

AgKnowledge

COMMUNITY RESEARCH SERVICE

2019

KENTUCKY STATE UNIVERSITY
COLLEGE OF AGRICULTURE, COMMUNITIES,
AND THE ENVIRONMENT



**SCIENCE
HAPPENS HERE**



Researchers release new pawpaw cultivar, KYSU's third variety



Dear Reader,

I am excited to present the 2019 edition of AgKnowledge magazine, an annual publication of Kentucky State University's (KYSU) Land Grant Program including its College of Agriculture, Communities, and the Environment and its Cooperative Extension Program. This annual report is designed to highlight the research and Extension activities that our faculty and staff are conducting at Kentucky State University.

Over the past year, the Land Grant Program's faculty, staff and students have concentrated on a wide variety of research endeavors aimed at helping Kentucky farmers and communities. Organic research focused on introducing goats into crop rotations as well as hemp variety trials ahead of the passage of the Farm Bill late in 2018, which legalized industrial hemp production. Moving forward, our work in hemp will help current and new producers find a profitable market for this emerging commodity.

Research efforts continued in horticulture culminating in the release of our third pawpaw cultivar in September, KSU-Chappell™. Our faculty and researchers also continued work in the areas of urban agriculture, livestock nutrition and forestry. The Aquaculture Research Center had research accomplishments in indoor shrimp production, aquaponics, koi breeding, and largemouth bass production.

In the coming year, we will continue our research efforts to benefit Kentuckians, we will continue to build valuable partnerships with community and government organizations, and we will promote our programs and potential to prospective students and collaborators.

Kentucky State University's agriculture programs continue to make great strides. We are here to serve you, our stakeholders. Please give us your feedback and let us know how we can help you solve your problems.

Follow us on social media—@kysuag on Facebook, Twitter and Instagram—and visit us on the web at kysu.edu/ag to keep up with our day-to-day activities in communities near you. Subscribe to our newsletters, sign up for our workshops. Join us for a campus visit or invite us to your school or community event. We can't wait to work with you.

Thanks again for reading, and we hope you can use the information provided in this magazine. If you have questions, please call (502) 597-5120 or email kysuag@gmail.com.

Kirk Pomper, Ph.D.
Land Grant Director and Interim Dean of the College of Agriculture,
Communities, and the Environment
Kentucky State University

Check out KYSU AG on social media!



kysu.edu/ag | [@kysuag](https://www.instagram.com/kysuag)

Kentucky State University's Land Grant Program welcomes new Interim Associate Research Director



DR. CHRISTINA J. MCMANUS

Interim Associate Research Director
College of Agriculture, Communities,
and the Environment
Kentucky State University

Land Grant Director and Interim Dean of the College of Agriculture, Communities, and the Environment Dr. Kirk Pomper is excited to announce Kentucky State University's new Interim Associate Research Director Dr. Christina J. McManus.

Dr. McManus received her Bachelor of Science in Animal Science from Cornell University in 1994 and her Master of Science and Ph.D. in Veterinary Science specializing in Equine Reproductive Physiology from the University of Kentucky in 1996 and 2001, respectively. Her research focused on the impact of nutritional status on the timing of the breeding season in mares. Dr. McManus was a post-doctoral scholar in the Department of Physiology and Pharmacology at West Virginia University where she studied the neural signals that regulate secretion of reproductive hormones in sheep and the influence of nutrition on steroidal negative

feedback on the hypothalamic-pituitary-gonadal axis. Dr. McManus spent the next ten years as a medical writer.

She joined the staff of Kentucky State University in 2017 as the Scientific and Technical Editor for the College of Agriculture, Communities, and the Environment and was appointed to the faculty later that year. Dr. McManus will conduct research into the communication of scientific information to farmers and consumers in her new role.

"We are elated to appoint Dr. McManus to this important research position at Kentucky State," says Dr. Pomper, who served as associate research director before his appointment as Land Grant Director. "She is going to do great things for our research program and we look forward to the innovative work she and our staff will do to help Kentuckians and producers around the world."

