

LEGACY

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Resurging interest in cover crops raises a new set of practical questions from farmers looking to improve soil health.





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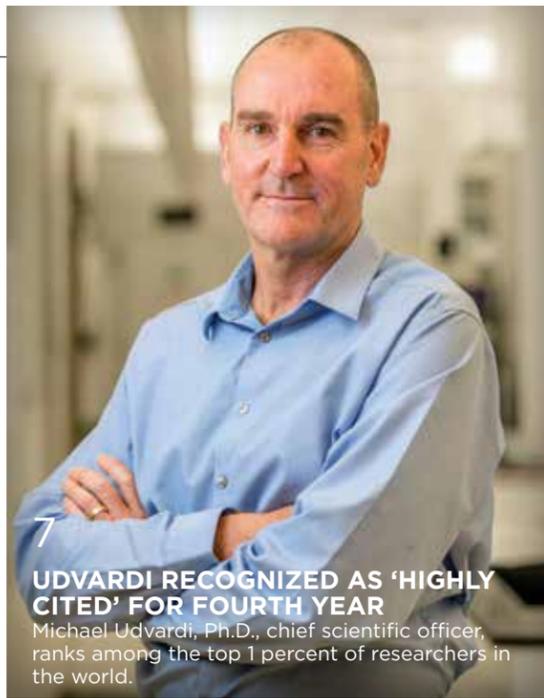
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ON THE COVER: In 2017, the Noble Research Institute and Foundation for Food and Agriculture Research (FFAR) announced a \$6.6 million research initiative, made possible by a \$2.2 million grant from FFAR, to promote soil health through the development and adoption of new cover crops across the U.S. Twain Butler, Ph.D., a Noble research agronomist, will lead the project. Learn more about this initiative and other cover crop research studies taking place at Noble, in this issue of *Legacy*.



7 UDVARDI RECOGNIZED AS 'HIGHLY CITED' FOR FOURTH YEAR
Michael Udvardi, Ph.D., chief scientific officer, ranks among the top 1 percent of researchers in the world.



LEGACY

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TO OUR READERS:

I do not like being late. But there I was, 20 minutes tardy, trying to quietly slip into the back of a breakout session at a soil health and cover crop conference in Omaha, Nebraska, several years ago, just after I started with Noble.

To be fair, I had left the previous session with plenty of time; but a business associate caught me in the hall with a question, so the panel discussion regarding cover crop supply chain issues would have to wait. More ideas are advanced by impromptu conversations in the lobbies, hallways and dining rooms of America than in the boardrooms. He had something to say, and I had the ears to listen.

When I finally entered the room, the voice of the panelist speaking elevated as he said, "We need organizations like the Noble Foundation (now the Noble Research Institute) developing new cultivar varieties!"

I stopped at the threshold of the bulky double doors. I didn't know the speaker. He didn't know me. Soon I would be the one in the hallway with a question to ask.

The man turned out to be Keith Berns, a fourth-generation Nebraska farmer, who is a leading authority on cover crops. Berns, along with his brother, Brian, began producing cover crop seed in 2010. Their venture blossomed into a company, and now Green Cover Seed produces enough cover crop seed to blanket 500,000 acres, according to *The New York Times*.

After the session, I asked Berns to expound on his proclamation. He noted that Noble should be at the center of the cover crop industry, "because, frankly, you are already there." He reminded me that we have one of the most popular cereal rye varieties, Elbon rye (which I had never heard of and is Noble spelled backwards).

I thought to myself, we are a reputable researcher and breeder of forages, which in reality are cover crops. Elbon rye, which in 1956 became our first plant variety release, is his company's No. 1 seller. Perhaps we are missing something. Do we really hold one of the many tools to soil health enhancement and just haven't tapped our potential? I returned to Ardmore and posed these questions to our team.

Today, I'm proud to say that this year, the Noble Research Institute and the

Foundation for Food and Agriculture Research launched a \$6.6 million, national research initiative to improve cover crop varieties (see page 20). The initiative will bring together representatives from the seed industry, the U.S. Department of Agriculture's Agricultural Research Service (ARS) and Natural Resources Conservation Service (NRCS), multiple land-grant universities, and an existing Legume Cover Crop Breeding Team. This research promises to propel cover crops into the next generation.

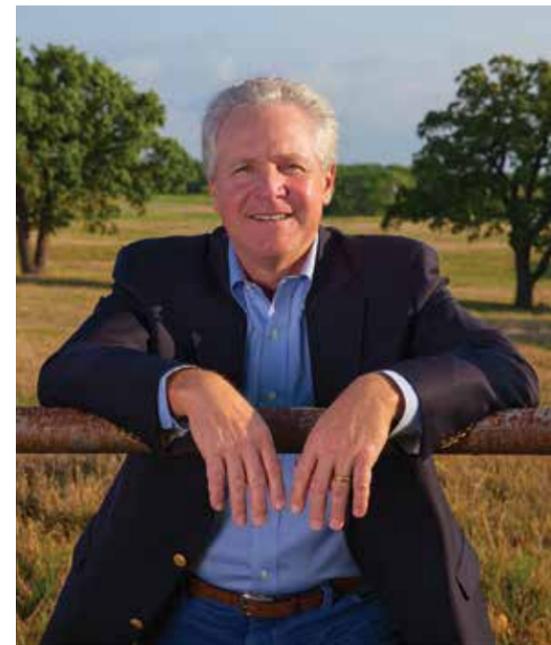
Likewise, we also convened industry leaders, government agencies, private organizations and agricultural producers this spring to discuss how we could modernize the nation's supply chain for the large-scale delivery of cover crops. The result of these discussions was the formation of the Cover Crop Coalition, which has the express goal of having 150 million acres of agricultural land utilize cover crops in the next 10 years.

This is the beginning of the second great era of cover crop usage. The first was several centuries ago when cover crops were commonly used by our founding fathers George Washington and Thomas Jefferson. Today's effort will combine the traditional virtues of this practice with today's technology and advanced breeding practices. This is the moment for agriculture to delve deeper into cover crops and embrace the opportunities and, yes, even the challenges that come with cover crop management.

We must continue to invest our resolve and resources to make cover crops a permanent fixture within agriculture practices. We must build momentum so we can restore and rebuild our soil. We cannot delay action, and we cannot be late. You know how much I dislike that.

Sincerely,

BILL BUCKNER, PRESIDENT AND CEO



THIS IS THE MOMENT FOR AGRICULTURE TO DELVE **DEEPER INTO COVER CROPS AND EMBRACE THE OPPORTUNITIES** AND CHALLENGES THAT COME WITH COVER CROP MANAGEMENT.

ALL BEEF IS GRASS-FED

We want you to know what you're seeing - and not seeing - at the beef counter.

Walk up to the beef case in your local grocery store, and you are sure to find a variety of labels calling out to you: "I'm the best choice for your family!" "No, I am the one you want!" If we're going to sell beef, we have to market it. Right? Well, in the marketing process, the reality of products and how they compare to one another often gets lost.

One of the meat labels we frequently see is "grass-fed." In reality, all beef comes from cattle that are grass-fed. All cattle eat grass the majority of their lives. Here, we illustrate the main difference between the two production systems: what cattle eat to put on those final pounds during what's called the "finishing" period.



MEET THE NOBLE EXPERT SOURCE
Evan Whitley, Ph.D., coordinates applied research programs related to sustainability of agricultural production systems in the Southern Great Plains. He has also served as a livestock consultant and directed livestock operations as executive vice president at Dakota Beef, a vertically integrated organic beef company.

1 From the time a calf is born, it has access to grass. Calves increasingly depend on forages (edible parts of plants other than the separated grain) as a complement to their mother's milk until they are weaned at 6 to 8 months of age.



2 After a calf is weaned, it may continue to graze on its birth ranch or go to market.



3

Depending on market conditions, calves lighter than 750 pounds are purchased by stocker operators, who graze the calves on small grains pastures (commonly wheat, rye, triticale and/or oat grass) for an additional four months before they go to the finishing yard.

4

Calves 750 pounds or heavier are typically sold to a finishing yard. There, about 10 to 15 percent of their diet is roughage (hay, or dried grasses). The remainder is grains, which are the seeds of grasses and other crops. This finishing process lasts about three to six months.



There, their diet is made up of

10-15% ROUGHAGE.



Why do we need both grain-finished and grass-finished beef?

Choice is good for both producers and consumers. Finishing on grain uses less land, water and fossil fuel resources compared to grass-fed systems, according to research by Judith Capper at Washington State University. Grain-finishing also allows us to produce more beef. It typically takes longer to raise a grass-finished calf ready for harvest compared to a grain-finished calf, and often grass-finished cattle do not yield as much beef. Plus, most grass resources aren't conducive to finishing cattle. We simply don't have enough land to produce the same amount of beef on grass alone. These efficiency losses are partially why grass-finished beef is more expensive.

Closer to the dinner plate, beef from grain-finished cattle achieves the marbling (streaks of fat) most Americans associate with a high-end steak. Less marbling may mean some advantages in leanness, but all beef (including grain-finished) offers 29 lean cuts of meat.

Bottom line: With facts in hand, you can feel good about any choice you make when it comes to food. The Noble Research Institute's research is focused on improving land stewardship, which includes enhancing efficiency in beef production regardless of marketing claims at the grocery store. There is no one-size-fits-all production system when it comes to sustainability, and farmers and ranchers must be able to determine what best fits their land and operation. You, too, must determine what best fits your family, so don't be afraid to ask questions of producers and other experts when it comes to understanding a label.

CATTLE TAGS OF THE FUTURE

All Noble cattle carry three forms of identification: a traditional visual tag and two types of electronic identification. Here's why.

by Austin Miles, cattle and technology research associate

In livestock production, most ranchers keep track of "who's who" with the help of visual tags. These tags are placed in the cartilage of the animal's ear, much like an earring. The number on the tag, and sometimes other details such as the tag's color or placement, provides the rancher with information about that animal with a single glance. Each animal has a unique number, featured on the tag, that links that animal to its production and health records. For example, a rancher would use these numbers to record when a cow gave birth (and which calves were hers), when an animal was given a vaccine, or to record weight gains of growing calves.

Visual tags will always be the most widely adopted form of animal identification, but that does not mean they have not been infused with modern technology. Electronic identification (EID) tags have been commercially available for many years and are making data collection and animal ID as simple as scanning a barcode.



MEET THE NOBLE EXPERT SOURCE

Austin Miles assists with research projects involving beef cattle at the Noble Research Institute. He specializes in data management and analysis, animal stockmanship, and identification and implementation of innovative technologies relevant to beef production and animal husbandry. Miles manages a cow-calf herd with his wife and family on the farm he grew up on in Texas. Follow him on Instagram @austinmiles2010 for a look at life on Noble research and demonstration farms and ranches.

What agricultural technologies are you interested in knowing more about? Send your questions to legacy@noble.org.



What are EID tags?

EID tags allocate a unique number to the animal that can be read by a digital scanner. These tags (or buttons) are placed in an animal's ear in the same way as conventional visual tags. Using digital readers, a computer program recognizes the encrypted number, electronically recording which cow was scanned and any production or processing data a producer wishes to catalog.

Why would producers want to use EID tags?

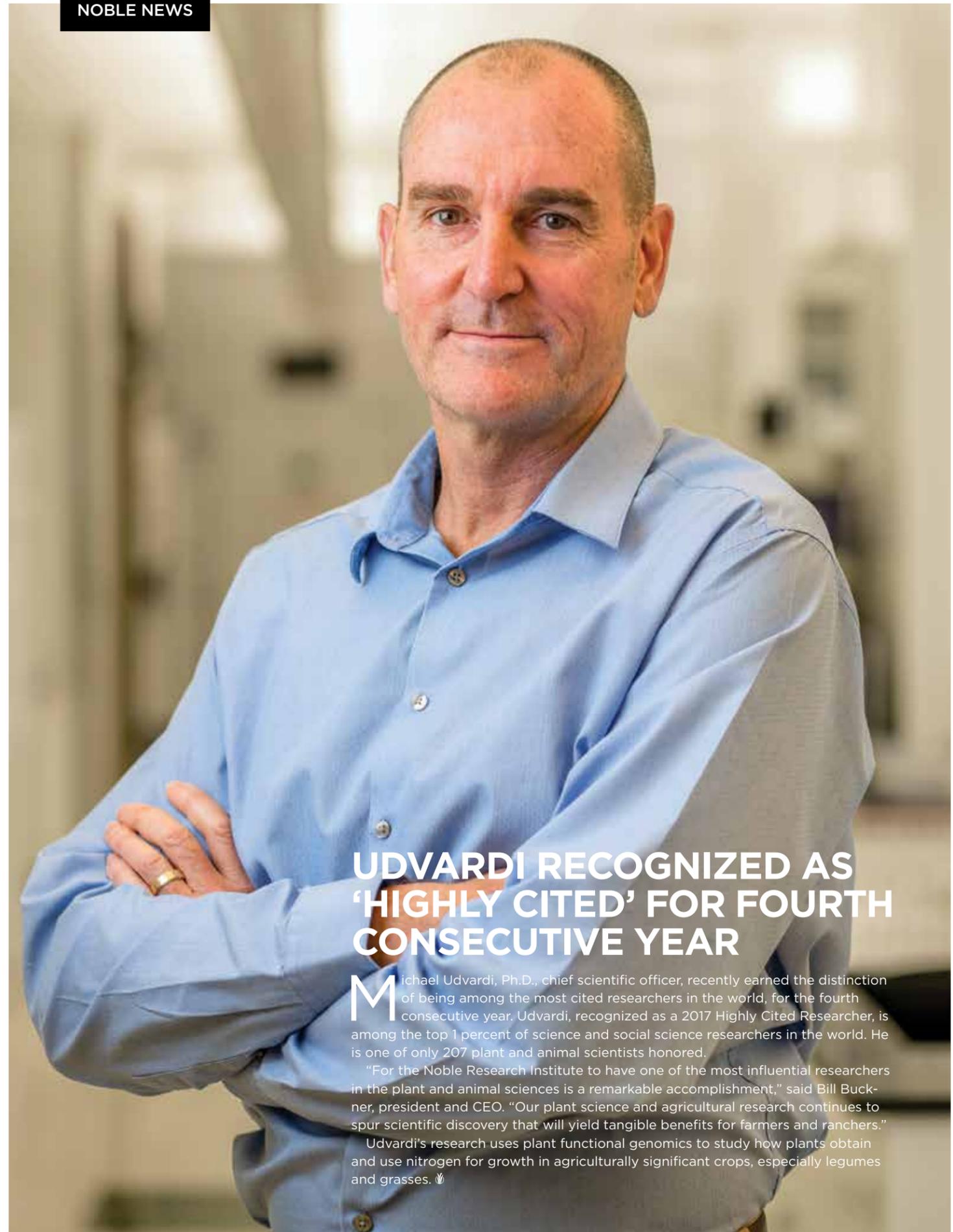
The primary value of this technology is the collection and transfer of information (i.e., animal health records), especially when those animals change ownership or move to the next phase in the beef production system. In addition, many other innovations rely on the use of EID technology, such as GrowSafe Systems, Ltd., a company the Noble Research Institute collaborates with to identify individual animal performance to assess efficiency and predict illness.

