-time results for agriculture's sustainability practices.

ACTIVE MEASUREMENT WITH FIELD TO MARKET

Corn farmers play an active role in Field to Market: The Alliance for Sustainable Agriculture. Field to Market helps to quantify and demonstrate the broad range of sustainability improvements across the entire value chain in several ways and farmers are pivotal in that delivery.

Field to Market®
The Alliance for Sustainable Agriculture

Benchmarking

Corn farmer adoption of technology and improvements to resource management are measured through established sustainability metrics.

Catalyzing

Farmers voluntarily join in initiatives within the supply chain to garner more information and meet specific sustainability needs of their customers.

Enabling Claims

Through the field-print calculator, farmers submit individual information that is then aggregated into regional data for supply chain partners to use when measuring their sustainability imprint.