

VOLUME 17, NO. 1

THE

magazine

UNIVERSITY OF KENTUCKY

COLLEGE OF AGRICULTURE, FOOD AND ENVIRONMENT

CAFE for KY

**Everything
Aged is New Again** pg 16

**"Sensing" the Change
in Agriculture** pg 12

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.....from the dean

CAFE Is For Kentucky

What do you think of when you think of the College of Agriculture, Food and Environment? It depends on your perspective. We serve many segments of Kentucky's population, and they all see different slices of our college. This issue of the magazine displays the fact that our college is a collection of virtuosos driven by service, who are able to see the needs of the commonwealth and act on them in meaningful ways. We consider all of Kentucky's citizens as shareholders in our programs.

Our three feature stories illustrate how different members of our college family are addressing the needs of shareholders with very different interests. A partnership between Kentucky Cooperative Extension and the YMCA serves youth who are homeless or unstably homed in Kentucky's largest city. UK personnel offer life skills and programs in a safe environment. Maybe these students take away the memory of some nice people who taught them some things they valued. We sure hope they will remember Cooperative Extension as a source of help and information at a critical time of their lives. Regardless, we will take what we learned from them and try to improve our services for the future.

The feature on precision agriculture involves a completely different group of shareholders who are hungry for new technologies. Farmers who use advanced technologies are smart and sophisticated, and they are willing to invest in new products to give them a competitive edge. UK research and extension personnel are valuable to these stakeholders, because we help them know what such technologies would be worth to them. Through our research and willingness to take on the risk of failure or success, we can then recommend what might work. University work like this has made the U.S. land-grant system the envy of the world and has allowed tremendous efficiencies of scale, from the Green Revolution onward.

A third group of shareholders is comprised of both the students and the practitioners of Distilling, Wine and Brewing Studies. Our land-grant philosophy is taking us into new focus areas as workforce needs have greatly increased, particularly in the distilling industry. CAFE's partnership with the colleges of Engineering and Arts and Sciences



has opened new doors for students interested in this industry. These growing industries are truly agriculture, adding value to what is produced from our great Kentucky land. Forest products are increasingly important too, with white oak barrel staves currently in great demand.

The different shareholders say a lot about our college: we care about Kentucky's young people, we like to impart cool technological information that can turn a profit, and we serve rapidly growing industries. We're kind, we're geeky, and we're excited about growing agribusiness. The College of Agriculture, Food and Environment truly is for Kentucky.

—Nancy Cox
Dean, College of Agriculture, Food and Environment

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Everything Aged is New Again

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.....short rows

Sun-Fueled

What could be more organic than crop production fueled by the sun? That's what Biosystems and Agricultural Engineering's Joe Dvorak thought. He and his students are designing a solar tractor with the help of a \$25,000 UK Sustainability Challenge Grant. A solar array will be built on the UK Horticulture Research Farm in Lexington to provide the energy needed to charge the small 20-horsepower machine. The goal is for the college's Community Supported Agriculture (CSA) project to walk away from fossil fuels and produce their crops using only the sun's golden glow. Any excess energy generated will be used to offset other energy demands on the organic farm.

Read more: <http://bit.ly/28Sa78N>

Carb Counting Counts



Carbohydrates—sugars and starches—directly affect blood glucose levels. Counting those carbs, limiting intake, and spreading them throughout the day can help manage weight and blood sugar levels, dietetics professor Ingrid Adams said. It's no surprise that sugary sweets contain carbohydrates, but so do fruits, vegetables, grains, and legumes. That's the bad news. The good news is three servings of raw veggies equal only one serving of carbs. So eat your veggies and count carbs slower.

Read more: <http://bit.ly/28QytP2>

They Can Stomach It

Farmers can still retain feed value when they feed their cattle soy hulls, a by-product of soybean meal and soybean oil production that is high in fiber, according to Roy Burris, extension beef specialist. Soy hulls can replace corn on a pound-per-pound basis, especially if the cattle are on forage-based diets. And the cattle like it.

Read more: <http://bit.ly/28U5fiq>



Long Live the Monarch

An indelible image of summer is of a beautiful orange and black butterfly flitting from flower to flower—the monarch. Its very name suggests that it reigns supreme in the butterfly kingdom. But monarch populations are declining in the eastern United States due to loss of habitat and milkweed, the primary food source for their caterpillars. Including one or more of the 20 varieties of the plant in the home landscape or a riparian zone can provide needed breeding habitat for the butterflies and ensure the image of the monarch in summer does not fade from our memories.

Read more: <http://bit.ly/28Q7Eug>



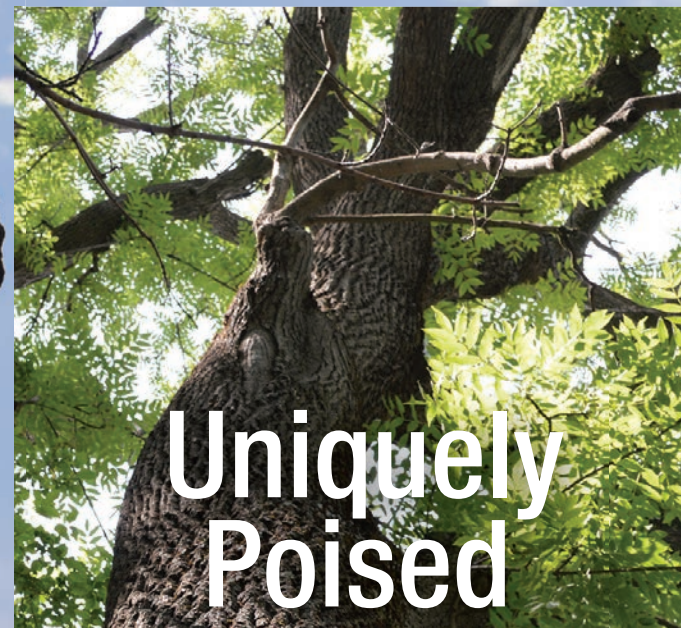
These are Pounds You Want

From okra to eggplant, kale to carrots, peas to potatoes, a well-planned and well-maintained home vegetable garden can produce a great deal of food for much of the year—600 to 700 pounds of produce per 1,000 square feet. Buy all that in a store, and that's a big grocery bill. With spring, summer, and fall seasons providing a bounty of flavors and nutrients, gardening contributes to healthy bodies and wallets.

Read more about the best vegetables for Kentucky gardens: <http://bit.ly/290mnkg>



....CAFEcorner



Uniquely Poised

Because of Kentucky's geographical position, the state faces a variety of forest threats. But it is also uniquely poised as the perfect laboratory for researching issues that affect the health of eastern deciduous forests. The college's newly created Forest Health Research and Education Center also is uniquely poised to protect our forests.

The center's strength comes from its partnership between the UK Department of Forestry, the U.S. Forest Service Research and Development Southern Research Station, and the Kentucky Division of Forestry. For the first time, scientists from the U.S. Forest Service are permanently located in the college, one of whom is Dana Nelson, center co-director and the Southern Research Station's genetics program project leader.