How are tags used at the Noble Research Institute?

At the Noble Research Institute, all cattle carry both an EID and a visual tag. Embedded in each animal's visual tag is another form of electronic identification that relies on UHF (ultrahigh frequency) technology. It acts similarly to the EID tag but has a vastly superior read-range and can be housed in much smaller applications. This form of digital identification allows for larger groups of animals to be scanned at greater distances and higher speeds compared to the low frequency of the EID tag.

What do you see for the future of electronic identification?

The utilization of UHF technology is in its infancy in the agriculture sector, but I am excited about what the future may hold. Soon, ranchers may be able to fly drones to check their cattle, scanning the herd to get an accurate inventory, all without leaving their home or office. 🌱



UDVARDI RECOGNIZED AS 'HIGHLY CITED' FOR FOURTH CONSECUTIVE YEAR

Michael Udvardi, Ph.D., chief scientific officer, recently earned the distinction of being among the most cited researchers in the world, for the fourth consecutive year. Udvardi, recognized as a 2017 Highly Cited Researcher, is among the top 1 percent of science and social science researchers in the world. He is one of only 207 plant and animal scientists honored.

"For the Noble Research Institute to have one of the most influential researchers in the plant and animal sciences is a remarkable accomplishment," said Bill Buckner, president and CEO. "Our plant science and agricultural research continues to spur scientific discovery that will yield tangible benefits for farmers and ranchers."

Udvardi's research uses plant functional genomics to study how plants obtain and use nitrogen for growth in agriculturally significant crops, especially legumes and grasses. 🌱

New 'toolbox' created to better study alfalfa

Alfalfa is the fourth most widely grown crop in the United States and an important crop throughout the world. Agricultural researchers are looking to better understand and improve the many positive attributes of alfalfa, such as its high protein content and nutritional quality.

Scientists at the Noble Research Institute have developed the Alfalfa Breeder's Toolbox, a comprehensive, web-based portal that serves as a community resource enabling alfalfa breeders and the research community to share, access and visualize knowledge about alfalfa.

"The Toolbox will provide more opportunities to solve practical challenges for alfalfa production and include more efficient ways to organize, store, manage, integrate and analyze all of the complex, large-scale datasets being generated for the crop," said Maria Monteros, Ph.D., Noble associate professor in legume breeding and project coordinator. "Ultimately, the Toolbox will enhance efficiencies and result in shorter timelines to develop new varieties that address current and future agricultural production challenges."

Contributions from Noble, the National Center for Genomic Resources, University of Minnesota, J. Craig Venter Institute, University of California and other industry partners make up the resources available in the Toolbox. 🌱



🖱️ Visit www.alfalfatoolbox.org for more information.



Grant allows researchers to study genes that help legumes access nutrients

Legumes have long been used by farmers as part of crop rotations and other soil-health-building practices because of their unique ability to fix nitrogen.

A better understanding of how this happens at the genetic level can ultimately provide scientists the ability to improve legumes' natural abilities to efficiently acquire nutrients. This knowledge could also potentially be translated to other, non-legume plant systems like corn and wheat.

Scientists at the Noble Research Institute, Boyce Thompson Institute, Clemson University, Texas Woman's University, University of Delaware and University of North Texas recently received a four-year, \$5 million grant from the National Science Foundation to identify and study key plant genes required for important, mutually beneficial relationships between soil microbes and the model legume species *Medicago truncatula* and alfalfa. 🌱

🖱️ Learn more at: noble.org/legume-grant

10 TRUTHS ABOUT BEEF

Beef is tasty anyway you fix it: sizzled on the grill, roasted in the oven or dried for jerky. Here are some facts about our favorite protein and the industry that produces it.



The journey of bringing beef to the table represents the most unique and complex life cycle of any food. The process takes about two to three years.



There were **93.5 MILLION CATTLE IN THE U.S.** as of Jan. 1, 2017.

About a third of them were beef cows. The rest include calves, beef bulls and dairy cattle.



The average number of cows in a herd is 40.



To be considered lean, a 3-ounce cooked serving of beef must have less than 10 grams of total fat, 4.5 grams of saturated fat and 95 milligrams of cholesterol. This qualifies more than 60 percent of beef cuts (when cooked with visible fat trimmed) found in the supermarket.



An estimated 30 to 40 percent of all food in the U.S. is wasted each year. That's about \$2,500 down the drain for the average American family. But meat, including beef, is one of the least-wasted food categories, according to the U.S. Department of Agriculture.



Nearly 160 cattle producers in 33 different states have been recognized through the Environmental Stewardship Award Program since 1991. Winners are selected by a group of university, conservation organization, and federal and state agency representatives, who consider management of water, wildlife, vegetation, air, and soil along with leadership abilities and overall business sustainability.



Rangelands cover about 30 percent of the U.S. and are found in all 50 states. Rangelands across the Great Plains were developed under grazing pressure, which is why grazing cattle is important for the health of this ecosystem.

Texas, Nebraska, Kansas, California and Oklahoma

RAISE THE MOST CATTLE IN THE U.S.



A cooked 3-ounce lean beef burger patty averages around 154 calories while providing nearly half the recommended daily value of protein (about 25 grams). Expect to consume more calories for the same amount of protein with options like peanut butter (6 tablespoons for 564 calories) or quinoa (3 cups for 665 calories).



Beef provides 10 essential nutrients including protein, vitamins B6 and B12, selenium, zinc, niacin, phosphorus, choline, iron, and riboflavin.

Crop Science Society of America selects Noble scientist for highest honor



Noble Research Institute professor Twain Butler, Ph.D., was named a Fellow of the Crop Science Society of America at their annual meeting earlier this year. It is the highest honor bestowed by the organization.

“Dr. Butler continues to distinguish himself as one of the top researchers in agricultural science,” said Michael Udvardi, Ph.D., chief scientific officer. “He has also demonstrated leadership in applying sensor technology for forage research.”

Butler’s research focuses on tall fescue, alfalfa, wheat and bermudagrass grazing systems to determine the optimal forages for the Southern Great Plains. As new technologies and varieties are

developed, livestock producers need to know the best management practices and economic considerations prior to making decisions to adopt these new practices on their operations. Butler is also the project manager for the national cover crop research initiative. 🌱



Exploratory research grant allows scientists to study plant root function, nutrient uptake in agricultural crops

Roots are more than just the location where soil and plants come into contact. They play a critical role in the environment and hold a great deal of promise for helping improve agricultural sustainability.

However, roots are the hidden half of the plant, and observing their form and function is made difficult by their underground life. While scientists have gained a better understanding of the structure of root networks within the soil (called root system architecture), few studies have explored what roots do and how they do it.

Researchers at the Noble Research Institute and University of Missouri received a two-year grant from the National Institute of Food and Agriculture to enhance understanding of root function and plant nutrient uptake. 🌱

[To read more, please visit noble.org/plants-roots-release](https://noble.org/plants-roots-release)

3 Things to Look Up



Cover Crops in the Garden

Did you know you can use cover crops in your home vegetable garden? If you don’t plan to grow cool-season vegetables, consider planting a cover crop to help replenish and retain soil nutrients. Jack Horan from *State-by-State Gardening* has some recommendations for cover crops you can use in your backyard.

[View the full article at: bit.ly/cc-vegetable-garden](https://bit.ly/cc-vegetable-garden)

Uncover 4 Key Mindsets to Successful Cover Cropping

It takes a great deal of thought to successfully use cover crops on the farm. Steve Groff, a cover crop pioneer who farms on the Chesapeake Bay watershed, provides farmers with helpful tips in this *American Agriculturist* article. Groff wants to empower producers to plant with confidence and leave the soil better than they found it for generations to come.

[View the full article at: bit.ly/cc-key-mindsets](https://bit.ly/cc-key-mindsets)

10 Potential Cover Crop Pitfalls

It’s good to walk into every situation prepared, and growing cover crops is no different. Sonja Begemann from *Farm Journal* points out 10 potential cover crop pitfalls for farmers to keep in mind. Cover crop knowledge is farming power.

[View the full article at: bit.ly/cc-potential-pitfalls](https://bit.ly/cc-potential-pitfalls)

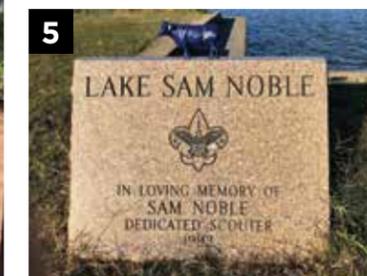
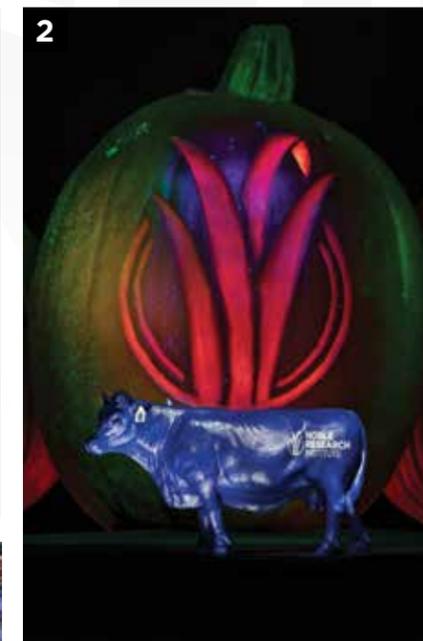
WHAT'S ONLINE



#BLUECOW TRAVELS

FOLLOW ALONG @bluecow

The blue cow has crossed seas and wild terrain, relaxed in some of the world’s most beautiful places, and met great people doing important work for science and agriculture.



1. Meeting insect scientist Mark Moffett, Ph.D., at *Profiles and Perspectives*, Colorado, *Jennie Hodgen*
2. Happy Halloween from Noble, Ardmore, Oklahoma, *Rob Mattson*
3. With a new friend, Jesiah, in Uganda, *LaNese Mahan*
4. Enjoying snow at the National Cattlemen’s Beef Association in Denver, *Brice Cazenave, Ph.D.*
5. Honoring founder Lloyd Noble’s son at Camp Simpson, Bromide, Oklahoma, *Shane Porter*
6. Prescribed burn time at Oswalt Ranch in Marietta, Oklahoma, *Mike Proctor*
7. Beach time after an international agriculture conference, Florida, *Brice Cazenave, Ph.D.*

Keep up with the blue cow’s adventures at facebook.com/bluecow and share your connections to agriculture, science and the Noble Research Institute by posting your own blue cow photos. Use #bluecow and @nobleresearchinstitute (on Facebook and Instagram) and @nobleresearchinst (on Twitter). Don’t have a blue cow? Turn the page for how to receive one and join the fun.

FROM OUR FEEDS

FOLLOW ALONG  @nobleresearchinstitute  @nobleresinst

We love to hear from colleagues and friends on social media, and we'd love to hear from you. See what people have been saying.

 Scientists across the nation, including ours here at Noble Research Institute are giving us more to work with as they continue to discover the complex world of soil. If you are farming and ranching and haven't had the chance to delve into these discoveries, now is a great time to start. They will change your perspective and your bottom line.
Amy Hyatt Hays, Dec. 7



 Nonresident fellow @nobleresinst Johnathan Lynch explains "steep, deep and cheap" root ideotype #plantbio17 @isipg2, June 14

 Hands-on (&mouth) experience, taste testing cover crops @nobleresinst @FridayTracy @STEAM_MS #agchat #steampin #steamlearns @Hernandez_STEAM, June 20



 Noble Research Institute President and CEO Bill Buckner thanks OKFB for working alongside his organization to promote agricultural research. #OKFB75 Oklahoma Farm Bureau, Nov. 10

 Good day, got combine moved from Eakly to Perkins, torn apart and cleaned then cut @nobleresinst NF402 #Oats this evening. @OSU_OKFoundSeed, June 7



 We just downloaded this "AG TOOLS" App we learned about through the Noble Research Institute. Check it out! The Luling Foundation, Oct. 20



 Renovation white clover - released for its agronomic & animal performance @nobleresinst #openaccess @PlantReg, June 12

HOW CAN I GET A BLUE COW?

The Noble Research Institute is opening up the blue cow campaign so that anybody can participate. The first 300 people who like or follow one of the organization's social media networks will receive a blue cow.

Participants must like or follow one of our social networks, then post a message with @nobleresearchinstitute (or @nobleresinst on Twitter) with the hashtag #bluecow and the phrase, "I want a blue cow!"



The participating Noble Research Institute social network pages include:

-  facebook.com/nobleresearchinstitute
-  facebook.com/bluecow
-  Instagram.com/nobleresearchinstitute
-  twitter.com/nobleresinst

Instagram TOP 10

The year 2017 will go down in Noble history as the year we refocused our attention on delivering solutions to agricultural challenges by becoming the Noble Research Institute. This is lived out in our everyday moments: farming and ranching for research and demonstration, conducting plant science, working with producers, sharing what we've learned, and giving back. Here are our top 10 moments shared on Instagram this year.