AgKnowledge

2019 Edition, Volume 5

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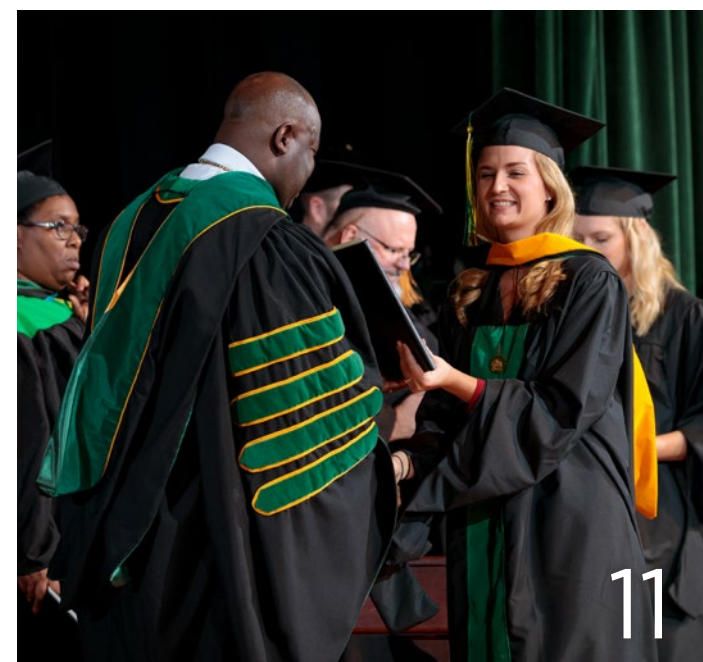
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AgKnowledge magazine publishes annually by Kentucky State University Land Grant Program to promote the research and extension work of the 1890 Land Grant Institution.

Educational programs of Kentucky Cooperative Extension serve all people regardless of economic or social status and will not discriminate on the basis of race, color, ethnic origin, national origin, creed, religion, political belief, sex, sexual orientation, gender identity, gender expression, pregnancy, marital status, genetic information, age, veteran status, or physical or mental disability. Kentucky State University, University of Kentucky, U.S. Department of Agriculture, and Kentucky Counties, Cooperating.

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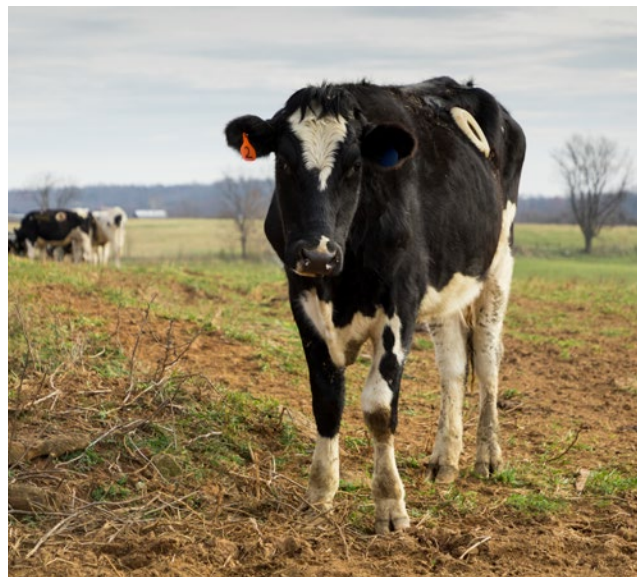


Beef research evaluates forage and feed additives

Beef cattle nutrition research at Kentucky State University's College of Agriculture, Communities, and the Environment focuses on improving the efficiency of microbial digestion of forage in the animals. Research led by Dr. Ibukun Ogunade, assistant research professor of livestock nutrition, evaluates the use of feed additives to enhance the activities of forage-fiber digesting bacteria in the rumen of beef cattle. This is important because beef cattle operations in Kentucky and other areas of the southeastern United States rely on forage-based diets.

Over the past year, Dr. Ogunade and his team have developed four unique research projects, published three peer-reviewed research articles in high-impact academic journals, and have provided relevant research experience for two undergraduate students in the College of Agriculture. Projects initiated in the program encompass research questions important to the production of agriculture, beef nutrition and bioinformatics. Currently, researchers are applying high-throughput sequencing technology and metabolomics to decipher the mode of action of commonly used livestock feed additives.

The beef cattle nutrition team recently received grant funding from Land O' Lakes, which will support research in beef cattle nutrition and provide research experience for three undergraduate students.



Calling all urban farmers

Kentucky State University's College of Agriculture, Communities, and the Environment is interested in helping urban farmers grow profitable and beneficial operations. To do that, Dr. Leigh Whittinghill, assistant professor of urban agriculture, is conducting a survey of Kentucky's urban farms and vegetable gardens. Through this research study, Dr. Whittinghill identifies general information about urban farms and vegetable gardens in central Kentucky as well as information about urban growing practices related to crop selection, cover cropping, nutrient management, pest management and irrigation.

Dr. Whittinghill and her team are interested in a wide range of urban farms and vegetable gardens from backyard gardens to community or institutional gardens (like school gardens) to larger commercial operations. Kentuckians who own, operate or manage a farm or food-producing garden in an urban area are eligible to take this survey.