The center also involves the college's departments of Entomology, Plant Pathology, Plant and Soil Sciences, and Horticulture, because fighting forest menaces takes cross-disciplinary teamwork.

Currently, Kentucky forests face at least six serious threats. Red Baker, chair of Forestry and center co-director said most have a grim outcome.

The emerald ash borer's attack on ash trees is one. At least four native Kentucky tree species are susceptible to the beetle, but many plants and animals are also likely to be impacted by the widespread death the emerald ash borer is causing. It's the same with the hemlock woolly adelgid in hemlock trees, thousand cankers in walnuts, and down the road, sudden oak death.

"The Forest Health Center is trying to get out in front of these problems," Baker said. "Because being proactive is always better than being reactive."

—Carol Lea Spence

I Feel Smart



JESSICA MORRIS

The success of the program surprised Jessica Morris. The Wolfe County 4-H youth development extension agent thought introducing her county's elementary school students to computer programming would be a way to show them something different, but the exercise ended up opening windows to a new vista for many of the students.

"They were very excited," she said. "There were students who typically struggle in a normal classroom setting who really excelled at this. I don't know how it happened, but they just picked it up and ran with it."

Morris introduced 379 students in 18 different classes to coding through the Hour of Code website. Hour of Code is a nationwide initiative by Computer Science Education Week and Code.org to introduce millions of students to one hour of computer science and computer programming. Though it isn't an official 4-H program, Morris could see the benefits of trying it in the Eastern Kentucky county.

"There are very few job opportunities around here," she said. "I look at it as an opportunity to show a child they can do this for a living."

Depending on their age, students either programmed an Angry Bird to travel through a maze or guided Elsa from Frozen along the ice, creating snowflake patterns in the process. This was the first time any of the students had tried to code, and each of them could work at their own pace.

Morris had several students come up to her later to tell her they continued to explore other training modules on the website.

"I feel smart!" one student beamed.

—Carol Lea Spence

Grayson Brown



world to determine how to monitor its spread. I have talked with international policy makers about how to manage this mosquito. I am also the leading entomologist on an aerial mosquito control campaign in Brazil this summer. Not only can this mosquito carry Zika, but it caused the yellow fever outbreak in Peru. And I worked in Brazil during the recent dengue and chikungunya outbreaks caused by the same insect.

Q: What other mosquitoes have you monitored?

A: During the West Nile virus outbreak a few years ago, I did a lot of work on the Culex genus of mosquitoes, considered to be the principal carriers of that disease. We (the Public Health Entomology Laboratory) also do case investigations of other mosquito-borne outbreaks in the state like the Eastern equine encephalitis virus. It was transmitted by a mosquito that is uncommon in this state.

Q: How do you keep up with all the mosquitos and mosquito-borne diseases out there?

A: I conduct a general mosquito survey in the state every year to see what species are out there. We also work extensively with county public health departments and the Kentucky Department of Public Health. In addition, we conduct research on improving mosquito management systems. Our current research involves developing improved insecticides and implementing aerial releases of biotechnologies, such as sterile males and other biologically modified mosquitoes, into comprehensive management programs.

Q: What sparked your interest in mosquitoes?

A: I grew up in West Palm Beach, Florida. My first job in high school was working at the Palm Beach County Mosquito Control.

Q: You came to UK in 1978. What has kept you here?

A: I started a family here. Another big attraction for me is that the UK Department of Entomology has evolved to be among the best departments, certainly in the country and probably in the world.

Q: How did you develop your interest in public health entomology?

A: I worked in Peru during the biggest yellow fever outbreak in South America in nearly a century. I saw the impact it could have in people's lives, especially children.

Q: What is your role in fighting Zika?

A: I've been fighting *Aedes aegypti* since I was in high school. In March, I organized a summit in Brazil that brought in entomologists from all over the



Be Mosquito Aware

- Dump containers with standing water, including bird baths.
- Remove Japanese honeysuckle.
- Wear long sleeves outside.
- Avoid being outdoors between 4 and 8 p.m. when mosquitoes are most active.
- Make sure screens are in good repair.
- Use a mosquito control service.

Direct from the Plant Kingdom: Flavonoids

The key to developing plant-based pharmaceuticals, natural food dyes, and even environmentally safe paint could lie in studying flavonoids, chemicals produced in plants. That's what is happening in Jan Smalle's laboratory.

Up until now, research has been difficult, because it meant destroying the parent plant, extracting the flavonoids, then using solvents to purify them, which often modified or degraded them.

Plant and Soil Sciences researchers Smalle and Jasmina Kurepa developed a new method for harvesting the chemicals. The UK team discovered that, when placed in a water solution that contains titanium dioxide nanoparticles, the plant will take them up. Within an hour, the plant will secrete the nanoparticles back into the solution, this time coated with flavonoids.

"That was a shock," Smalle said. "We never expected the plant would simply secrete them for us. We were very happy when we saw that, because it made everything a lot easier."

Now, one year into a four-year \$450,000 U.S. Department of Agriculture National Institute of Food and Agriculture grant, Smalle has found the pathway for nanoparticle uptake into the plant cells. The cells transport the particles through their outer membranes in a process called endocytosis. By looking at different ecotypes of the model plant arabidopsis, graduate student Tim Shull has also discovered that some pick up the nanoparticles more easily than others.

Kurepa has also examined mutant strains of arabidopsis and found a whole palette of colors emerging back into the water solution, a discovery with potential for producing natural food dyes and antimicrobial paints.

"When extracted from shoots, flavonoids tend to be reddish-purple, but when they bind to the nanoparticles, there is a color shift



Jan Smalle, Jasmina Kurepa, and Tim Shull

toward blue. However with the mutants, we get a whole range from orange to yellow to green to kind of a brownish color," Smalle said. "It looks beautiful, and we're now analyzing exactly what sticks to these particles."

The team has looked at a variety of other plants and is confident that this process works in many different plant species, not just arabidopsis,

though the efficiency will vary.

"This is important, because if you compare different plant species, one plant will have a set of compounds that another plant won't have," Smalle said. "To be able to use the wealth of all the flavonoids in the plant kingdom would be nice."

—Carol Lea Spence



Cooking Up Something Special



Karen Grant hands out materials for that day's lessons on sugars and solid fats.

STEPHEN PATTON

It's an average Tuesday for Cheri Stacy and Karen Grant as they walk into the Active Day Center. Their clients, many of whom are exercising, stop what they are doing and come over to say hello to the Nutrition Education Program assistants.

As Stacy and Grant prepare to speak, most sit and wait while others come in from elsewhere in the building. The women's monthly presentations are one of the few in which everyone from the center gets to participate. The Richmond center is just one of several special needs groups in Madison County that Grant and Stacy work with in their roles with the University of Kentucky Cooperative Extension Service.

The Active Day Center offers health care and numerous other services for disabled and elderly adults and their families. Member adults have a variety of conditions that include chronic obstructive pulmonary disease, stroke, dementia, seizures, Parkinson's disease, multiple sclerosis, heart disease, and developmental and intellectual disabilities.

Active Day members have many unique nutritional needs and concerns, most notably diabetes. Most also have limited financial resources.