FOLLOW ALONG  @nobleresearchinstitute



10



9



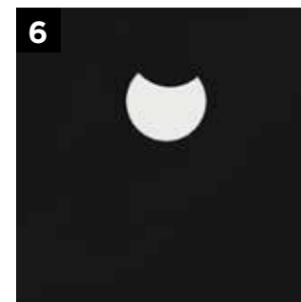
8



7



4



6



5



2



3



1

- | | |
|--|---|
| 10. Touring one of Noble's research and demonstration farms | 5. Oklahoma Agricultural Leadership Encounter students visit our greenhouse |
| 9. College student Ethan Thibault spends his summer conducting real-world alfalfa research at the Noble Research Institute | 4. Another day of caring for cattle |
| 8. Baling hay on a Noble farm | 3. A bird's-eye view of agriculture near Mosca, Colorado |
| 7. Team Noble assists with the nonprofit Air Race Classic | 2. Merry Christmas 2016 from Noble |
| 6. Viewing the 2017 solar eclipse from Ardmore, Oklahoma | 1. A new name and a new era of delivering solutions to agriculture |

FOLLOW #everyNoblestory

Catch up with our experts online for a behind-the-scenes look at the research and education activities taking place in our laboratories and on our farms.

Open range. Grazing paddocks. Pecan groves. Laboratory

benches. Solutions to great agricultural challenges are not found in one place. Every day, you can find Noble researchers focusing their expertise in varying locations. But ultimately the combination of their work contributes the greatest magnitude of solutions. We invite you to follow these individual pieces while taking a look at the grander picture by searching #everyNoblestory on Instagram and Twitter and following our blogs at www.noble.org.

The places of discovery extend far beyond our campus in southern Oklahoma. Anyone who has connected with the Noble Research Institute has a Noble story, too. We invite you to share your story. Use the hashtag (and tag us on Facebook or use @nobleresinst on Twitter and @nobleresearchinstitute on Facebook and Instagram) when posting about your part in the Noble Research Institute's quest to deliver solutions to great agricultural challenges. You can also share with us at legacy@noble.org.

In this issue of *Legacy*, we're highlighting a few of our experts who share their views of advancing agriculture and land stewardship. Check back in future issues for more #everyNoblestory perspectives. Don't forget, we want to hear your Noble stories! Connect with us on social media or email legacy@noble.org.



@rangeroaster

Mike Proctor
Research Associate
Range Ecology and Technology

#EVERYCOGANDWHEEL

Join Mike Proctor out on the range as he manages and monitors vegetation, grazing and livestock using prescribed fire and advanced technologies. Taking note from conservationist Aldo Leopold, Proctor uses Instagram to show how the components (cogs) and processes (wheels) of range management and grassland ecology come together for a healthy landscape.

OUT ON THE RANGE

Follow @rangeroaster to put a face and name to the plants, animals and processes that are affected by, and drive, land management decisions. And enjoy the natural beauty of southern Oklahoma.



Big Bluestem in the sunset
#AndropogonGerardi
#BigBluestem
#EveryCogAndWheel



@MedicagoNews

Sonali Roy, Ph.D.
Postdoctoral Fellow

INTRIGUING SOLUTIONS

Legumes – plants including alfalfa and soybean – are great at working with the microbial communities around them to fix their own nutrient needs (especially nitrogen). This ability – which could be tapped into to improve a plant's capacity to efficiently use nutrients thereby reducing the need for fertilizers – intrigues scientists including Sonali Roy, Ph.D., who studies how it works.



Here's an opinion article listing the 'Top 5' resources available to our research community today.

REACHING RESEARCHERS

Scientists often use alfalfa (*Medicago sativa*) and its cousin *Medicago truncatula* in these studies (and others). Roy uses Twitter to reach fellow researchers studying *Medicago*. Follow her for relevant news and resources from the Noble Research Institute and the research community.



@drwebbwildlife

Stephen Webb, Ph.D.
Landscape Ecologist

ON THE WILD SIDE

The research of Stephen Webb, Ph.D., has put him in close contact with wildlife from elk to bobcats while working in Texas, Mississippi, Colorado and Wyoming. Now, at the Noble Research Institute in Oklahoma, he focuses on how feral hogs and white-tailed deer interact with their environments while incorporating natural resources and livestock into these wildlife studies.

OH DEER

Get an inside look at Webb's latest research, and what he has learned in the past, by following him on Instagram. He shares timely information – and some cool animal behavior videos and images – relevant to hunters, biologists and anyone interested in wildlife.



#deerseason is here. Don't forget to #harvest #does to help meet your #population #management #goals.



@Grass_Fed_Geeks

Sindy Interrante, Ph.D.
Technical Scientist

TO FILL A NEED

As new technologies and forage cultivars are developed, livestock producers need access to best management practices and economic analyses before deciding if they should adopt these new tools on their operations. To meet this need, Sindy Interrante, Ph.D., and others in the Forage Agronomy Laboratory, led by Twain Butler, Ph.D., evaluate grazing systems to determine the best forages for the Southern Great Plains.



#Rotationally stocked #800RR #alfalfa still looking good in mid-July with #bermudagrass #pasture #grazing #everynoblestory @nobleresinst

SEE THE GRASS GROW

Follow Interrante on Twitter to discover what Noble is doing in the fields of grazing, cover crop and soil health research.



@noble_pecanpieces
@PecanPieces

Will Chaney
Senior Research Associate

IN A NUTSHELL

The Noble Research Institute is one of just a few research organizations that investigate pecan – a heart-healthy nut packed with more than 19 vitamins and minerals. Will Chaney is one of the faces behind research that seeks answers to pecan growers' questions, and he's building a social community for pecan producers and all interested.

TO THE PECAN ORCHARD

Join Chaney in the pecan orchard via Twitter and Instagram for a look at how this nut is produced and to stay up-to-date on the latest research and management information.



Kanza pecans shelled and cleaned. Harvested just a few weeks ago @nobleresearchinstitute and ready for the holiday sales. #everyNoblestory #pecan #farm #agriculture #food #traditions #fall



@Yuhong_Julie

Yuhong Tang, Ph.D.
Genomics Core Facility Manager

A CURIOUS MIND

Yuhong Tang, Ph.D., has always been curious about the natural world, and she brings her inquisitiveness to work every day. Tang helps meet scientists' needs through the Genomics Core Facility, which delivers the information they need about genes through DNA sequencing (the first step toward detecting genes related to desirable traits for agriculture, like nutrient-use efficiency).



#Chinesepapercut was one of the activities during #Noblefest. @nobleresinst scientists and families from the world celebrate their cultural heritage. #everynoblestory

NOBLE TOGETHER

See what sparks Tang's curiosity by following her on Twitter. She also shares some of the multicultural activities that bring the Noble Research Institute community together.



@nobleresearch_north_farms

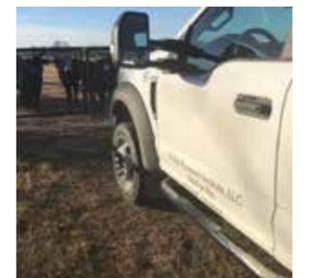
Brooks Braunagel
Research Assistant

IT'S A FARM LIFE

Head out to Noble's farms in the Ardmore, Oklahoma, area with Brooks Braunagel. Follow him on Instagram for a look at daily life caring for cattle and the routine activities that need accomplishing on a farm, from fixing fence to planting and managing forages.

HEALTHY LAND AND CATTLE

Braunagel points out the importance and benefits of no-till planting, rotational grazing and other land stewardship practices demonstrated on Noble ranches. Whether he's on the job or at home, Braunagel knows the value of these practices. He implements them on his own cow-calf operation on family land.



I think these girls are starting to learn the routine! #everynoblestory #homeraised #lowstresshandling #bredheifers #blackbaldies #blackangusbeef

Pollinators are attracted to sunflowers, one of many species evaluated as cover crops for the Southern Great Plains by consultant Jim Johnson.

CO COVER ED

A resurging interest in cover crops raises a new set of practical questions from farmers looking to improve soil health with “green manure.”

by Laura Beil

Three generations have worked the 9,000 acres of southwestern Oklahoma farm and ranch land Jimmy Emmons' grandfather bought in 1926. About seven years ago, though, the yields for all his crops – sorghum, winter wheat, sunflowers and more – hit a wall. No matter what he tried, his output remained stubbornly flat. “It didn’t matter if we put on more fertilizer or it rained more,” he says. “We had reached a peak in production.”

In search of fresh ideas, Emmons began to attend conferences and seminars. In one, he heard a farmer from central Ohio talk about how he transformed his land by planting cover crops, which are grown specifically for the benefit of the soil. Cover crops often remain where they are planted until they die or are killed, the organic matter dissolving into the ground below. In the seminar, Emmons was told that cover crops leave healthier soil, which leads

to plants that grow better even as you cut back on fertilizer and water.

“I thought, man, if I could do that here in Oklahoma that would be great,” Emmons says. He went back home energized, determined to give cover crops a try.

In doing so, he became part of a new trend that is in fact centuries old, possibly as old as farming itself. Native Americans used a concept called “Three Sisters” in which corn, beans and squash were grown together to enrich the earth. George Washington and Thomas Jefferson, who were gentleman farmers before they were revolutionaries, also hailed the benefits of planting crops specifically to replenish the soil after a harvest. In the 1800s, cover crops became known as “green manure” and were widely embraced.

With the invention of synthetic fertilizers in the mid-20th century, however, the practice fell out of favor. Cover crops

seemed like a quaint idea of yesteryear, not a tool of modern farming. Their use fell and, by the 1970s, almost all farmland lay bare as it awaited next season’s planting.

But now, cover crops may be on the verge of a new golden age as more farmers recognize that planting a cover crop makes sense both agriculturally and economically. “There is a renewed interest in the old practice of using covers,” says Twain Butler, Ph.D., a research agronomist at the Noble Research Institute. Butler serves as project manager for a national cover crop research initiative jointly supported by the Foundation for Food and Agriculture Research and Noble Research Institute.

The agriculture industry – and consumers – are showing a greater interest in farming practices that naturally tend the soil while protecting the environment. By reducing the need for chemical fertilizers, cover crops also lower the danger of



A B O V E : The Natural Resources Conservation Service of Missouri’s Soil Health Committee discussed soil, roots and cover crops with Jim Johnson, soils and crops consultant, (far right) during a tour at the Noble Research Institute. **R I G H T :** Sunn hemp, a tropical legume, grows as part of a cover crop trial.



NATIONAL COVER CROP RESEARCH INITIATIVE

In March 2017, the Foundation for Food and Agriculture Research (FFAR) and the Noble Research Institute announced a \$6.6 million, national research initiative, made possible by a \$2.2 million grant from FFAR, to promote soil health through the development and adoption of new cover crops across the U.S.



While cover crops are generally planted to improve soil health, not every variety will fit every producer. There are many factors to consider, including geographic location.

As part of the research initiative, researchers from across the country have pulled together to answer questions producers have about “What will work for me?” whether they farm or ranch on the East Coast or in the Midwest. This network of researchers will also work with farmers and ranchers to better understand what is needed in the field as well as with seed companies to expand effective options on the market.

QUICK FACTS:

The initiative brings together researchers from the USDA’s Agricultural Research Service and Natural Resources Conservation Service, several land-grant universities, and the Noble Research Institute.

Cover crop species to be studied include small grains (wheat, rye, oat and triticale), annual legumes (hairy vetch, winter peas and clovers) and brassicas (turnips, radishes, kale and mustards).

Primary field trials will take place in five strategic sites representing different regions of the U.S.: the Northeast (Maryland), the Southeast (North Carolina), the Southern Plains (Oklahoma), the Northern Plains (Nebraska) and the Midwest (Missouri).

nitrogen and phosphorus runoff into nearby waterways. (Excess nutrients in ground and surface water can contribute to the excess growth of algae and other aquatic plants.) So-called green manure is green in more ways than one.

Based on a national farmer survey, funded by the U.S. Department of Agriculture, cover crop users in 2012 were planting just more than 200 acres per farm. By 2016, that number had doubled, reflecting a rapid rise in adoption. Still, the estimated 17 million acres of cover crops in the U.S. today represent just a small fraction of the 250 million acres of row crop fields in the U.S. as of the most recent census, from 2012.

In encouraging cover crop planting, scientists like Butler and others stress the benefits to farmers. They are working to provide data to address some of farmers’ practical questions: Which is the best type of crop to use for which field? How do short-term costs compare with long-term gain? When is the best time to kill the cover crop? How do cover crops affect soil moisture? “There’s not going to be one answer,” Butler says. “It’s going to be different in Oklahoma and this part of the country than elsewhere.”

The most common types of cover crops in use today are cereal grains, mustards such as tillage radishes and turnips, legumes like crimson clover and winter peas, and summer annuals. The choice of what to plant depends on climate and each farmer’s need – including the location, growing season and type of farm, says Rob Myers, regional director of extension programs for the Sustainable Agriculture Research and Education program, which is part of the USDA, and an adjunct professor at the University of Missouri. Each type of plant has its own particular character. Soybean farmers in northern states harvest shortly before the

CONTINUED ON P. 23

OPPOSITE PAGE

T O P : Close-up views of plants being evaluated as cover crops for the Southern Great Plains by consultant Jim Johnson. While farmers are increasingly interested in cover crops, answers to their questions, including which cover crop species to use, will vary from region to region.

B O T T O M : As a legume, sunn hemp’s roots form specialized organs called nodules. Soil bacteria called rhizobia live within these nodules and enable the legume to produce its own nitrogen fertilizer from nitrogen in the air.



For more information

Learn more about the project and watch a recording of the announcement at www.noble.org/cover-crops-initiative



ASK THE EXPERT:
JAMES LOCKE

James Locke serves as a soils and crops consultant for the Noble Research Institute and is certified as a crop adviser by the American Society of Agronomy.