KYSU's definition of an "urban area" is one within city limits (not "in the county"); one located in an area of relatively dense development; one in a suburb or subdivision; and/or an area that has streetlights and sidewalks.

Those interested can contact Dr. Whittinghill by phone or email: (502) 597-6139 or leigh.whittinghill@kysu.edu.

KYSU Ag is looking for graduate research assistants

Graduate Research Assistantships are available for qualified students in the Master of Science in Environmental Studies program. Research opportunities are available in the areas of animal science, apiculture, aquatic and terrestrial ecosystems, changing climate, conservation biological control, food systems, forest management, fruit crops, fruit and ornamental plant breeding, food safety, forage crops, genetics, genomics, land use change, organic agriculture, hemp, ornamental plants, and water quality. For more information on how to apply, visit: kysu.edu/agresearchassistantships.

A limited number of graduate research assistantships are available for qualified, full-time, thesis-track Aquaculture and Aquatic Studies students. Assistantships are typically funded through grants from state and federal agencies and are awarded only after a student has been academically accepted into the program. Students granted graduate assistantships are required to assist with activities relevant to the grant objectives for 20 hours per week while attending classes and full-time during the summer term. Compensation package includes a competitive stipend, opportunities to travel to and present research at professional meetings, and engage in a range of hands-on learning opportunities. Research areas include production systems, Extension activities, recirculating systems, aquatic diseases, aquaponics nutrition, genetics, and economics and marketing. Learn more at www.ksuaquaculture.org.



Interested in learning more about undergraduate and graduate opportunities or looking for information on careers in ag? Visit us online at kysu.edu/ag and follow us on Instagram, Twitter and Facebook: [@kysuag](https://www.instagram.com/kysuag)



Research works to prevent soil loss in Kentucky

Soil quality loss is a major concern among farmers in Kentucky because poor and degraded soils are devoid of the essential plant nutrients crops need. Some of the most productive crops and pasture are grown in the state's north central counties, and there is a considerable uncertainty as to exactly how future climate variability (i.e., high/low rainfall and warming) in this region might impact soil organic carbon—an essential element that all living things must have.

Recognizing the critical role soils have on mitigating increasing atmospheric carbon dioxide, emerging land management approaches to sequester carbon in the soils are gaining attention. These approaches not only offer a low cost means to mitigate greenhouse gas emissions but also provide simple solutions in the effort to improve soil health and resilience.

Many understand the benefit of conservation tillage and cover cropping in reducing runoff and mitigating emissions of soil gases. Acceptance of the practice has happened in part as a result of the increased prevalence of herbicide-resistant weeds. This has prompted some farmers to revert to conventional tillage.

A team of researchers, led by Dr. Maheteme Gebremedhin, assistant professor of soil science in the College of Agriculture, Communities, and the Environment, partnered with the Kentucky Natural Resources Conservation Service to provide guidance to small-scale crop row growers on how to maintain soil quality, improve crop productivity while maintaining the quality of soils.

To learn more, contact Dr. Gebremedhin at (502) 597-6830 or maheteme.gbremedhin@kysu.edu.



KENTUCKY STATE UNIVERSITY THEN *and* NOW



DID YOU KNOW?

Kentucky State University was chartered in May 1886 as the State Normal School for Colored Persons, only the second state-supported institution of higher learning in Kentucky.

AN 1890 LAND GRANT UNIVERSITY

KYSU and 16 other state schools were established as land grant colleges under the Second Morrill Act of 1890, which included the stipulation that African-Americans were to be included in the U.S. Land Grant University higher education system that had previously been established in 1862. Historically, the land grant universities provided research and education accessible to all. With this status in 1890, KYSU added agriculture, mechanics, and home economics.

Bees

What's the buzz around Kentucky's favorite pollinators? Here are some fast facts about the benefits of bees.



130,000

THE NUMBER OF POUNDS OF HONEY KENTUCKY BEEKEEPERS PRODUCED IN 2018.



Over 90 crops in the U.S., including almonds, tree fruits, cotton, berries, and many vegetables, are dependent on insect pollinators such as the honey bee for reproduction.

52

OF KENTUCKY'S COUNTIES HAVE BEEKEEPERS ASSOCIATIONS.

Honey is the only food source for humans produced by an insect.

SUGAR TO HONEY CONVERSION:



For every 1 cup of sugar, substitute 1/2 to 2/3 cup of honey.

Bugs

Beneficial insects can help control insect pests on some of the state's top crops.

Mayflies and Assassin bugs can be helpful indicators of a healthy ecosystem.