"We used to have a diabetes center in the county, but it closed, and we had no other options for our members to get good information about their diets," said Jeannice Ledford, center director. "Our members enjoy interacting with Cheri and Karen and receiving the good information they provide."

Stacy has taught the group for the past 12 years. She uses the Nutrition Education Program's core curriculum, which includes lessons on food safety, meal planning, reading labels, eating on a budget, breakfast, and the daily limits of solid fats, salts, and sugar. She also discusses food groups.

"Most of these folks have dietary concerns or have elevated risks for heart disease or diabetes," Stacy said. "I try to tailor my lessons to some of their dietary concerns. I target eating fresh veggies, low sodium and low sugar. I also encourage gardening."

Tim, one of the center's members, has fluid retention problems, so Stacy's message on lowering salt intake hit home for him. He listened intently and frequently asked questions.

"I know what it feels like to be over 200 pounds because of my fluid trouble. It made me feel bad. I don't want to have 200 pounds of fat on my body," he said. "She tells us what we need to do to take care of ourselves, like how not to eat so much salt and stuff."

Stacy said Active Day members have many of the same habits and concerns many people have, including the tendency to gravitate toward convenience items like junk food, fast food, and microwave meals that are often high in salt. Most are active family members and participate in meal preparation, meal planning, and grocery shopping.

"We don't treat them any different, and we don't expect any different out of them," she said.

While it may be an average day to Stacy and Grant, to their clients, they really are something special.

—Katie Pratt

Protection Against Costly Disease

Until recently, leptospirosis vaccines were only available for cattle, sheep, swine, and dogs, leaving horses unprotected. The University of Kentucky Veterinary Diagnostic Lab worked with pharmaceutical company Zoetis to remedy that, culminating 10 years of research.

UK VDL director Craig Carter led an effort involving 29 laboratories in the United States and one in Canada to gather blood from 1,495 horses.

"We found that horses are exposed to leptospirosis across the country," Carter said. "It's one of those bugs that is everywhere. It's difficult to control."

Leptospirosis is a costly disease. Causing problems like abortion, premature birth, blindness and more, the disease spreads easily through nose, mouth, and eye contact. Carter sees an economic benefit to stopping leptospirosis. During the 2006-2007 breeding season, the lab confirmed 39 leptospirosis-induced abortions. The average value of the lost foals was about \$189,000. Carter studied abortion cases from 1993 to 2012 and put a loss value on 541 foals at about \$102 million.

Many farms are now vaccinating their horses, and the UK VDL will track the vaccine's effectiveness in Kentucky.

—Aimee Nielson



A Dollar Saved

A quality mineral supplement is vital to cattle's overall health, but not all producers use it.

"The problem was, you could get a good quality mineral supplement, but it was terribly expensive, and you could get cheap mineral, but it really wasn't very good quality. It was an issue, and that's really how the whole program started," explained Graham Cofield, Trigg County agriculture and natural resources agent.

Cofield is referring to a cost-saving program run by UK Cooperative Extension and the Trigg County Beef Cattleman's Association that provides producers with high-quality mineral supplements at a good price. Using the beef IRM specifications that UKAg beef specialists compile and recommend, Cofield puts out a call for bids from the feed mills in the area. Then in January, May, and September the orders go out, and the farmers can pick up mineral supplements that contain the appropriate minerals in the proper form and percentage while saving anywhere from \$4 to \$15 a bag.

"If they were already on a good mineral program, they're benefiting from saving money," Cofield said. "And if they're maybe not on a good mineral program, they're saving money and improving the herd too."

—Carol Lea Spence



In Their Corner

By Katie Pratt
Photography by Matt Barton

Sitting at The Muhammad Ali Center in view of the Ohio River, Jesse Hobson, 22 of Louisville, talks of idolizing Ali and how he enjoys playing the video game Fight Night, so he can pretend he is the champion boxer.

Like Ali, Hobson has bounced back from punches his entire life. Although he will readily admit that most of them have been self-inflicted.

Hobson is just one of 555 adults between 18 and 24 who have stayed in a Louisville homeless shelter during the past year, according to the Coalition for the Homeless. The Coalition Supporting Young Adults reported in 2012 that many of those young people list finding a job as their most important short-term goal and a job that will turn into a career as their top long-term goal.

"It's bearing down on me," Hobson said. "I don't always want to be in this place or in this situation. The only way out is to get myself up and get out of there."

Unlike the vast majority of Louisville homeless youth who list "no one" as the person they turn to for help, Hobson has had support. To get to this point, it's taken him seven years and countless conversations with professionals who work with homeless youth in Louisville—one of whom is Nick Brown.



Nick Brown understands the young people he helps. He's traveled some of the same roads they have.

A hand up

Brown is a no-nonsense, straight-talking extension associate with the College of Agriculture, Food and Environment. He was hired in 2014 by UK researchers Janet Kurzynske, Ken Jones, and Kerri Ashurst to work with at-risk, urban youth as part of a unique grant from the Children, Youth, and Families at Risk program in the U.S. Department of Agriculture. In partnership with the YMCA of Greater Louisville, the grant allows them to reach some of the state's most vulnerable citizens.

"Partnering with the Y has allowed us to reach people we would never have been able to reach, as they have provided the audience, space, and location to conduct our programming," Jones said.

Brown teaches life skills to young people ages 12 to 17 at the YMCA Safe Place Shelter House and to 18- to 24-year-olds at the YMCA Youth Development Center. When young people come to the center, 92 percent are homeless or transient, 87 percent have little or no income, and 5 percent report a previous or current drug problem. All live below the federal poverty level.

On the ropes

Adopted at a young age, Hobson grew up in Middletown, a middle class neighborhood in Louisville. But he stole from his parents, quit school, and started heavily using drugs. At 15, Hobson first stepped into the YMCA Safe Place Shelter. He's slept in shelters and on friends' couches ever since.

"Back then I was just young and dumb," he said. "I just thought I was here to have fun. Then I realized the fun comes after you take care of your main issues and stuff."

Brown teaches at the Y and also in other venues like a barbershop or The Muhammad Ali Center, where thanks to various partnerships, he is able to take young people like Hobson to get things they need, such as haircuts or a cultural or educational experience. In 2015, he taught more than 1,000 life skill lessons to youth. Many of the 12- to 17-year-olds have returned home. In addition, 10 youth got jobs, three secured housing, and two were working

toward their GED certificate after the first six months of programming.

"The goals are different when you're working with this population. We hope to give the younger youth improved communications skills, so they can be reintegrated into their families, if possible," said Kurzynske, the project's principal investigator. "For the older youth, we hope to also teach them life skills that would allow them to be successful employees and become self-sufficient."

Reality check

Brown tells youth what they need to hear, not what they want to hear. It's a lesson he knows all too well, because he has walked in their shoes and slept on their streets. A self-described "punk kid," Brown decided at 15



David Reinford and Jesse Hobson



that he was going to leave his parents and make it on his own. That landed him sleeping in a dumpster outside a Louisville Shoney's before he sought help from the YMCA Safe Place. He stayed in the shelter for eight days before being reunited with his family.