Q. Were the farming practices of the early and mid-1900s more eco-friendly than modern agriculture?

A. In some ways “yes,” and in other ways “no.” On the one hand, agricultural producers in the early and mid-1900s used fewer synthetic fertilizers and pesticides. They utilized more green manure crops (which we call cover crops today) to provide nitrogen fixation and weed suppression, which provided greater plant diversity. Most operations were diversified to include an animal component to provide meat, milk and eggs.

On the other hand, while fewer pesticides were used, those pesticides were not well tested or regulated. They were often very toxic, and most are now off the market.

Perhaps the most significant difference is the lack of conservation tillage used. In that era, it was widely believed that clean tillage was the only way to farm. The resulting bare soil and destruction of soil structure allowed significant soil erosion.

Also, little crop rotation was practiced. Farmers typically planted a primary cash crop on the same ground year after year, often without replacing the nutrients removed. These practices greatly exacerbated the effects of drought in the 1930s and made the Dust Bowl much worse.

Since the early and mid-1900s, agricultural research has yielded many innovations that have improved crop yields and mitigated impacts on the environment. We use more pesticides today, but these pesticides are extensively tested before release and must be approved by both the U.S. Environmental Protection Agency and state departments of agriculture. Most farmers now follow Integrated Pest Management principles, which consider economic thresholds and biological or cultural options in addition to pesticides.

We use more synthetic fertilizers and have more concentrated use of animal manures today, but we have improved our efficiency by following the “4R” approach of using the “right place, right rate, right source and right time” for nutrient inputs. Many farmers are working to improve soil health and reduce erosion potential by implementing reduced or no-tillage farming practices, adding cover crops, and increasing crop rotation.

Finally, protecting pollinator health has become a new focus for production agriculture. While these efforts have paid dividends, there is still room for improvement. Nutrient runoff into water bodies, erosion, pesticide resistance and off-target drift remain as areas for improvement.

According to the 1920 Census of Agriculture, there were more than 6.4 million farms using 503 million acres to provide food and fiber for about 106 million Americans, plus exports.

In comparison, today’s modern agriculture has become more efficient at producing food and fiber. As of the 2012 Census of Agriculture, there are 2.1 million farms using almost 390 million acres to provide food and fiber for 313 million Americans, plus exports. This is a 73.82 percent reduction in land use per person.

While modern agriculture must always continue to find new methods for improvement, the progress we have made in the face of ever-diminishing land, labor and water resources benefits both mankind and the environment.

For more information

Learn more about James Locke at www.noble.org/staff/james-locke

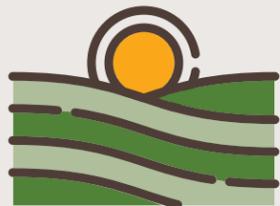
DOING MORE WITH LESS
1920 vs. 2012

FARMS IN OPERATION



1920	2012
6.4	2.1
million	million

TOTAL ACRES IN OPERATION



1920	2012
503	390
million	million

AMERICAN POPULATION



1920	2012
106	313
million	million

LAND USE PER PERSON

-73.82%
since 1920

Sources: 1920 Census of Agriculture and 2012 Census of Agriculture

Cover crops are planted in fields that otherwise would lie bare. Keeping the ground covered with rooted plants provides benefits to the soil and ultimately improves agricultural production and land stewardship.



CONTINUED FROM P. 20

first fall frost. The most common cover crop for them is quick-growing cereal rye. But some issues are overcome with creative management, Myers says. Farmers with shorter growing seasons can overseed cover crops before the main crop is harvested. The cover crops won't get big enough to interfere with harvest, and they gain a head start going into winter.

Other cover crops have surprising dual uses. Those with oversized roots, such as turnips and radishes, burrow deep into the ground and can break up the hardpan, a packed layer of soil largely impervious to water. But turnips can also be planted as a grazing crop for cattle, allowing farmers to either graze their own cattle or rent out their farms for grazing fees. Turning a crop field into a temporary pasture for livestock also adds actual manure into the soil, not just the green kind.

This ancient practice from the past may be one thing that carries us into the future, says Wayne Honeycutt, chief executive officer of the nonprofit Soil Health Institute. “The reality is that we need

to grow more and more food for this burgeoning population,” he says. “Our concern is that we are not only losing land at an alarming rate but that a lot of our soil has become diminished. Some of it is still quite productive, but it’s not as productive as it could be.”

One obstacle to cover crops, Honeycutt says, is that they are perceived as an added expense. However, after a few years they usually pay for themselves. “We know they generate a return,” he says. Over time, soil nutrients leach deep into the soil. “Cover crops bring those nutrients back to the surface so you don’t have to buy as much fertilizer.”

With their added carbon content, cover crops bind different components of the soil together into aggregates. This helps create more pore space for water. Over time, the soil becomes more drought tolerant. “When you increase organic carbon by 1 percent, you increase the soil’s ability to hold water by 2,500 to 12,000 gallons per acre,” Honeycutt says. “And that’s just in the top 6 inches alone.”

On his farm, Emmons uses a mixture of

different types of crops, including forage sorghums, radishes and mustards. He plants them immediately after harvesting, right behind the combine. In the summer months, he turns his fields of winter wheat into grazing land for cattle by planting cover crops.

Each year he planted a cover crop, Emmons saw his soil turn darker from the extra organic matter. The thick roots of the radishes break up the soil. He’s stopped tilling entirely.

And as he had hoped from the beginning, cover crops have improved his efficiency. After about three years of use, they started to more than make up for their cost. Emmons says he has cut back his fertilizer use 40 percent, and he hopes soon to reduce it by more than half. “In economic terms, that’s real dollars pretty quick,” he says. Whenever he can, Emmons now educates other farmers on the uses of cover crops. Most of all, cover crops have made him appreciate that what happens beneath the ground is just as important as what happens above, he says. “I’m never going back.”

FROM A COVER CROP RESEARCH FUNDER

The executive director of the Foundation for Food and Agriculture Research shares an interest in cover crops.

by Sally Rockey, Ph.D., FFAR executive director

Soil is the foundation of American agriculture. To give future generations a sustainable food supply, we must address soil health challenges with science-based solutions. Since the Foundation for Food and Agriculture Research (FFAR) was established in 2014, we have heard many times about the critical need to improve soil health across the United States. We have also heard about the host of environmental and economic benefits offered by one soil-health-promoting practice: cover crops.

Cover crops are known to improve soil health, reduce soil erosion, increase water efficiency and provide economic benefits to producers. But not every cover crop is right for every food production system in every environment. We must provide producers with the right options that yield benefits to their operations.

One study alone won't provide the solutions we need. We need long-term, collaborative work to investigate the complexities of using cover crops and provide real solutions for farmers.

That's why FFAR is proud to be working with the Noble Research Institute on a national cover crop initiative. The \$6.6 million partnership was designed to promote soil health through the development and adoption of new cover crops across the United States.

Why is FFAR interested in cover crops? With 10 billion people projected to populate the world by 2050, our soil – our greatest natural resource – will be strained more than ever. Farmers will need to produce more with less – less land, less resources and less water. Healthy soil will be vital to meeting future production demands.

Cover crops are a viable solution to the issue of declining soil health. New technologies and continued adoption of sustainable agricultural practices will be essential to continuing America's tradition of providing a safe, nutritious food supply.

FFAR is a 501(c)(3) nonprofit organization established by bipartisan Congressional support in the 2014 Farm Bill. We bring together leading experts to identify and investigate the researchable questions whose answers have the potential to enhance the economic and environmental resilience of our food system.

FFAR has prioritized "Healthy Soils, Thriving Farms" as one of its seven strategic challenge areas and aims to increase soil health by building knowledge, fueling innovation, and enabling adoption of existing or new practices that improve soil health.

This initiative is the perfect example of what FFAR is working to achieve – bringing together key players toward a common goal that benefits agriculture. Most important is the direct impact this research will have on producers. The work done in the lab will not stay there. It will be field-tested and applied in systems-based approaches so the investments made by FFAR and others will have a real impact on producers.

I thank the Noble Research Institute for its leadership on this project and for the dedication of its researchers to getting cover crop solutions into the hands of farmers. Together with producers, we can develop and deploy cutting-edge science to improve soil health and work toward a more efficient American agriculture system. 🌱



SUMMERTIME COVER CROPS FOR CATTLE

Noble researchers are testing how cover crops can be grown as summer forage.

by James Rogers, Ph.D., associate professor of forage systems

Cover crop use in agriculture is nothing new. Cover crops used as "green manure" date back more than 2,300 years. Prior to World War II, many experiment stations did extensive work on cover crops and crop rotations. In the 1930s, a term often used for cover crops was "soil-improving crops." These crops included clovers, alfalfa, Sudan grass, rye, oats, vetch and even weeds.

After World War II (entering the Green Revolution era), there was an abundant, cheap source of commercially produced nitrogen fertilizer, and production agriculture began to shift away from extensive cover crop use. Now the pendulum has swung back, and there is renewed interest in cover crops for their soil-improving qualities, abilities to reduce wind and water erosion, and other benefits.

An issue we face is that a lot of cover crop knowledge obtained through previous, early research work must be relearned. That is where the Noble Research Institute's applied cover crop research plays a role.

One of the major livestock production systems in the Southern Great Plains is grazing young, weaned beef cattle (stockers) on small grain, mostly wheat, from fall to spring. The land used to grow small grain pasture is typically summer-fallowed in an attempt to conserve moisture for the next small grain crop. Fallowing ground during the summer leaves it vulnerable to wind and water erosion. Also, the high summer temperatures can elevate soil temperatures, which can reduce soil microbial activity.

In our research, we want to know how we can enhance this system by growing a summer cover crop to protect and improve the soil without affecting winter pasture production, animal performance and economics.

To do this, we took an existing winter pasture study area and established a summer cover crop/winter pasture grazing study where the main factors are tillage (no-till and till) and cover crop (summer cover crop and summer fallow). The summer cover crop is a multi-species mixture of 50 percent grass (millet and corn) and 50 percent broadleaves (cowpeas, soybeans, sunn hemp and buckwheat).

Our evaluation measures forage production, animal performance, water infiltration, soil microbial activity, soil bulk density, soil moisture, nutrient cycling, and system economics of both cover crops and winter pasture. Stocker cattle graze both the cover crop and winter pasture.

Several small plot studies are also in place to evaluate other aspects of summer cover crops and winter pasture production. These include evaluating the effects of cover crop termination date, cover crop seeding rate, and terminating or not terminating cover crops on winter pasture production.

This research is producing needed scientific information on summer cover crop impacts on winter pasture livestock grazing systems, which will help producers. 🌱

A VALUABLE INVESTMENT IN SOIL HEALTH

Cover crops can boost soil health. But there is much to learn about which species work best in Oklahoma and Texas.

by Lisa Bellows, Ph.D., North Central Texas College Department Chair of Science

Many landowners spend considerable time and money investing in generational transfer of property. These same folks contribute to college funds for children and retirement accounts for themselves. They are well aware of long-term investments and appreciation of assets. Through annual evaluation of portfolios and scheduled contribution to their various accounts, they plan for the future. With land being one of the longest-term assets in a financial portfolio, an investment in soil health should be considered a priority for their future and the future of their heirs.

Cover crops can be a valuable investment in the soil health portfolio, but, like selecting the best mutual funds or timing of investments for your financial portfolio, selection of seed varieties for the cover crop mix and determining the best time to plant are two factors that require careful consideration.

Half-hearted consideration of seed selection became evident a few years ago when a farmer friend had no clue what seed varieties were in his planter box nor what the seedlings would look like if his seed germinated. This situation sparked a question for Noble Research Institute's soils and crops consultant Jim Johnson, and a research project was initiated with 93 varieties of cover crop seed species planted as monocultures to determine which varieties would best perform as winter cover crops in the North Texas and southern Oklahoma region – a region dominated by warm-season pastures for grazing and hay production. The idea was that if the seed variety performed well as a monoculture in our pastures, it would likely benefit soil health in a cover crop mix. If the variety failed to thrive or performed at a lower rate than others in the legume, grain or brassica classes, it would likely not be a good choice for a cover crop mix in the region.

As anticipated, some varieties performed favorably, and we still don't know what a few of the 93 varieties look like as seedlings because they did not perform at all in our region. Faba beans endured our winters, woolly pod vetch matured earlier than other vetch varieties, and brassicas did not stand much of a chance getting started in well-established grass pastures. Planting time of cover crops in pastures also emerged as an unexpected factor in the research. Well established, grass-growing pastures suppressed seed germination. Summer cover crops failed to compete with established perennial grasses, and planting before frost in the fall was also a deterrent for the cool-season cover crops.

Cover crops can be a strong allocation in your overall soil health portfolio. Just as with planning financial portfolios, soil health is a long-term endeavor. There are no magic bullets, and understanding the seeds you are investing your money and time into can yield dividends. 🌱



THE GREAT COVER CROP TEST

An agricultural consultant took to the field when posed with a rancher's question about cover crops.

by Jim Johnson, soils and crops consultant

Cover crops and I have grown pretty close during the past four to five years. The “recipes” for some of those first cover crop mixes I put together were little more than educated guesses based on what I knew about the familiar species and what I read about the less familiar ones.

During that time, many cover crop recommendations were being made by various advisers based on what was being done in places like Ohio or North Dakota, which was not necessarily relevant in the Southern Great Plains. It was at that time when an influential producer in North Texas challenged me with the question: “What do we really know about which cover crops work here?”

In 2014, we began working with several partners to evaluate the local adaptation of a broad suite of nearly 100 common and exotic cover crops offered by one of the leading vendors. To date, we have completed 18 site years of observations (four years of testing across eight sites; not every site was used each year).

In those plots, whenever an entry performed below average, it was not included the following year. Interestingly enough, some species we expected to surely work did not, while others unexpectedly performed well. We have also found that some species typically thought of as warm-season or cool-season can actually be planted and used in either season.

During these same years, I have also spent many hours observing cover crops in mixtures in producers' fields. I have gained insight into how the different species affect the soil ecosystem and have seen how cover crops fit into different production systems, including grazing systems, across the region.