27,000

ACRES OF NATURE PRESERVES COVER KENTUCKY. THESE LANDS PROTECT THE STATE'S MOST DIVERSE NATURAL HABITATS AND PROVIDE NESTING SITES ESSENTIAL TO POLLINATORS.



Many beneficial insects prey on pest species such as aphids and mosquitoes. A single dragonfly can eat hundreds of mosquitoes in a day.

4,300

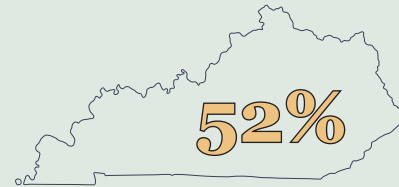
THE NUMBER OF LADYBUG SPECIES IN THE WORLD. NORTH AMERICA IS HOME TO 400 SPECIES.

Praying mantises are carnivorous and will eat crickets, grasshoppers, spiders, frogs, lizards and even small birds.



Farms

Kentucky is home to more than 77,000 farms covering about 13 million acres of land in the state.



OF THE STATE'S TOTAL ACREAGE IS FARMLAND



Kentucky is home to 77,000 farms, ranking it 6th in the U.S.

Kentucky is home to a wide variety of agriculture production, from horses and beef cattle to tobacco and corn. The state also produces poultry, aquaculture and horticulture.



170

THE AVERAGE ACREAGE OF A KENTUCKY FARM, COMPARED TO THE NATIONAL AVERAGE OF **435 ACRES**. KENTUCKY AGRICULTURE IS DOMINATED BY SMALL-SCALE FAMILY FARMS. **OVER 57%** OF ITS FARMS HAVE ANNUAL SALES OF LESS THAN **\$10,000**.

Commodities

Agriculture contributes approximately \$45.6 billion to Kentucky's economy each year.



Kentucky ranks in the **top 30** nationally in several commodities including **1st** for burley and dark air-cured tobacco, **4th** for hay production, **7th** for broiler production, **7th** for meat goat production, and **8th** for beef cattle.

#1

KENTUCKY LEADS THE U.S. IN HORSE SALES.



Broiler chickens are Kentucky's leading commodity.

12.5 million

ACRES MAKING UP **49%** OF THE STATE ARE FORESTED. THE STATE'S FOREST AND WOOD INDUSTRY DIRECTLY EMPLOYS **28,000** KENTUCKIANS AND HAS A TOTAL IMPACT OF **\$12.8 MILLION**. **75%** OF THE FORESTS ARE FAMILY-OWNED.

There are over 60 small-farm wineries in Kentucky.

Hard-Earned SUCCESSES

KYSU AG GRADUATES 14 BACHELORS AND 15 MASTERS STUDENTS IN COLLEGE'S 6TH YEAR

Kentucky State University's (KYSU) College of Agriculture, Communities, and the Environment (ACE) celebrated the successes of several of its students in 2018. The academic programs, which formally organized into a college in 2012, include one undergraduate degree in Agriculture, Food, and Environment, two graduate degrees in Environmental Studies and Aquaculture/Aquatic Sciences, and 13 12-credit-hour certificates.

In 2018, the program graduated 14 students with Bachelors of Science in Agriculture, Food, and Environment. It graduated nine students with Masters of Science in Environmental Studies (MES).

Several MES students will go on to doctoral studies. Those include Oguz Sariyildiz (University of Florida-Gainesville), Bijesh Mishra (Oklahoma State University), Mamata Bashyal (University of Georgia), and Kyle Slusher (University of Georgia). MES student Jarod Jones accepted a position at the Kentucky Division of

Water and graduates Ashley Bates, Megan Goins, and Brandon Preece accepted positions within KYSU's Land Grant Program.

Kentucky State University's Master of Science in Aquaculture and Aquatic Studies degree program celebrates its 20th anniversary in 2019. The program has graduated 46 students in its history, who have gone on to doctoral programs and professional careers all over the world. Last year, six students successfully defended their theses. Most of those have accepted professional positions following graduation.

Two current aquaculture students have already been accepted into Ph.D. programs. Alex Kramer accepted a position at the University of Ohio under Dr. Konrad Dabrowski and KYSU Aquaculture graduate Dr. Thomas Delomas. He will work in the field of genetics. Gagan Kolimadu accepted a position as a doctoral fellow in veterinary biomedical science at the University of Saskatchewan in Canada.



Featured Stories

Since its start in **2012**, the undergraduate degree in Agriculture, Food, and Environment has increased its option areas. The program now offers **six** tracks: Agricultural Systems, Environmental Systems, Food and Nutritional Systems, Aquaculture Systems, Agriculture Business, and Agriculture Communications. It also offers **10** undergraduate career-focused certificate programs. The college offers **two** graduate degrees and **three** graduate-level certificates.