"There was a guy at the Y named Richard Elon who taught me life skills when I was in this situation," Brown said. "No matter what we were talking about, he somehow brought it back to a lesson. I always thought that was a beautiful art form. I've tried to take that approach with my career."

It has worked.

Straight from the shoulder

"Nick has helped me go the farthest," said David Reinford, 19. "All I've seen is nothing but success. I've come a long way here."

Reinford has a past he doesn't like to talk about. Born the fourth of 12 kids on Chicago's South Side, he had little schooling and spent most of his youth in and out of incarceration. He came to Kentucky to work in construction with his brother in Breckinridge County but found small town life wasn't for him. When business slowed in the winter, he asked his brother to bring him to Louisville. He's been coming to the Youth Development Center for two months. In that time, Brown has helped Reinford get his Social Security card and an identification card so he can find employment. Brown has also connected him with the Kentucky Youth Career Center, so Reinford can start on the path toward earning a GED certificate.

"Out of all the programs I've been in that work with men, Nick is one of the best I've ever worked with," Reinford said.

It's a sentiment that KiAndra Hilliard echoes.

"When I have a problem, Nick goes through it and gives me each person's perspective," she said. "It's good, because I can learn what I need to make better and how to choose to cut people out. A lot of it is my choice of letting people in and then letting them stay while they do me wrong."

Hilliard, 19, has been on her own since September 2015, when she left an abusive home environment after her mother and she fought over finances. When she left, Hilliard could

Nick Brown (r) listens intently to Jesse Hobson. With a daughter on the way, Hobson has begun to take Brown's advice to heart.

no longer attend Jefferson Community and Technical College.

Brown has worked with Hilliard on resumes, goal setting, and interview preparation in addition to communication skills and conflict resolution. He has taken her to get a haircut through a partnership with a local barber and secured her interview attire through another partnership. In early May, Hilliard was working for a temporary employment agency and preparing for a job interview. She had just signed an apartment lease with two other homeless young women.

Hilliard sees her future in the medical field and wants to become a certified nursing assistant. Brown asked her to paint that on a rock outside of the building, as he does many of the young people to remind them of their goals.

"I can tell them, 'Look you painted this. This is what you wanted. This is not what I wanted you to want.'"

Some young people are ready and willing to improve, and some need to fail before they listen. Hobson was a prime example. For a month, Brown worked with five young people on resumes and life skills like introductions, communication, proper interview attire, and public speaking to prepare them for a job interview with the Crowne Plaza. Of the five, one was offered a job, three others, including Hilliard, were asked to take a pre-employment drug screening, and the other, Hobson, didn't get anything because he was inappropriately dressed.

"It was a good learning lesson for Jesse," Brown said. "I had been teaching him these things, but he wasn't listening. It made him realize I'm not talking just to talk."

With a daughter on the way, Hobson has started to listen. In April, he secured a job as a cook at a local restaurant. In early May, he got a second job with a temporary employment agency. With the money he earns, he hopes to get an apartment. He's also working with the Kentucky Youth Career Center on obtaining a GED certificate.



David Reinford and Jesse Hobson work on their job applications.



Jenie Carter, Expanded Food and Nutrition Education Program assistant from Kentucky State University, teaches KiAndra Hilliard about healthy eating.

Ringside

Brown has not only formed meaningful connections with the young adults and potential employers like Amazon and UPS but also with other community agencies. He is closely connected to personnel at the Jefferson County office of the University of Kentucky Cooperative Extension Service and extension personnel with land-grant partner Kentucky State University. Brown uses their expertise to offer youth-development opportunities and food through an on-site hydroponic garden at the Y.

In turn, Brown has helped Cooperative Extension form a number of community-based partnerships. He is a member of a Jefferson County coalition that supports young adults. Through a partnership with the Salvation Army, youth can stay there as long as they are being case-managed at the YMCA. He has a partnership with the Louisville Public Library that gives the young people computer access. He obtains professional attire through partnerships with Dress for Success and the Schuhmann Center. UPS personnel teach a computer class at the YMCA, and Simmons College has been to the center to talk to them about future careers.

It is the goal of the researchers to sustain the program beyond the five-year grant through partnerships and collaborations.

Learning to roll with the punches

Brown believes most of the youth want to improve their situation, are willing to listen, and can be successful adults if given the same opportunities and securities of average people.

"You do find you have your limits," he said. "I'm not going to get through to every kid. Some of them are going to see success quicker. Some of them will see success in a different way."

Reinford wants a job that will give him the ability to pay bills and have a place to live. Hilliard hopes to eventually return to college. Hobson hopes to attend UK and become a psychologist.

This will not only help him provide a good life for himself and his daughter but give back to his parents, who have remained constant supporters and recently have fallen on hard financial times.

"It's time I start doing right by them and show them that I really can change," Hobson said. "Nick's helped me see a few things along the way that maybe it's time for a change and maybe I need to get it together. If you're willing to get it together, they are willing to help you."◆

“Sensing” the Change in **Agriculture**

By Aimee Nielson
Photography by Matt Barton

In the early 1900s, farmers walked their fields to take soil samples. Once they knew what the soil needed, they drew maps to show them where to apply certain amendments. They used wagons and mules to haul loads of heavy limestone to precise locations. Without calling it that, they were practicing precision agriculture.

Simply put, precision agriculture is collecting and analyzing data and then making an action plan for the agricultural enterprise based on that data.

Farmers have always known the method gives them the highest yields and the highest quality crops. Today's technology has just made precision agriculture easier and more efficient.

“Farmers can benefit from technology by having the ability to do more,” said Tim Stombaugh, an agricultural engineer with the University of Kentucky College of Agriculture, Food and Environment. “We’re running out of manpower, and we need to be able to maximize the people we do have. Technology allows farmers to multitask.”

Precision in practice

Bob Wade, B.S. '82, knows the value of being able to multitask. He's a third generation farmer in Hardin County who annually grows 2,000 acres each of corn and soybeans. Practicing precision and efficiency ensures that he survives the ups and downs of row crop agriculture.

"In 1987, I bought this farm, and I rented equipment from my father; that's how I got my start," Wade recalled. "I've seen a lot of changes since I started farming, and it seems the pace of change is accelerating now."

On a clear, warm day in April, Wade was in the field planting corn. With variable soil and typical rolling Kentucky topography, the planter he uses is smart enough to vary the pressure and seeding rate of each row. The sensor on the planter measures depth 400 times per second and then relays that to a computer that adjusts the pressure on the unit.

"If you have a 60-foot swath, you have different ground conditions across the field, especially here in Kentucky where you have varying soil conditions. On one side of the planter the down pressure might be low, because the ground is soft. On the other end of the planter, it might be more, if the ground is really hard," he said. "It's important for me to be able to put the seed uniformly into the ground. If a plant comes up a day or two later than the one next to it, that can hurt the yield of the later one."

While he is planting, Wade can get text messages alerting him when an irrigation pivot turned on or off. He also uses his smart phone to communicate with recordkeeping software and schedule tasks so farm workers never duplicate work. He can multitask while planting because of technology like auto-steering.