I have pared down to a short list of plants that I feel comfortable will perform well in any of the southern Oklahoma and North Texas environments in which I have planted them (find the list at www.noble.org/cover-crops). Going forward, we will begin looking more in-depth at this handful of species in additional replicated plots to gain more information on traits such as above-ground biomass, allelopathy (a plant's ability to produce a herbicide-like quality), soil impacts and economics, among other things.

The cover crop learning curve has been steep, but these experiences have allowed me to provide better information to our producers, make better recommendations, and hopefully help advance the science of cover crops and soil health. 🌱



For more information

Jim Johnson shares what he has learned about specific cover crop species through an ongoing online video series available at bit.ly/cover-crop-series



THE KEY TO COMING HOME

Brenda Myers Brown has lived a life away from the land. Now she's returning to continue her father's legacy and make new memories with her children and grandchildren.

by Courtney Leeper

Brenda Myers Brown manages North Texas land used for farming, ranching and wildlife. When she first contacted the Noble Research Institute in 2012 for advice, she had a key problem.

Brenda Myers Brown had a key problem when she first met Steven Smith in 2012. The then-64-year-old land steward was about to tour Smith, a Noble Research Institute wildlife and fisheries consultant, around the property she was managing for her mother. Brenda had driven up to the farm southeast of Gainesville, Texas, from her home in Dallas, where she and her husband, Fred, had lived 37 years. Smith had driven down from Noble's headquarters in Ardmore, Oklahoma.

But before they could get started, Brenda piped up: "We'll need to stop by the tenant's house to get the gate keys."

Taken aback, Smith jotted a mental note. Recommendation Number 1: Keep your own set of keys to your own property.

Five years later, Brenda and Smith both laugh at the incident.

"When I received Steven's first set of recommendations, it was a 'well, duh' moment," Brenda says. "This was not rocket science."

But, she adds, there was much to learn.

THE JOHN DEERE DEALER'S DAUGHTER

After Brenda was born in 1948, her parents, Jim and Nita Myers, brought her home from the hospital to a farm north of Gainesville, Texas. Interstate 35 was constructed right through their property just two years later, and Nita Myers was not interested in raising her daughter on the highway. So, the family moved to town.

Jim Myers was a John Deere dealer in downtown Gainesville at the store he, his brother and his father owned and operated together for 50 years. When he wasn't selling tractors, Jim Myers was driving one. He, like his father and grandfather before him, was a farmer at heart.

Brenda remembers her father rising before the sun every morning to go out to the farm southeast of Gainesville to milk cows. He owned and operated a dairy in partnership with Leo Hoedebeck, whose family lived on the farm. Once the cows were milked, Myers would begin his

day at the dealership. And on Sundays, he always finished the milking in time to serve as an usher at church.

As an elementary school child, before air conditioning came to town, Brenda spent summer days out on the 50 acres of land her father had donated to the Girl Scouts of Gainesville. Buses filled with girls and their mother-leaders would wind their way through the thickets of trees and up to a pavilion constructed on the property for their use. Beyond those day camps, Brenda was rarely at the farm. For the first 18 years of her life, she says, she was known as the John Deere dealer's daughter but knew nothing of tractors or cows.

When Brenda graduated high school in 1966, she saw three career options for herself. She could become a teacher, a secretary or a nurse. She went to Southern Methodist University in Dallas, earned her teaching certificate and taught math. Later, she earned a Master of Business Administration by taking night classes while working for John Deere's regional headquarters in Dallas.

Brenda met and married Fred Brown in 1984; adopted his two young children, Adam and Erin; then gave birth to Scholle five years later. The young family sometimes visited the Hoedebeck & Myers Dairy, where the children would bottle-feed calves and watch the cows "ride the milking merry-go-round," a round, rotating platform that cows would step onto to be milked.

But the farm continued mostly out of sight.

A LAND DILEMMA

By 2011, after her children were grown and starting families of their own, the farm began to weigh more heavily on Brenda's mind.

Her father worked at the dairy nearly every day until his death in 1997. She and her mother had decided to keep the land but sold the equipment to the Hoedebecks, who are now in their second and third generation of living on and working Myers land. Then, in 2005, Brenda's mother's health began to decline. She had been diagnosed with macular degeneration, so Brenda moved her to Dallas and became her eyes and ears.

Brenda wondered if she should sell the land, but there was part of her that didn't want to end her father's legacy.

During dinner with some Gainesville friends one evening in November 2011, a local attorney and landowner, Phil Adams, stopped by their table. After hearing her dilemma, he recommended she talk with the Noble Research Institute (then the Noble Foundation). Their agricultural consultants would give her no-cost advice and help her consider her options, he told her.

Brenda wrote the information down in her datebook, and, later, after making a call, she received the paperwork needed to request consultation services. The questionnaire asked about her land, its uses and her goals.

"The sheer act of filling out those three to four pages of information was of tremendous value to me," Brenda says. "It got us organized."

On Jan. 15, 2012, Brenda submitted the paperwork. A month later, Steven Smith, the consultant who Brenda has now adopted as an honorary part of the family, made his first visit to her property.



Steven Smith, wildlife and fisheries consultant, answers Brenda Myers Brown's questions about land stewardship.

A B O V E: Kenny Hoedebeck (left) and his son Joe Hoedebeck (not pictured) represent the second and third generations of their family to work with Jim Myers and now his daughter, Brenda Brown.

L E F T: The Hoedebecks operated one of the last five dairies in Cooke County, Texas, when they sold out of the business in 2007. An old sign and the building that still houses the out-of-use milking carousel tells of the farm's past.



Fred and Brenda Brown's children and grandchildren visit the farm. From left: Tom Brown, 4; Will Brown, 11; Erin Brown Cordray; Walker Cordray, 8 months; Margaret Robertson, 6 months; Scholle Brown Robertson; Chris Cordray; Bennett Cordray, 2. Not pictured: Adam and Amy Brown.



PART OF THE FAMILY

The Hoedebecks operated one of the last five dairies in Cooke County when they sold out of the business in 2007. By 2012, they had moved to raising beef cattle on Myers land.

In addition to addressing the key situation, Smith recommended managing brush to enhance wildlife habitat as well as soil sampling to more efficiently manage pasture and crop land. He also introduced Brenda to the idea of recreational leasing. Now, she works closely with five hunters who come up from the city to hunt turkey, deer, duck, dove and feral hogs, in addition to the Hoedebecks who continue to farm and ranch.

Brenda also likes to say the Noble Research Institute gave her a valuable gift: 55 acres.

When she received an aerial map of her property, just like any new producer to work with Noble consultants, she says her “boring left-brain math major” mind went into overdrive. The map showed 55 acres more than was listed on the deed to the farm.

After checking with the Noble map makers and consulting the appraisal district as well as a Surveys of Cooke County book she bought, Brenda discovered a mistake made when the land was originally surveyed. As a result, she was able to officially reclaim 55 acres of the land her father had purchased and that he and the Hoedebecks had operated for decades.

But most importantly, Brenda says the Noble Research Institute has helped her get back to where she now wishes she would have been 40 years ago.

“That’s the biggest success to me,” Smith says. “The farm has gone from

being a piece in her financial portfolio to being a member of the family. She’s interested and attentive. She wants to do right by the land and her father’s memory.”

BUILDING A SANCTUARY

Today, Brenda carries her set of gate keys in a plastic zip-close bag. She knows where each key is and who has it.

Brenda teases Smith when he comes to the farm to help her take a soil sample or check on progress, saying “Think of this as spending a day with your mother.”

Smith smiles in response and answers any question she raises.

“He’s so calm and knowledgeable,” Brenda says. “If he doesn’t know the answer to a question, he’s got the resource of 400 people back in Ardmore.”

Brenda taps into those resources herself when she attends the Noble Research Institute’s agricultural education events, like the Pond Management Workshop held in May 2017, where she says she and Fred were “extra spongy” soaking up information from consultants Mike Porter and Will Moseley.

In 2015, Brenda’s mother died. A few months later, she found out her daughter Erin was expecting “Grandson Number 4.” That’s when Brenda decided they needed to create a more permanent family sanctuary on the land, a place where her “city slicker grandsons” (and now a granddaughter) will be able to experience the country and make memories.

The couple have begun the process of building a house on the farm, less than a half mile from where Brenda grew up going to the Girl Scouts day camps. They’re thinking of constructing a pond nearby.

These plans might not have even been dreams without the Noble Research Institute, Brenda says.

“It’s complicated my life in a good way,” she says. “I can’t imagine where I’d be in five years without the Noble Research Institute. Probably flailing around. But with them, I feel like I have Daddy on my shoulder. I have a peace of mind that I know Daddy is proud of me.” 🌿

LEFT: The Myers land rests near Gainesville, Texas, in the northern part of the state. After learning she would soon have four grandsons, Brenda Myers Brown and her husband, Fred Brown, decided to build a home on the family land. They look forward to providing a family sanctuary where their grandchildren can experience the country and make memories.

MIRACLES MAGNOLIAS

No one expected Kevin Newton to live after a tragic automobile accident. But he defied all odds – with the strength, encouragement, and prayers of his family and friends.

by J. Adam Calaway

Kevin Newton, an electrical maintenance technician at the Noble Research Institute, and his wife, Lori Newton, dared to trust their faith with magnolia-like strength during some of the darkest hours of their lives.

Kevin Newton knows how much his wife, Lori, loves magnolia trees.

In 2016, Kevin ordered a pair of magnolia saplings months before Lori's Halloween birthday. Two impish sprouts arrived Monday, Oct. 17, and Lori gushed with excitement at the sight of her surprise gift. One day, she dreamed the trees – with their stately structure and fragrant, saucer-sized white blossoms – would grow to be the signature pieces of their 11-acre country homestead southwest of Ardmore, Oklahoma. All Kevin needed to do was plant them, a chore he planned to handle later that week.

What the Newtons didn't know was this gift held a much deeper meaning – both ironic and prophetic. Magnolias grow slow and strong, symbolizing perseverance to arborists, and in the South, a woman with great determination is often called a "steel magnolia." Unknowingly, the couple sat on the cusp of a year that would test their resolve in an extraordinary fashion.

The Newtons had already ridden the rollercoaster of life together for almost three decades. They had scrimped to pay the mortgage, raised two children, and faced a once-in-a-lifetime health tragedy. Kevin's kidneys unexpectedly quit in 2010, and he spent three-and-a-half years on dialysis until his transplant. Hills or valleys – it didn't matter as long as they were together.

The day after the magnolias arrived, Kevin and Jacob Bonner, the Noble Research Institute's in-house electrical team, headed to one of the organization's research and demonstration farms. An old barn was slated for demolition, and power needed to be removed. Routine work on an unremarkable Tuesday.

What ensued was a year marked by miracles of modern medicine and miracles that modern medicine cannot explain. The first of which happened around lunchtime on a highway just a few miles from the Red River.

IMPACT

Take Oklahoma Highway 32 west about 5 miles and you will find Coffey Ranch – Kevin and Jacob's destination.

The two lanes of blacktop branch off of I-35 near Marietta, Oklahoma, and dissect miles of green pastures dotted with black cows. The road had been under-going construction for months, so Kevin and Jacob weren't surprised when traffic ground to a halt. They were the third vehicle in line with the front car turning left.

What happened next is defined in the police report as "driver distraction (non-cellphone)." That's the official designation to explain the unexplainable reason for a semitruck driver's failure to stop. The truck was only traveling at 45 miles per hour, but it was fully loaded with gravel – supplies for the road construction – and easily weighed 80,000 pounds, or twice as much as a Greyhound bus.

The rest was physics. Forty tons of metal and momentum transferred its energy into Kevin and Jacob's work truck, setting off a life-sized game of billiards. Their truck smashed into the vehicle in front of them before ricocheting to the right, across a drainage ditch, and coming to rest 65 feet later. The second vehicle clipped the lead car then bolted forward 105 feet.

Semi-unconscious Jacob's world blurred and faded. Two ribs busted. Left foot broken. L1 vertebrae ruptured. Jacob fumbled with his phone and called his wife, Jenifer. She answered. All Jacob could muster was: "Oh my God, it's bad. It's bad. Come get me."

"Where are you?" Jenifer asked. "It's Kevin. He's trapped," Jacob responded.

"Where are you?" his frantic wife asked again. The phone went dead. Jenifer called Lori, and the pair met at the Bonners' home. The spouses' impulse to act was tempered by the fact they had no idea where their husbands were located, what had happened or where they were headed to receive medical attention.

Mike Richardson witnessed the entire wreck from the eastbound side of the intersection and was the first at Jacob's side. Richardson took the phone from Jacob who – through the blur – recognized the face. Richardson is a deacon at the Bonners' church. He called 911.

Jacob's world went black with Kevin's cries echoing in his ears. "Your best friend in the world is screaming at you for help,"



LORI'S DIARY

Lori Newton pulls a spiral-bound journal from a drawer, but she doesn't open it. The words inside are a reminder of a year she simply will never forget.

A few days after Kevin Newton's accident, a friend came to Lori with the journal and said, "You need to write this all down." At first Lori dismissed the notion, but, in the quiet of the hospital, she began chronicling her fears and frustrations, the heartbreaking healing process and small moments of celebration.

Day after day she wrote, filling countless pages. Included are just a few of her words, which she freely shares as a reminder to the world to cherish the everyday moments of life.

Jacob remembers a year later. "I'd have pulled him out of that truck, but by the grace of God, I passed out. If I would have moved him, it could have killed him."

The next 45 minutes were a flurry of phone calls, ambulance lights and questions. Rescue personnel cut Kevin from the truck.

Jacob regained some consciousness when the paramedics arrived, and he tried to connect with Jenifer again. By accident, he called the one person he needed to alert at Noble: Jeff Rutledge, security manager and a 20-year-veteran of law enforcement. "I couldn't recognize his voice. It was pure hysteria. But he was able to tell us he was on Highway 32 and Allen Road," Rutledge says. "When he said the name Kevin and the location, I thought he was another employee named Kevin."

Rutledge, along with Robert Williams, safety and risk manager, and Laura Claypool, benefit coordinator, sped south not knowing who they were going to

help or what had happened. While en route, they received a call from Jenifer, who confirmed Kevin and Jacob were the employees involved. As the Noble team arrived on the scene, both ambulances raced out – one headed to Ardmore with Jacob, one headed to nearby Marietta with Kevin, who would be taken by MediFlight to Medical City Plano, the only Level 1 Trauma Center in Collin County, North Texas Region.

Rutledge caught sight of the truck and melted inside. The truck was crumpled where the bed met the cab. The driver's seat rested just a few inches from the steering wheel, meaning the person who had occupied that spot – their co-worker and hunting buddy Kevin – had been compressed into the sliver of space. Electric conduit protruded from the front of the semi. More pieces were shoved through the metal cab of the work truck. Those pipes would leave red rings on Kevin's back for half a year. "From the look of the vehicle," Rutledge says, "I

just knew we were dealing with a fatality accident."

Lori had little information at this point. She had left Jenifer's side at the Bonner home and went to Mercy Hospital in Ardmore, where she sat in the parking lot and prayed. "We had already been through so much," she says.

Then the phone rang. It was Grant, their youngest son, who had been headed to Marietta for a friend's funeral, arrived at the hospital in time to tell emergency personnel about his father's kidney transplant and the fistula in his arm for dialysis. Kevin could bleed out if the doctors didn't know about the fistula.

Grant told Lori to head to Plano. She began to figure out directions when her phone rang again. It was her best friend, Shelly, who informed Lori that her husband, Marty, just happened to be at Mercy. "I look up, and here comes Marty," Lori says. "He opens the door and says, 'Move over, sister, I'm driving. I know exactly where we're going.'"

OCT. 27, 2016:

Kevin stayed on the RotoProne bed all day. This has been a long day of waiting just to see if he lives.





A B O V E : Two primary screws (the largest almost a foot long) were used to reconstruct Kevin Newton's pelvis.

JAN. 28, 2017:

Kevin was released to go home. It is a true miracle. We are thankful for all of the medical staff and family. There's still a long way to go, but he's still here!



HE SHOULD HAVE BLED OUT

When Kevin arrived at Medical City Plano, he was greeted by one of the country's most elite trauma teams. Dr. Devlin McCormick, then a fifth-year surgical resident, helped lead the group that began immediate work on Kevin.

A CT scan revealed a significant pelvic fracture and a laceration to the right iliac artery, the primary blood supply for the right leg and sole source of blood for Kevin's transplanted kidney.

The priority for the team was simple. "We had to stop the bleeding," McCormick says.

Kevin was whisked into the interventional radiology suite where the iliac artery injury was sealed from the inside. However, the seal did not hold, and Kevin required a trip to the operating room where he was packed with medical gauze to stop the bleeding. Kevin received six units of blood and six units of plasma during his first 12 hours in the hospital.

Most surprising is that Kevin had not already bled out. A cut to the iliac artery could result in death within minutes

without medical attention. "It took 45 minutes to cut him from the truck plus the transportation time to Marietta, the flight to Plano and the assessment time. He should have bled out," Williams says. "The fact that he didn't is a miracle."

Lori, several family members, and the Noble team arrived and began the excruciating wait. The surgery would last for hours. Late that evening, McCormick and his fellow surgeon, Dr. Tessa Woods, emerged. They detailed the shattered pelvis, severed artery, extremely low blood pressure and heart rate, the potential permanent neurological damage, and to top it off - the danger posed to the transplanted kidney, which was in shock from the accident. "I just remember them saying, 'We've done the best we can,'" Lori says. "They tried to prepare me for the worst."

Lori didn't sleep at all that night. Her thoughts went back to how different her life was just 12 hours prior, how they had parted that day with their routine good-bye kiss and "I love you."

"I was not ready to let him go," says Lori, whose thoughts turned to their unborn grandchild. "I was supposed to

be "Lolly" and he was going to be "Pop." I couldn't be a lolly without a pop."

The sun rose on Wednesday, Oct. 19, and Lori didn't know what to make of her new world. Her husband was on a ventilator, a temporary closure held together his abdomen. There were a thousand questions and no answers.

Lori saw her husband for the first time at the end of Day 2 and just for a few seconds. "He didn't look like himself," Lori says. "Grant couldn't go back after seeing him that way. It knocked the breath out of him. You question if he is going to live, and then, if he does, what kind of life would he have?"

Back at the Noble Research Institute the day of the accident, Kevin's co-workers and friends began to amass. Cards, text messages and financial resources began to flood in. A prayer blanket was sent and spent every day on his bed. The next morning, dozens of employees gathered in the campus plaza for a prayer vigil. As the sun rose on the coolest fall morning yet, members of the board of directors, scientists, agricultural consultants and support staff joined hands, bowed heads and asked for a miracle.

More than a year after the accident, Kevin Newton continues his recovery with a smile on his face.



Over the next several months, a handful of his colleagues continued to gather and pray each morning.

They weren't the only ones. "I would get fearful, but I was surrounded by awesome prayer warriors," Lori says. "The doctors would tell me what was happening, and I would tell people what to pray about. We had people all over the world praying for us."

Kevin was going to need it. The fight was just beginning.

FROM BAD TO WORSE

Eight days after the accident, Kevin, who remained in a medicine-induced coma, went into surgery to repair his pelvis. When the doctors laid Kevin down, his blood pressure and oxygen levels crashed. He was dying - again. The doctors believed the combination of a blood clot in his lungs and pneumonia were the culprits. Blood thinners and antibiotics were started; however, Kevin went into acute respiratory distress.

Lori and the doctors made a life-or-death decision: They placed Kevin in the RotoProne Therapy System, a specially designed bed that helps increase the lungs' capacity to absorb oxygen. Patients on a RotoProne are sandwiched between two padded mattresses suspended from a rotating motor. The patient is then slowly turned like they are being roasted on a spit. It took 12 health-care workers to get Kevin in the bed, and there was a good chance he would not get out of it alive.

The clock ticked, and Kevin slowly rotated. 6 hours. 12 hours. 18 hours. He kept turning. 24 hours. 48 hours. The therapies started to work, and his vitals rebounded. On Day 4, he emerged from the bed.

The treatment came at a cost. Laying in such a position causes significant swelling, which affected Kevin's eyesight. One eye was bad for almost two weeks then suddenly returned to normal. The rubbing of the pads opened up a pair of golf-ball-sized divots on his body, wounds that required treatment for eight months.

Kevin returned to the operating room a week after coming off of the RotoProne. This time, the surgery went as planned.



A B O V E: Kevin and Lori Newton celebrated their 29th wedding anniversary, as well as both of their birthdays, Thanksgiving, Christmas and New Year's, in the hospital. On Feb. 28, 2017, more than four months after the accident, Newton was released to continue recovery at home.

L E F T: Jacob Bonner, a fellow electrical maintenance technician at the Noble Research Institute, began his own journey of healing following the accident. Bonner spent as much time as he could with Kevin Newton at the hospital.

They inserted two primary screws (one almost a foot long) to reconstruct the pelvis and examined multiple fractures (that would heal on their own), including a broken clavicle.

All the while, Kevin's kidney remained in shock. The afternoon of the pelvis surgery, Kevin was switched from the slow continuous dialysis to the regular machine. Within 30 minutes, his blood pressure and heart rate plummeted. Kevin went into respiratory distress. For the third time, Kevin almost died. And for the third time, he survived.

THE LONG ROAD BACK

For the next six weeks, Lori endured an endless routine of commuting 103 miles between work in Ardmore and the hospital, where ICU visiting hours began at 8 a.m. This was the slow reality of healing and the painful forging of a steel magnolia.

Lori and the family took turns in the ICU with Kevin, reading to him from the Bible, talking or just sitting.

Kevin doesn't have memory of those first several weeks. He doesn't remember the accident, the surgeries or almost dying three times. When his healing finally gained traction, they eased him back to the conscious world.

Lori stayed busy writing and reading. She even found time to lend a shoulder to other families enduring similar tragedies. "God puts you in places," she says. "You're not there for yourself. You're there for other people."

Slowly Kevin began to make micro-steps of progress. Sitting up in bed. Breathing without a ventilator. Sucking on ice chips for his birthday. "I had the easy part," Kevin says. "I just laid there and let people pray for me."

Williams, Claypool and others regularly checked in on the family. Jacob, sporting his left foot in a boot, came as much as he could while enduring his own recovery process.

At the sight of his mentor prone, swollen and protruding with tubes and wires, Jacob openly wept. The two men talked about the accident and the driver who changed their lives. "There was about two seconds when you question what

in the world he was doing," Jacob says. "But then we began to pray for him. He was going through his own recovery. You have to forgive him. You have to let it go."

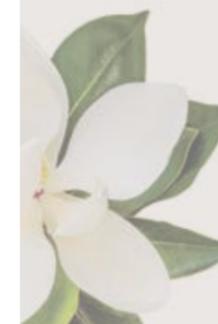
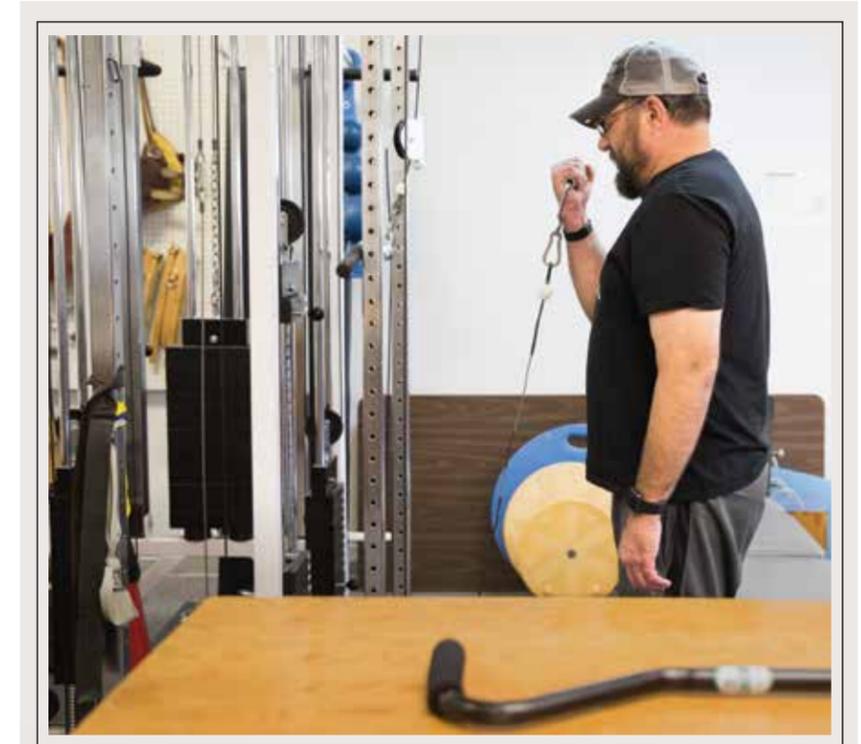
Back at Noble, the entire employee population wanted to do more. Since no cards or balloons were allowed in the ICU, the staff created a special video for Kevin at an all-employee meeting in November. The video was simple and short. It was just three solid minutes of 350 employees cheering wildly and chanting Kevin's name. His extended work family was behind him. "We played it over and over," Lori says. "We all bawled. It was so special to receive that kind of love and support. We thank God every day that

Kevin works for such a great organization with such great people. We couldn't have done it without all of them."

"It is humbling to see how we responded, but it's not surprising," Rutledge says. "To me, it's just what we do. It's who we are. That's why I work here."

Thanksgiving passed with a family meal in the hospital cafeteria - the last place they wanted to be - but the family was together, and Kevin was getting stronger.

Then on Dec. 3, another miracle. His kidney, which had been trying to wake up for weeks, became fully functioning. It was a moment of pure relief and joy followed by another setback. Four days



JULY 10, 2017:

Kevin drove himself to physical therapy today. I was a nervous wreck. I made him call me when he got there and call me when he got home. He has come a long way. Still has a long way to go, but we are getting there.

later, Kevin's legs began to swell, and the doctors discovered a series of blood clots in his legs – the result of severe trauma and lying in bed for eight weeks. Blood thinners plus physical therapy were prescribed, and the Newtons continued to march forward.

Four days before Christmas, Kevin crossed the Red River headed to Mercy Rehabilitation Services in Ardmore. "You can't imagine how amazing it is to see things that are familiar to you," Kevin says. "I was so glad to be closer to home so Lori didn't have to drive all that way."

All totaled, the Newtons spent both of their birthdays, Thanksgiving, Christmas, New Year's Eve and their 29th wedding anniversary within the confines of various hospitals. Finally on Feb. 28, Kevin was released to go home. His final medical file measured almost 15 inches thick. The journey was far from over, but, as they drove up to the house for the first time, they wept yet again. Kevin saw the magnolia saplings. They had been planted by his brother-in-law.

They were alive and so was Kevin.

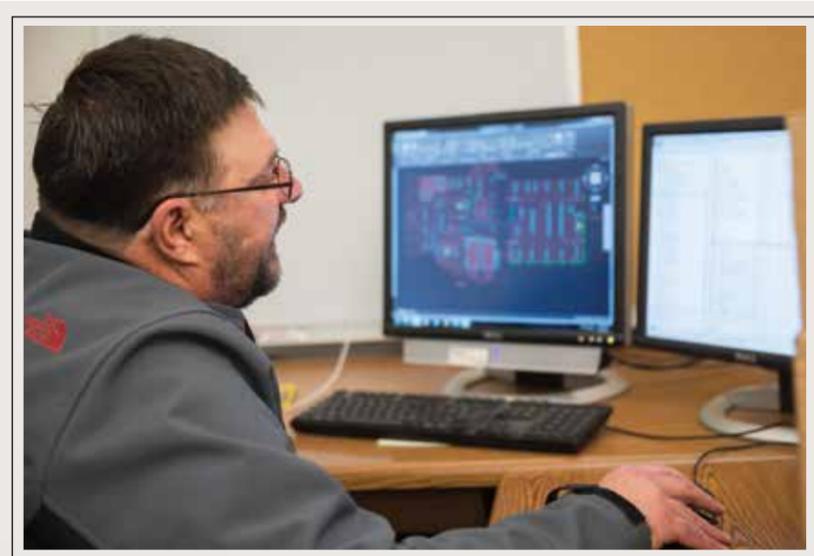
A NOBLE RETURN

Spring brought new growth to the impish magnolias, and Kevin continued his long road back. Every week included physical therapy three times and wound care for the RotoProne gashes. Lori's intensive caretaking continued. She rose at 4 a.m. to cook the day's meals before work, skipped lunches to make up for lost hours, and took Kevin to countless follow-up appointments.