"With auto-steering technology, we don't take the operators out of the equation," Stombaugh said. "The fact that technology can take care of some of that rudimentary steering frees the operator to do other things that help the overall operation. They don't have to constantly watch if the rows are straight or spend time focusing on the fence post across the field. They may even be less fatigued after a long day of planting."



Eyes on the future

Stombaugh and other UK Department of Biosystems and Agricultural Engineering researchers are continuously working on the next innovation for farmers. Stombaugh said the college has traditionally acted as a clearinghouse, a testing area, to see how well new technology works.

"We want to go beyond what the manufacturers are saying and find some common ways to test so that any farmer buying the technology has a way to compare what's out there and to know what's best for their unique situation," he said. "We want them to learn to read beyond advertising. We test yield monitors, GPS receivers, sprayer technology."

Precision technology is now incorporated into the design on most new machines, and it's becoming more and more affordable and easier to use.

Wade uses technology from planting through harvest, when sensors on the combine can give an immediate idea of yield and moisture levels.

"Each year, we can study our yield maps and make decisions about unproductive areas we may need to stop planting or areas we may need to amend soil to help make it more productive," Wade said. "When you think about it, successful farmers are the ones who have the lowest costs per bushel, so being careful where you allocate your capital is key to staying in the game."

Efficiency touches every part of Wade's Back Forty Farm. Sensors that measure moisture and temperature throughout the grain bin ensure the

Technology and farming go hand-in-hand at Bob Wade's Hardin County farm. Here, grain bin sensors measure moisture and temperature.

highest investment returns. All the sensor data goes into the computer system, where he can monitor the current conditions. If there is a quality issue, he can address it right away.

"Being able to monitor is important when there's 100,000 bushels in the bin," he said. "That's approximately \$370,000 worth of corn sitting in there, so I'm protecting my finances."

Currently UK researchers are studying unmanned aerial systems, or drones, but Stombaugh said it's the sensors that are unique, not the aerial vehicles themselves.

"What we can do with sensors is where the innovation comes in, sensors that can help us understand what's going on with the crop in the field," he said.

Motivating the next generation

Most agricultural engineering students are not easily amazed by technology these days, Stombaugh said. They've grown up with it and have such a familiarity with innovation that nothing surprises them.

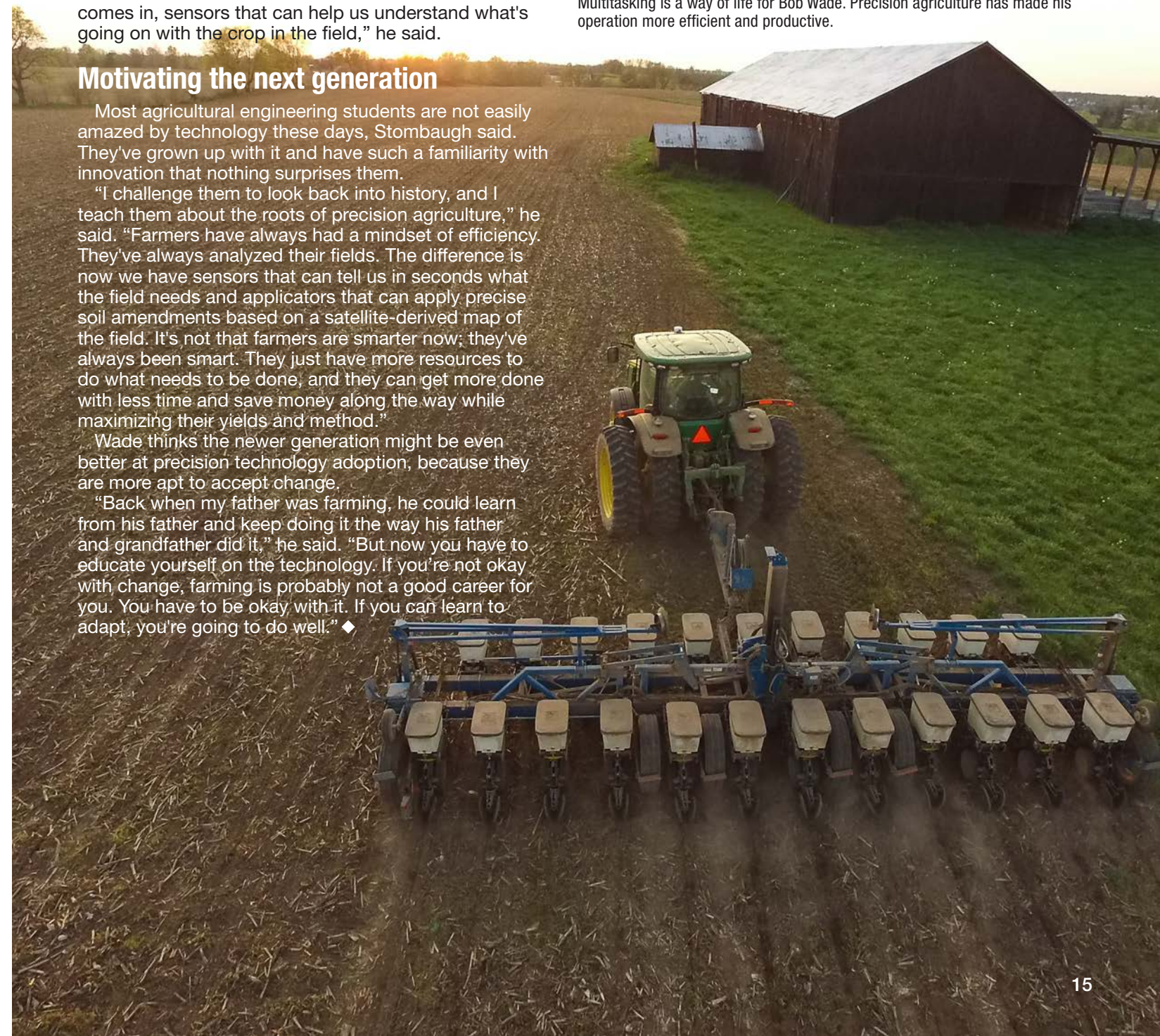
"I challenge them to look back into history, and I teach them about the roots of precision agriculture," he said. "Farmers have always had a mindset of efficiency. They've always analyzed their fields. The difference is now we have sensors that can tell us in seconds what the field needs and applicators that can apply precise soil amendments based on a satellite-derived map of the field. It's not that farmers are smarter now; they've always been smart. They just have more resources to do what needs to be done, and they can get more done with less time and save money along the way while maximizing their yields and method."

Wade thinks the newer generation might be even better at precision technology adoption, because they are more apt to accept change.

"Back when my father was farming, he could learn from his father and keep doing it the way his father and grandfather did it," he said. "But now you have to educate yourself on the technology. If you're not okay with change, farming is probably not a good career for you. You have to be okay with it. If you can learn to adapt, you're going to do well." ♦



Multitasking is a way of life for Bob Wade. Precision agriculture has made his operation more efficient and productive.



Everything Aged is New Again

By Jeff Franklin
Photography by Stephen Patton

When it comes to craft beer microbreweries and small-batch distilleries, Kentuckians are bellying up to the bar. The Bluegrass State has seen unprecedented growth in both areas. With taps now flowing around the state, there are 17 microbreweries, 14 since 2011, and craft distillers outnumber the multi-million dollar distillery giants. The College of Agriculture, Food and Environment is keeping up with the boom with its three-year-old Distillation, Wine and Brewing program.

"This is really a dynamic industry where marketing, business, arts, writing, and the hard sciences, like chemistry and fermentation science, are part of a lot of the jobs," said

horticulture professor Seth DeBolt, who is the director of the program.

The Kentucky bourbon industry is enjoying the largest expansion since Prohibition ended in 1933. According to the Kentucky Distillers Association, bourbon is a \$3 billion signature industry to the Bluegrass State, the birthplace of bourbon. Thanks to the perfect mix of climate, conditions, and pure limestone water, 95 percent of the world's supply of bourbon comes from right here at home. But the expansion of the bourbon industry in Kentucky is mostly in small-batch distilleries coming on line. The American Distilling Institute, a trade group for the small distillers, predicted there

Thanks to the perfect mix of climate, conditions, and pure limestone water, 95 percent of the world's supply of bourbon comes from right here at home.



Everything is done by hand at Stitzer-Weller Distillery. CAFE alumna Stephanie Carey is an assistant distiller.

would be 600 to 800 craft distillers in the United States and Canada by the end of 2016, and Kentucky has its share.

One of the first distilleries to open following Prohibition was the Stitzer-Weller Distillery, five miles from Louisville, which opened on Derby Day in 1935. Most of the whiskey that made the Pappy Van Winkle brand famous was distilled at Stitzer-Weller. In the 1980's, however, bourbon wasn't moving, and the industry was hurting. Stitzer-Weller eventually closed in 1992.

The facility remained closed until 2014, when it opened—once again on Derby Day—as the Bulleit Frontier Whiskey Experience and is now a stop on the Kentucky Bourbon Trail. Bulleit Bourbon is one of the fastest growing bourbon brands in the world. They will soon open a new state-of-the-art facility in Shelbyville, a \$115 million investment, considered to be the most environmentally friendly distillery in North America.

Stephanie Carey, B.S. '14, is an assistant distiller at Bulleit. Carey said everything is

done by hand at Stitzer-Weller, all in one room, from grain to barrel.

"I dump every bit of corn, rye, or wheat. I am turning the valves and watching my temperature gauges. I am in there, hands-on, watching it. It's my workout. It really has become my art," Carey said.

Carey has worked for Bulleit since 2014 and said the science she learned at UK in CAFE's biotechnology program has helped her in her job.

CAFE's Distillation, Wine and Brewing Program

For three years the UK College of Agriculture, Food and Environment has been offering an undergraduate certificate with courses in distilling, wine, and brewing. And while the 12-hour program won't turn students into master distillers or brewers the minute they graduate, it does serve to give them a solid introductory training in the field.

"The program shows students a possible career avenue. They can get a flavor, at an undergraduate level, for what is out there," DeBolt said.

Courses from spirit chemistry to brewing science and technology—12 in all—are offered. The program had its first graduate this year, and there are currently about 200 students enrolled in the classes. Debolt said it's not just classroom work, but includes a good research base, with a wine lab and the experimental vineyard and orchard at UK's Horticulture Research Farm.

"We planted an experimental hard cider apple orchard to help the industry, because we need to know what apples work well and what styles to produce," DeBolt said.

Students enrolled in any college at UK can enroll in the certificate program.

The program is being embraced by those who work inside the business. It is estimated that distillation jobs employ 16,000 Kentuckians, with average annual salaries of \$91,000. Daniel Harrison, better known as DH, one of the owners of Country Boy Brewing in Lexington, said having the knowledge up front, which the UK program provides, will cut three months off training new employees.

"I think it's a combination of a bunch of different things," Harrison said. "We need a science background, which involves chemistry and biology, a little bit of human resources, a little bit of marketing. We wear a bunch of different hats, and the fact that we didn't have a program like this before to train people is just crazy."

Craft brewing boom

According to Fortune Magazine, in 2015 there were a record number of breweries in the United States—4,144. That growth is attributed to the expansion of craft breweries and the meteoric rise in the localized beer movement.

Harrison and the "boys" at Country Boy Brewing, were on the front end of the craft



Students in CAFE's Distillation, Wine and Brewing program are led through a taste test by BAE professor Czar Crofchek (in white).



Stephanie Carey and Seth DeBolt discuss the bourbon business.

brew craze in Lexington, opening their tap room and brewery in February 2012. Their success has well surpassed expectations.

"Our business model was if we could sell 30 beers a day, we could keep the tap room open and the lights on," Harrison said. "Luckily, we sell way more than that now, and it has helped us grow. We are reinvesting a lot of money back into the business."

Country Boy opened just a couple of months ahead of West Sixth Brewing in Lexington with Blue Stallion and Ethereal following soon after. This spring, Country Boy Brewing announced its first big expansion, returning to their home county to break ground on a new production facility, tap room, and brewery in Georgetown in Scott County. Harrison said they have slowly grown to 16 employees, with plans to hire 10 to 15 people in Georgetown. They have come a long way from their Chair Avenue location in Lexington.



"We got this place up and running, kind of on a shoestring. We didn't hire any employees for about the first six months," Harrison said. "We did everything by ourselves, bartended every shift at night, no other employees but us."

Pretty scary stuff for Harrison, who had just started a family, with his daughter born a month before Country Boy Brewing opened.

Expansion seems to be in the offing for other craft brewers based on their initial success. West Sixth Brewing, located in the old Rainbow Bread Factory in Lexington, will open a nanobrewery, a scaled down microbrewery, on Main Street in conjunction with a bakery next door. And due to a change in legislation, Alltech's Lexington Brewing and Distilling will be able to open tap rooms at its Lexington and Bowling Green breweries and one to be added in Pikeville, which is in the planning stage. Alltech expects all three tap rooms to have an economic impact of \$13 million a year.

"It's a national, if not international, movement in a broadening of the beer market away from the big brands into smaller brands that have boutique products, and it's been happening for a while," said Seth Debolt. "They have created the boom. The educational component that we are looking at is to let students know there are careers in this area, not just in Kentucky, but nationally and internationally." ♦

Daniel "DH" Harrison is beaming over Country Boy Brewing's success.

Timber! Bourbon Demands White Oak

It's called "bourbon law." Bourbon must be made of 51 percent corn and must be stored in new, charred white oak barrels for no less than two years. Charring the barrel affects the tannins in the oak, which provide hints of vanilla, butter, and spice to the bourbon, while the charred interior gives it that amber hue.

"Bourbon is a corn product, a Kentucky product, and it is also a wood product. You can't do it without wood," said Jeff Stringer, University of Kentucky extension forestry professor. "We have white oak in Kentucky from Pike County in the east to Fulton County in the west; it is fairly common. It is not a particularly fast-growing tree relative to some things, and there is some concern over long-range supply issues."

As the bourbon industry grows, so does the demand for new barrels and white oak. All that oak comes from forests in a large swath of the eastern half of the United States. Kentucky, the world's No. 1 producer of bourbon, falls in the middle of that area.