Family and friends continued to pitch in. A crew from Noble's physical facilities group built a wheelchair ramp and installed handrails in the house. Countless others helped with chores around the house and played chauffeur to physical therapy appointments.

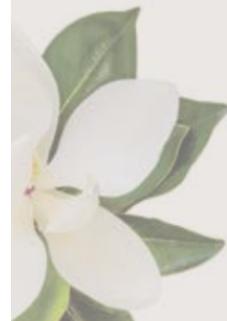
There were a few more surprises, including a short spell of Bell's palsy that just went away, and progress continued. Kevin went from a wheelchair to a walker to being able to drive.

On Aug. 14, 2017, Kevin Newton walked into his office at work for the first time in almost 11 months. He was back but only part-time and only at his desk.



AUG. 14, 2017:

Kevin went back to work part-time today. It's been 11 months since he last went to work. The doctor says he is only supposed to work two to four hours a day as tolerated and only desk work. He is excited to be back on the job and with his friends. What a truly amazing year this has been.



It's the happy ending no one dared to dream, but it is colored by the reality of the accident's ramifications. Jacob still receives treatment for his back. Kevin's body may never be the same. And Lori says, "I still haven't relaxed. I still worry about him driving."

Both the Newtons and the Bonners have made a choice to keep their eyes toward the sunshine, refusing to be angry about their circumstances. "A lot of good things came out of this, a lot of pain, but also a lot of good," Jacob says. "Families have been reunited. People have decided to get on new life paths. And we all have a sense of appreciation that we didn't have before. This life is so special, but you have to slow down to see it."

Lori's experience has sparked a passion to help other caretakers, and she's decided to write a book about the miracles she witnessed. Some will dismiss all the details that surround the wreck as coincidences: Jacob accidentally calling the

head of security. The deacon at the crash site. The family friend at the hospital who drove Lori to Plano. The fact that Kevin didn't bleed out. The RotoProne bed. The kidney waking up.

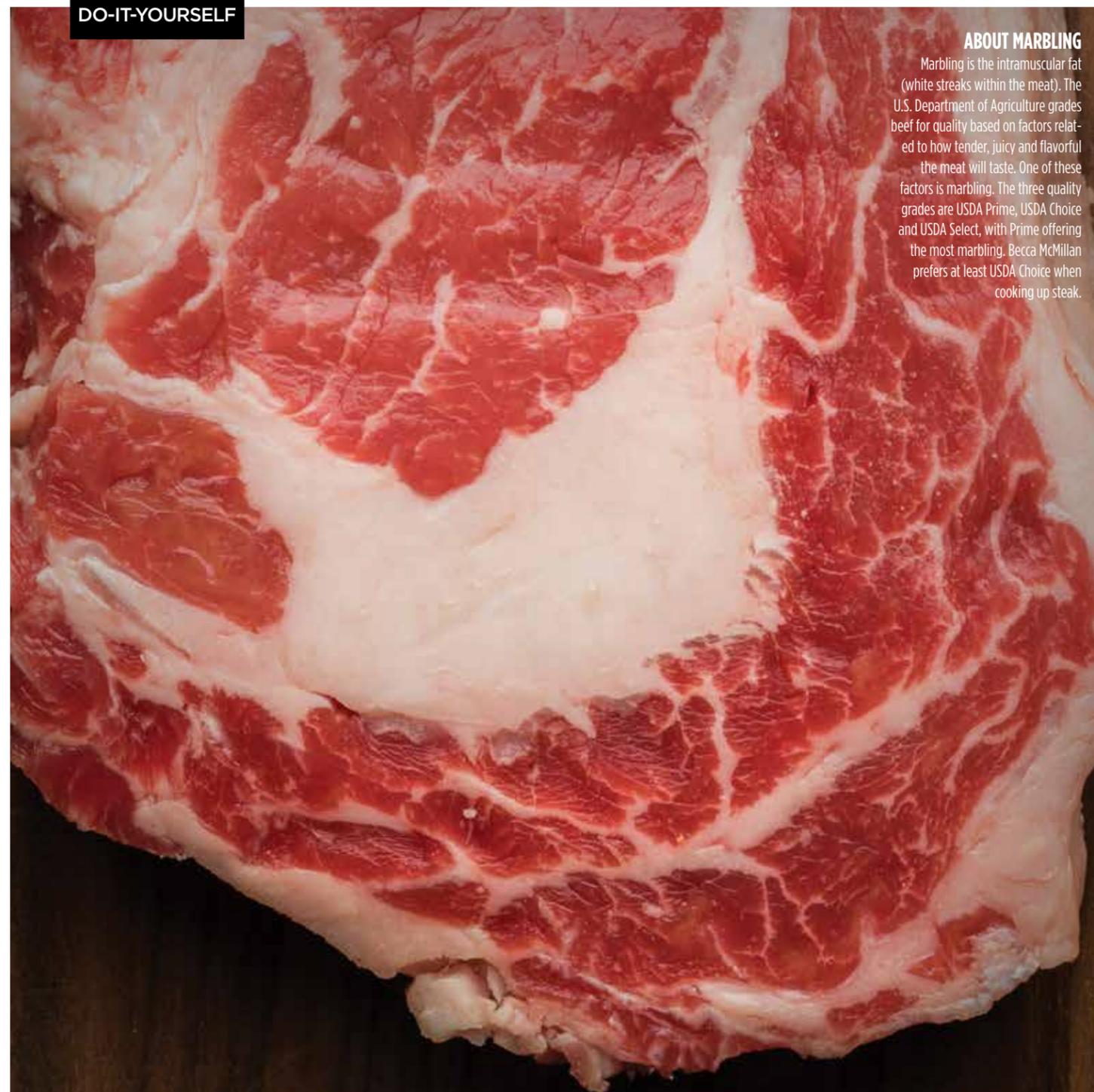
Lori knows it took the finest doctors, the most advanced technology and the best medical care in the world to keep her husband alive, but she will never overlook the unexplainable. "There are just too many circumstances to say it was all coincidence," Lori says. "There were too many miracles to not see God's hand in all of this."

As for Kevin, he is just happy. He shows off his scar that runs from his breast to his belt buckle. He is alive, and he has Lori, his steel magnolia. "I don't know how you go through something like this without faith and a loving wife. She meant it when she said, 'in sickness and health,'" Kevin says. "I've thrown enough sickness at her. Now it's time for some life." 🌿

DO-IT-YOURSELF

ABOUT MARBLING

Marbling is the intramuscular fat (white streaks within the meat). The U.S. Department of Agriculture grades beef for quality based on factors related to how tender, juicy and flavorful the meat will taste. One of these factors is marbling. The three quality grades are USDA Prime, USDA Choice and USDA Select, with Prime offering the most marbling. Becca McMillan prefers at least USDA Choice when cooking up steak.



A SEASON TO PREPARE

The end of the year brings a time for reflection and a time to consider new goals. Now is also prime time to get a head start on some of those goals and brush up on old skills. Turn to page 46 to learn how to build your own garden tower from Steve Upson, one of our consultants and an expert in horticultural production. With a little preparation and effort this winter, you will have a great tool to help you grow fruits and vegetables in small spaces next spring. On page 44, you will also find tips and tricks from Becca McMillan, a beef producer and mom, on how to grill the perfect steak. Whether you are preparing to grow food in your backyard or to make a meal out of the products of others' labors, we wish you all the best as we enter 2018. 🌿

How to Grill the Perfect Steak

Becca McMillan taught herself how to cook steak in high school. After years of trial and error, she shares her favorite recipe.



INGREDIENTS

- Steak (we used ribeye cut 1-inch thick)
- Tony Chachere's Original Creole Seasoning
- Onion powder
- Garlic powder
- Propane gas grill
- Aluminum foil
- Tongs

DIRECTIONS

Step 1: Pick your meat. Becca considers three factors when selecting steak: cut, thickness and marbling. She personally prefers ribeyes but says she would take a T-bone steak any day. She looks for steak at least 1-inch thick, and she looks for good marbling.

Step 2: Heat up the grill. Becca prefers cooking on a propane gas grill rather than charcoal. Cooking over a wood fire pit is nice too, she says, but takes longer. Consider the outside temperature and wind speed when determining how high you need to turn up the grill. We cooked our steak on high (425 to 500 degrees F) on a chilly November day. If it's too cold to grill outside, consider searing the meat in a cast iron skillet on the stove top then finishing it in the oven.

Step 3: Place the steaks on the grill. Be sure to use tongs. Piercing steak with a fork before or during the cooking process can release the juices and cause the steak to dry out.

Step 4: Prepare your seasonings. Sprinkle equal parts of each seasoning on each side of the steak. Becca starts with onion powder and garlic powder then adds the Creole seasoning.

Step 5: Cook the steak for 2 to 3 minutes on each side until it reaches your desired level of doneness. We flipped the steak about seven times before it was cooked to medium (145 degrees).

Step 6: Place steak on a plate or desired serving dish. Wrap the steak in aluminum foil and seal tightly to allow steak to continue cooking in its own juices. After 5 to 10 minutes, enjoy.



TO SEASON BEFORE OR TO SEASON AFTER?

The age-old question when it comes to cooking steak centers on what seasonings to use – if any. Some say marinate. Others have spent years perfecting their spice and herb mixtures. Still, the purists insist the steak go bare or maybe just sprinkle it with a little salt. If you decide to go with a seasoning, you are faced with another question: Should you season the meat before or after cooking? We decided to conduct our own impromptu experiment and put both methods to the test. It shouldn't come as a surprise that our taste testers enjoyed both ways. But they did come to a conclusion: If you want a stronger burst of flavor from your spices, season after cooking. If you would prefer to taste steak with just a hint of kick, season before cooking.

FOOD SAFETY NOTES

- Always wash your hands with hot, soapy water before and after handling raw meat and other fresh foods.
- Keep cutting boards and utensils used for raw meat separate from those used for cooked meat and other foods.
- The USDA recommends cooking steak to at least 145° F and allowing at least a 3-minute resting period.

See additional tips for cooking steak and more at bit.ly/cooking-food-safety

MASTER THE HEAT

Rare (Cool red center)	125° F
Medium-Rare (Warm red center)	130-135° F
Medium (Rosy pink center)	140-145° F
Medium-Well (Slightly pink center)	150-155° F
Well (Brown center)	160° F



Becca McMillan supports the agricultural systems research and technology activities at the Noble Research Institute. Beef is frequently on the dinner table at the McMillan household, which includes Becca and her husband, Zeno McMillan, and their 7-year-old daughter, Rory. The family owns and operates a cow-calf ranch northeast of Dickson, Oklahoma. Hear Zeno's perspective on raising cattle at bit.ly/fruits-of-their-labor.



Steve Upson serves as a senior soils and crops consultant with horticulture as his expertise area. Upson specializes in raised bed and container gardening, vegetable plasticulture, and hoop house vegetable and small fruit production. He also provides consulting services to organizations interested in starting community and school gardens. Prior to joining the Noble Research Institute in 1988, Upson managed a commercial vegetable farm and served as an extension horticulture agent for Oklahoma State University.

Build Your Own Tower Garden

Repurpose old tires and grow your own fruits and vegetables in this tiered container garden designed by Steve Upson, a soils and crops consultant.

MATERIALS

- 4 identical, used, full-sized automobile or light truck tires (preferably at least 30 inches in diameter)
- 3 joints of top chain-link rail fence tubing (1.375-inch by 10-feet)
- 1 sheet of plastic lattice (0.2-inch-by-4-feet-by-8-feet)
- 1 box (40 count) self-tapping sheet metal screws (no. 10 by 1-inch)
- 1 box tek screws (no. 12 by 3/4-inch)
- 6 machine bolts including nuts (5/16-by-6-inch)
- 18 pipe hangers (1-inch)
- Weed barrier fabric (4-feet-by-50-feet roll)
- Duct (Gorilla) tape
- 3 2-cubic-foot bags of potting soil

DESIGNING TOWER BASE

Step 1: Choose one tire to be the tower base.

Step 2: Using a tape measure and a white marker, make six evenly spaced lines on the tire as shown.

Step 3: Cut the top chain-link rail fence tubing into six, 60-inch long posts. Remove burs on the tubing.

Step 4: Drill a 5/16-inch bolt hole, 10 inches from one end, in each post.

Step 5: Install posts using 1-inch pipe straps and 1-inch self-tapping sheet metal screws. Use two straps per post. Before attaching post to tire, place a short piece of two-by-four lumber under the post.

Step 6: Align the center of each post over the mark, and use a level to ensure the posts are plumb before attaching.

Step 7: Insert bolts into holes at the end of each post, and secure using nuts. Make sure bolts on opposite posts are aligned with each other, twisting posts as needed to align.

Step 8: When posts are aligned, attach hangers to posts using 3/4-inch tek screws.

PREPARING PLANTER MODULES

Step 1: Create three planter modules by removing the side walls from the remaining tires. On one side of each tire, use a utility knife to remove the side wall as close to the tread as possible without exposing the steel belting. A jigsaw equipped with a fine-toothed hacksaw blade or rubber cutting blade can also be used for side wall removal. Save one of the side walls.

Step 2: To prepare the opposite side of each tire (planter module), mark the side wall along the midpoint (crown). Cut along the line to remove the side wall. This section of side wall may be discarded.