The 10-to-15 year outlook for oak is okay according to Stringer, but the long-term view isn't as good. Researchers in the newly formed Forest Health Research and Education Center, a partnership between the college and the U.S. Forest Service, are studying white oak genetics in the hopes of getting ahead of future problems. Conversations about the potential effects and threats on the horizon have been started with people in the industry.

Stringer said the only way to keep a good supply of stave logs is with good forest management.

"Don't be burning it, don't be neglecting it, don't be harvesting incorrectly. Be good stewards," Stringer said. "That's not a quick fix to the problem, but that's how you do it. We need to do good management that fosters the development of white oak in stands where it grows."

It's not so much about the long-term sustainability of white oak, because it is fairly plentiful according to Stringer, but it's about the quality that's important.

"We can do analysis for those kinds of things," Stringer said. "We know what the growing stock is. We can get estimates of demand from the industry, which is fairly guarded, but the bottom line is if you know how many bottles of bourbon are being sold, we can work it back to how many trees it takes to do that."

By Jeff Franklin
Photography by Stephen Patton



A cooper at Robinson Stave and East Bernstadt Cooperage is one of the people responsible for producing more than 100,000 barrels a year for the bourbon and wine industries.

Staves are slabs of wood that are steamed and bent to form barrels. The wood has to be free of knots and limbs and other defects. Only a certain percentage of wood qualifies as stave logs, and there is additional demand for it in other products such as veneer and lumber. If lumber prices go higher, that puts pressure on distillers to pay more for the barrels.

"There are very few trees per acre that have stave logs in them. If we lost the market for other timber products, it would be difficult to conduct a harvest just for the stave logs, unless the prices were very high," Stringer said. "The availability of stave logs depends on the overall timber market. If timber markets are good, there is enough harvesting to supply an adequate number of stave logs."

Kentucky's No. 1 wood export is barrels, primarily as a recycled product from bourbon production, because the barrels can only be used once for bourbon. The majority of the used barrels wind up in Europe for the production of other spirits, like Scotch whisky. Some barrels end up as new casks for the wine industry, because the wineries like to show off the better quality barrels, according to Stringer.

The biggest demand for the barrels still comes from large distillers rather than small craft distillers. Brown-Forman in Louisville, producer of brands like Jack Daniel's and Woodford Reserve, has its own cooperage, where the barrels are manufactured.

What started out as a stave mill in 1958 has since become Robinson Stave and East Bernstadt Cooperage in Laurel County, producing between 100,000 and 110,000 barrels a year for both the bourbon and wine industries. C.B. Robinson, the founder and owner of the business, said they could produce even more if needed. Their primary customers include Heaven Hill, Barton Brands, and Buffalo Trace.



Robinson Stave owner C.B. Robinson shows off the charred interior of a barrel lid.

"Our white oak comes from Kentucky, Tennessee, Virginia, South and North Carolina, and some out of Ohio," Robinson said. "We buy timber over a big territory, but 65 to 70 percent of the logs come from local, independent loggers."

Robinson doesn't appear concerned about the demand for white oak being able to keep pace with production. He has been in business for almost 60 years, and at age 90, he has seen the ebb and flow.

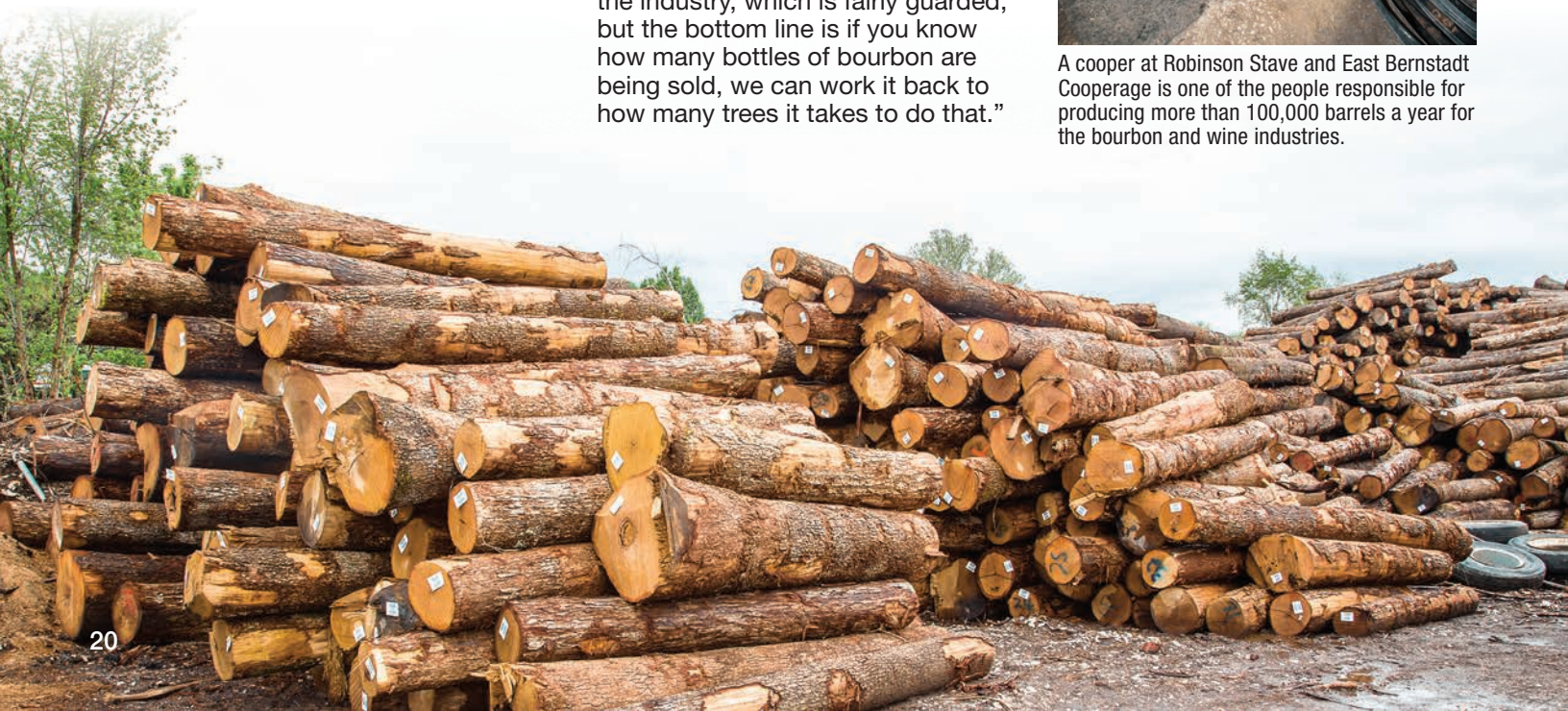
"We have been staying pretty busy. We never did think much about business going down;

it's always been going up," said Robinson, who along with wife Imogene, sons Ronnie and Joe, daughters Deborah Nantz and Diane, son-in-law Terry Nantz, and grandson Joe, employs 130 local folks. "We have never seen a time yet that we couldn't buy white oak."