Step 3: Construct a bottom for each module using a piece of

plastic lattice or metal livestock panel. Using the saved sidewall as a template, mark off three bottom sections using a permanent marker. Use a jigsaw to cut the lattice or a pair of bolt cutters to cut the metal panel.

Step 4: Prepare a liner for each bottom using a piece of weed barrier fabric. Use binder clips to attach fabric to the outer edge of the bottom sections or gather the fabric on the back side and secure using Gorilla tape.

INSTALLING PLANTER MODULES

Step 1: Insert one of the growing modules into the tower frame and position on top of the base.

Step 2: Next, insert the fabric bottom.

Step 3: Attach the planter module to the frame using pipe hangers and sheet metal screws. One pipe hanger per post is sufficient. To avoid injury, grind off protruding screw tips.

Step 4: Move tower to a permanent, level location before adding growing medium.

PLANTER MODULE CONFIGURATIONS

- When filled with growing medium, each module provides about 8 inches of growing depth. This is sufficient for root crops, leafy greens, strawberry and bedding plants. For large, deep-rooted crops such as tomato, pepper and trellised crops, the modules can be stacked to create additional rooting space. In a stacked configuration, only the bottom module needs a bottom section.*
- A two-level setup is ideal for growing a combination of high-light-requiring crops and crops that can tolerate some shade. In this configuration, strawberry will thrive on the upper level while leafy greens and root crops may be grown successfully on both levels. The support bolts must be installed (along with a bottom section) to use the upper planter module.
- Water dripping onto the lower planter module can be expected when using the two-level configuration. This should not pose a problem when growing greens and root crops but may increase disease pressure on warm-season fruiting crops growing on the lower level. If this becomes an issue, remove the growing medium from the upper module and replace with containers. Be sure to install a plastic liner before positioning containers.

*Use soil mixes high in organic material, such as peat moss and composted pine bark, to reduce weight on the tower frame.

 See more online

Find more ideas for your tower garden in the extended version of this article online at noble.org/diy-tower-garden. You can also view a related video at bit.ly/diy-tower-garden.

JANUARY

18 DORMANT SEASON PRESCRIBED BURN FIELD DAY

8:30 a.m.-3 p.m. | Thurs., Jan. 18
Noble Research Institute Coffey Ranch
16877 State Highway 32
Marietta, OK 73448

Registration fee: \$25, includes lunch

Prescribed burning is a natural process that can be effectively used in land resource management, but it must be used in a safe and proper manner. This field day is designed to introduce participants to the various aspects of burning, how to conduct a safe burn and give a hands-on experience. If weather permits, demonstration burns will be conducted.



FEBRUARY

22 INTEGRITY BEEF ALLIANCE PRODUCER MEETING

3:30-8 p.m. | Thurs., Feb. 22
Ardmore Convention Center
2401 N. Rockford Rd.
Ardmore, OK 73401

Registration fee: \$25 for non-members

The Integrity Beef Alliance is a cow/calf program with goals to increase marketability of ranch-raised calves through increased brand recognition, addition of stacked value-added traits and volume sales of high quality calves.

The winter Integrity Beef Alliance membership meeting will allow producers who are interested or new to the program to meet with seasoned program producers and to learn about program specifics and protocols for the upcoming year.

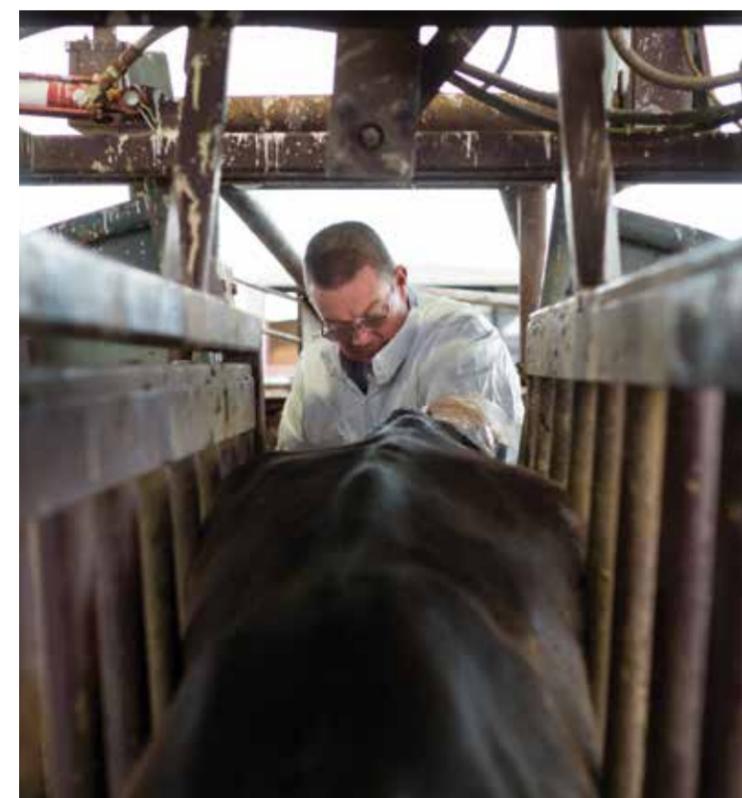
23 BEEF CATTLE REPRODUCTIVE MANAGEMENT WORKSHOP

9:30 a.m.-2:30 p.m. | Fri., Feb. 23
Noble Research Institute Oswalt Ranch
18414 Dixon Road
Marietta, OK 73448

Registration fee: \$25, includes lunch

The reproductive management workshop is a hands-on program for beef producers to provide management tactics, and introduce the tools and technologies available today to improve reproductive efficiency in your herd.

Topics will include heifer development and management; impacts of nutrition on reproduction; tools and technologies to improve herd genetics, manage the breeding and calving seasons, and determine pregnancy in your herd; and the value of these tools, technologies, and management systems.



MARCH

8 BEEF QUALITY ASSURANCE (BQA) WORKSHOP

1:30-5 p.m. | Thurs., March 8
Noble Research Institute
Kruse Auditorium
2510 Sam Noble Parkway
Ardmore, OK 73401

No registration fee

BQA raises consumer confidence through proper management education and guidelines for the beef industry. This workshop will give insight into BQA standards for animal care, record-keeping, nutrition and carcass quality. Participants can become BQA certified with successful completion of the workshop and a test.

For more information or to register for one of our agricultural events, visit www.noble.org/events or call Danielle Pacifico at 580-224-6376. Preregistration is requested. If you have other agricultural questions, please call our Ag Helpline at 580-224-6500 or submit a question using the online form at nobleapps.noble.org/aghelpline.



1961-2017 SHELLEY MULLINS

A Noble board of directors member leaves a legacy of generosity and service.

A longtime member of the Noble board of directors, Shelley Mullins, 56, passed away Nov. 23, 2017, after a short illness. Mullins is remembered as an active civic volunteer; a philanthropist; and a devoted wife, mother, and grandmother.

"Shelley's life stands as a testimony to service and generosity," said Bill Buckner, president and CEO of the Noble Research Institute. "She invested her energy, passion, kindness, and intelligence in her family and community. Though she is gone, her legacy will continue in all of those she touched. She will be greatly missed by the entire Noble family."

Shelley Dru Noble Mullins was born Aug. 8, 1961, in Ardmore, Oklahoma, to Sam and Mary Jane Noble. She spent her youth in Ardmore and graduated from Ardmore High School in 1979.

Mullins attended the University of Oklahoma (OU) and Western State College in Gunnison, Colorado. While at OU, she met her future husband, Jeffrey Mullins, on vacation in Mexico. The pair shared their first dinner at Senor Frog's and fell in love.

The pair wed on Oct. 15, 1983, and she moved to Vancouver, British Columbia, Canada, where the couple started a family and built a life for more than 34 years.

Mullins' primary focus was caring for and supporting her family. As a grandmother, she went above and beyond to help her granddaughter, Anabelle, with everything from transporting her to school and gymnastics lessons to making sure she had festive dresses for Easter and Christmas.

"She was an amazing wife, mother, grandmother and sister. She was one of those people who truly put others first," said Rusty Noble, chairman of the Noble board of directors and Mullins' brother. "Growing up, she wanted to do two things: have a family and help others. She fulfilled both of those dreams. There are no words to express how much she meant to our family and her community."

In addition to supporting her family, Mullins was an active volunteer in the Vancouver community. She was a member, donor and volunteer at St. Mary's Anglican Church of Kerrisdale in Vancouver, where she served multiple roles.

She was a volunteer driver for cancer patients from the British Columbia Cancer Society, helping to ensure patients were safely transported to and from their cancer treatment appointments every week. She was also a volunteer canvasser for the cancer society, helping solicit donations and share information about

the nonprofit.

Mullins was an active philanthropist who supported numerous nonprofits and charities, including the Bilby Foundation, British Columbia Cancer Society, Coast Foundation, Edgewood Recovery Center, Heart Transplant Homes Society, Ranch Hand Rescue, St. John's Northwestern Military Academy, St. John's School and Vancouver Orphan Kitten Rescue Agency.

Even in her passing, Mullins gave back to her community one final time. As an organ donor, she provided potential life to four others.

Mullins was the granddaughter of Lloyd Noble, the founder of the Noble Research Institute (formerly The Samuel Roberts Noble Foundation). She served on the Noble Foundation's board of directors for almost 20 years, helping direct the organization's research, education and philanthropic activities. She also served as a member of the board of directors for the Quien Sabe Corporation.

She is survived by her husband, Jeffrey; children, Ryan Mullins and Blair Mullins; stepdaughter, Jodi Mullins; brothers, Russell Noble, Nick Noble, and Lloyd Noble; sisters-in-law Sally Noble and Janet Mullins; granddaughter, Anabelle Mullins; and pets, Leo and Lucas. 🌿

LEFT: Shelley Mullins learns about improving soil health during a tour of the Noble Research Institute's Red River Farm on Oct. 12, 2017. Mullins, a granddaughter of the organization's founder, Lloyd Noble, served as a board of directors member for nearly 20 years. In this role, she helped direct the organization's research, education and philanthropic activities.

FIELD OF DREAMS (AND ROCKS, LOTS OF ROCKS)

by J. Adam Calaway, editor

It is dawn on game day. The first fingers of morning light stretch across the October sky, casting coral and violet hues, and Greg Self is already at Noble's employee softball field directing the finishing touches on a six-month personal quest to better a small piece of Noble's campus.

Self discusses the proper position of the first base line with his volunteer grounds crew. "It should go down the center of the two bags," he says, pointing at the first base and the new orange safety base he helped install – one of countless upgrades. When the teams take the field in a few hours for the annual company softball tournament, they will discover a very different playing surface than the year before. As it turns out, creating a field of dreams takes a lot of work.

By day, Self is a desktop systems specialist in the computing services department, troubleshooting error messages and quashing computer bugs for Noble's 400 employees. Nearly every evening since mid-March, he has crossed Sam Noble Parkway to North Campus to resume his semi-secret project – fixing the softball field.

When the softball tournament began six years ago, a team of employees managed to turn the long-abandoned field into something playable. Still, the stone-littered infield was more suited for mining than softball; but no one seemed to care, and countless memories have been made ever since.

Last year, while practicing with Noble's intramural softball team, Self watched as a routine ground ball hit an infield washout, ricocheted off a rock and knocked a player silly. "It sparked something," he says. "We needed to make this place safe and nice."

Self reached out to Josh Anderson, a research associate in the small grains breeding lab, who had worked on the grounds crew for the Boston Red Sox.

Anderson became Self's Yoda, providing expertise and a plan, while Self invested the sweat equity.

Terry Martin, landscape services manager, and Rodney Pierce, equipment supervisor, fueled the project by providing Self access to needed equipment – a tractor, a tiller and an ATV.

Self arrived on his first work night and decided to start with a small but long-held irritant – a softball-sized rock near second base that he had stared at for two years. Today would be its reckoning.

Hand-digging revealed the rock actually was the visible curve of a small boulder. Several hours of shoveling later, Self heaved a stone the size of a Labrador Retriever into the bed of his truck. "OK, this is going to be fun," he remembers thinking.

Self returned to the field four nights a week for the next several months. He tilled, watered and cleaned. The ground was so hard-packed he built his own drag out of two-by-four lumber and 60-penny nails to aerate. "We had to break it loose," he explains. The more he loosened the soil, the more trash he unearthed.

Glass, pottery, nails, railroad spikes and rocks (lots and lots of rocks) sprang from the ground. For every rock he picked up, the field seemed to push two more to the surface. He even discovered an old sprinkler system, the heads of which, with the approval of Martin, he removed by hand.

He quit counting how many hours he had invested at 250. It didn't matter anyway. He was in for the long haul. "It's one of those things," he says. "We work at Noble, and we want to do the best possible job whether it's in the lab, helping a farmer or out here. We don't scratch the surface and say, 'That's good enough.'"

Soon signs of life reappeared. The soil went from looking bland and lifeless to a milk chocolate brown. The infield grass recovered, allowing him to cut a



perfect arc from first to third base. With only weeks until the tournament, fellow employees Caleb Knight and Samantha Ephgrave joined Self for the final push. They continued dragging, leveling and cleaning right up until two days before the first pitch. Then Mother Nature decided not to cooperate. She dumped several inches of rain on the field, leaving it spongy. "When she's dry, she's a field of dreams," he said on tournament day, looking up at the morning sun. "She'll dry up by afternoon."

Indeed it did, and Self's half year of work was rewarded. Each game was played without incident – no balls careening off of rocks, no injuries due to field obstructions.

As for Self, his team lost in the opening round. He spent less than 30 minutes enjoying his handiwork firsthand. It didn't matter, though, he was satisfied. "Be noble is one of our core values," he says. "It's on our employee badges. We have to live up to that every day and in everything we do." 🌱

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 **LEGACY** | Winter 2017 | Vol. 11, Issue 2

Roots help prevent erosion by anchoring plants to the soil and soil to itself. They are also responsible for taking in nutrients and water from the soil. Natural variation in root form and function can be used to breed more resilient crops.