Foresters and researchers in the College of Agriculture, Food and Environment are working to make sure that industry professionals like Robinson never do see that time, and white oak continues to be an important component of Kentucky forests and Kentucky's economy. ♦



Charring the barrel affects the tannins in the oak, which provide hints of vanilla, butter, and spice to the bourbon, while the charred interior gives it an amber hue.



From Hogs to Horticulture

On the foundation of an old gestation barn, boxwood thrives. On the former nursery site, a new propagation greenhouse stands, its tables made from grates recovered from the farrowing house. The former finishing barn is now used for storage.

The hog farm that Keith Veech once worked with his father may be gone, but its infrastructure remains to support a growing enterprise—Keith and Shawn Veech's Nelson County greenhouse business, V&V Wholesale Nursery.

When his father retired in the mid-90s, Veech tried to keep the business going, but the bottom dropped out of the hog market. The Veeches hung on for about two years, but finally decided to get rid of the hogs and try something else on the property where Keith had grown up.

He had been working for AT&T and also helping out at a local nursery on the side. With the knowledge he'd picked up there, plus a small grant from the Agricultural Development Fund Phase I tobacco money, he and Shawn were able to make the switch to the green industry, albeit part time at first.

"It was a long, hard road," he said. "People will say it takes five years to get a business established. Well, that's a short period, I think."

The Veeches found help along that road, though, from Nelson County horticulture extension agent Robbie Smith, as well as a team

of horticulture extension specialists from the College of Agriculture, Food and Environment. Smith came to Cooperative Extension from the nursery business, so he had plenty of experience to back up his advice, aside from the access he provided to the college's specialists.

"I began working with them on the conversion," Smith said, talking about his more than 16-year working relationship with the Veeches. "Everything from fertilization to plant selection, those kinds of things. We worked through some nutrition issues, and it really has paid off. He's a very good grower. Anything that comes up that he doesn't know the answer to, he knows he can give us a holler."

Robert McNiel, now emeritus horticulture extension professor, visited the property back around 2001, when Veech was thinking about putting a greenhouse on the site of the gestation barn. The three men decided the site was probably best used for outdoor nursery space. The low walls serve to keep the plants from blowing over, and it has air flow through it, which Smith said is the nature of hog barns.

Water management is a big issue in the greenhouse business. Both drainage and fertility issues have to be taken into consideration. The old gestation barn's bones work well for that, Smith said.

"The houses were set up, because in the hog business, the manure and everything naturally flows to the center to the drain. That's the way it still is now that it's nursery space, so you're not standing in water, and it flows right to the middle, then back out to recycle it in the pond."

In the new propagation house, which uses the bones of the nursery barn, the concrete floor Veech's father poured in 1979 is also designed to funnel water into a deep trough that serves as a drainage system, though here the water is city water. Smith said being able to keep the floors dry that way pays dividends in safety, because algae can build up on a wet concrete floor and cause a serious slippage problem.

McNiel had some further advice, telling Veech to fill up the floor trough with water to keep the humidity up in the greenhouse over the winter. This would also serve as a heat sink, Smith explained, with the water capturing the day's heat and releasing it during the night.

It's been 17 years since Veech started converting his hog barns into a plant nursery. V&V is strictly wholesale, concentrating mostly on woody shrubs, such as boxwood, arbor vitae, and burning bush, though Shawn Veech said she "piddles" with flowering herbaceous plants.



Up until now, they've been buying their inventory in trays, flats, plugs, and up to gallon-sized pots, growing them into 3-, 5-, or 7-gallon pots for customers in Lexington, Louisville, Indiana, and Elizabethtown. Now they're venturing into growing their own from cuttings, which will reduce the freight they have to pay to ship young boxwoods from Oregon.

But the new venture will take three years, and Veech said it is a gamble.

"You tell me what's hot and what's not," he said. "In three years from now, they might be going to something different."

But with the backing of Smith and the UK nursery crops extension team, it's a gamble the Veeches feel safe in taking.

—Carol Lea Spence

Photography by Stephen Patton

"Anything that comes up that he doesn't know the answer to, he knows he can give us a holler," said UK horticulture extension agent Robbie Smith, shown here with Keith Veech.



Robbie Smith and Keith Veech discuss Veech's new propagation house, built on the bones of the old hog nursery barn.



Robbie Smith, Keith Veech, and Shawn Veech examine the roses.

A Commitment to Food Safety

Sometimes, to teach someone to swim, you have to jump in the water yourself. The College of Agriculture, Food and Environment recently took the plunge into wholesale sales and GAP certification, and more Kentucky growers could soon start swimming in the wholesale market on their own, supported by the college's experience.

GAP, short for Good Agricultural Practices, and the related Good Handling Practices or GHP are voluntary food security and safety practices to minimize microbial food safety risks throughout the production, packaging, handling, and storage phases. Many, if not most, food distributors require it of their suppliers.

"It's all important: worker hygiene, how you harvest, how you pack, how you store your food, how you ship your food," said Paul Priyesh Vijayakumar, principal investigator of the college's Food Systems Innovation Center. "You're trying to show you have procedures in place to reduce the risk of contamination from chemical, physical, or microbial sources at every point along the way."

Vijayakumar works with food processors and producers to understand aspects of food safety as they pertain to GAPs and the upcoming rollout of the Food Safety Modernization Act.

"It's good for farmers, because it shows their commitment to minimize food safety risks and increases customer confidence. It's good for the consumer, because as best as it can, it helps reduce risk," he said.

The UK Department of Horticulture has dedicated three acres at its research farm in Lexington to grow produce for the wholesale market. In May 2015 they became GAP/GHP certified by the U.S. Department of Agriculture.

Mark Williams, UK horticulture professor, said the intent is not to compete with Kentucky farmers.

"We're trying to increase production of wholesale farming among local farmers and, at the same time, increase awareness and training in good agricultural practices," he said.

To provide such training to farmers, the college has joined with The Food Connection at UK, UK Cooperative Extension Service, Kentucky Department of Agriculture, Bluegrass Farm to Table, and the Kentucky Horticulture Council.

At a recent GAP-certification workshop for farmers, Joseph Monroe from Ashborne Farms in Oldham County was one of about 25 Central Kentucky producers who gathered to hear what has to be done to receive USDA GAP/GHP certification. He does high-intensive, multiple cropping—growing salad and microgreens, tomatoes, and peppers. He sells directly to the consumer through a farmers market and a community supported agriculture, or CSA, program.

"I got into farming because I wanted to grow healthy food for people, and I want to make sure I'm doing that the right way. So even if I can't afford to pay for GAP certification, I want to be following those procedures," Monroe said as he toured CAFE's organic farm and handling facilities during the workshop. "It makes you a better farmer to think about these things."

Food safety practices can be a stumbling block when farmers try to find a distributor for their products. There are a number of certifying agencies that focus on anyone from massive growers down to smaller producers. To be effective, food safety programs must be tailored to the specific farm.

Aside from workshops, the college and KDA offer on-farm consultations and mock audits to help prepare farmers.

—Carol Lea Spence

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Roundup

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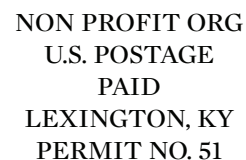
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