To learn more about academic programs in agriculture, email kysuag@gmail.com.



HISTORIC DAYS *of* HEMP

KYSU CONDUCTS VARIETY TRIALS AND ORGANIC RESEARCH AS INDUSTRIAL HEMP IS LEGALIZED BY NEW FARM BILL

- *Kentucky is a nationwide leader in industrial hemp production.*
- *The state was the first to submit its plan for the implementation of a growing program for legalized industrial hemp.*
- *KYSU researchers study hemp in organic crop rotation, aquaponics production, and best production practices.*

“Hemp is a crop that connects Kentucky’s past to its future,” wrote Kentucky Agriculture Commissioner Ryan Quarles in his letter to U.S. Secretary of Agriculture Sonny Perdue when he submitted Kentucky’s State Hemp Plan following the passing of the Agricultural Improvement Act of 2018, more commonly known as the Farm Bill. “Kentucky is emerging as an epicenter for the American rapidly growing hemp industry.”

The 2018 Farm Bill legalized industrial hemp production in the United States, and Kentucky was the first state to submit a plan for how it will implement a growing program. Kentucky State University’s (KYSU) Land Grant Program has participated in the

state’s Industrial Hemp Research Pilot Program since its inception and continues to be one of the primary research locations in the state.

Kentucky was the top producer of hemp in the United States in the 19th and 20th centuries with thousands of acres of hemp in production. Yields reached their peak around 1917 with more than 18,000 acres of the crop growing primarily in central Kentucky. Hemp production declined in the late 20th century and it was classified as illegal to grow by the federal government under the Controlled Substances Act of 1970. Hemp was once again legalized as a controlled substance crop under the passing of the 2014 Farm Bill (KRS 260.850-260.869, and 7

U.S.C. § 5940) and the Kentucky Department of Agriculture’s pilot program laid the groundwork for the state to become a leader in the industrial hemp industry.

In 2017, KYSU’s Harold R. Benson Research and Demonstration Farm was part of 3,200 acres of the crop planted by licensed growers across the state. In the 2018 growing season, Kentucky more than doubled that acreage. By removing hemp from the list of controlled substances and directing the U.S. Department of Agriculture to make hemp growers eligible to participate in federal farm programs on an equal footing with other crops, the new Farm Bill has laid the groundwork for full-scale commercialization of this promising crop.

KYSU researchers are currently studying hemp in diversified organic crop rotations. Dr. Shawn Lucas, associate professor of organic agriculture, leads the hemp research programs. Other projects include organic hemp variety trials studying strains of the crop that have been previously untested in Kentucky and a research trial investigating aquaponics production of hemp for non-intoxicating cannabinoid (CBD) compounds that may have use as health supplements. Hemp research at Kentucky State University aims to find best production practices and best uses for the crop to help establish a viable market for farmers as the hemp industry grows across the country.

HOW TO APPLY FOR A HEMP GROWERS LICENSE



Following the passing of the 2018 Farm Bill, implementation plans and regulation remains with the state departments of agriculture. Kentucky Department of Agriculture’s Hemp Research Pilot Program laid the groundwork for how its State Plan will run. Growers can apply for licenses to grow hemp by visiting kyagr.com/hemp.



Dr. Lucy Lang-Chappell, now 93, and her daughters, Kathy and Camille, were among the 100 individuals who attended the release of KYSU's third pawpaw cultivar, KSU-Chappell™, named for the family.



The Fruits *of* Research

KYSU RELEASES THIRD PAWPAP CULTIVAR NAMED AFTER DISTINGUISHED UNIVERSITY ALUMNI

- *KYSU researchers release their third pawpaw variety, KSU-Chappell™.*
- *The pawpaw tree is native to the forest understory in Kentucky and fruits from late August to early October.*
- *KYSU is home to the only full-time pawpaw research and Extension programs in the world.*



Though rarely seen on grocery store shelves, the pawpaw fruit (*Asimina triloba*) has been a part of American history from its earliest days. Native to the forest understory of Kentucky, pawpaws have been picked by the likes of George Washington, Thomas Jefferson, Daniel Boone and explorers Lewis and Clark.

In September 2018, Kentucky State University's (KYSU) Land Grant Program—home to the only full-time pawpaw research and Extension programs in the world—released its third

variety of the fruit. The cultivar, KSU-Chappell™, is named for Roy M. Chappell and Dr. Lucy Lang-Chappell, both graduates of KYSU. The fruit follows KSU-Atwood™ and KSU-Benson™, also named for outstanding friends of the university, former President Rufus B. Atwood and long-time Land Grant Director Harold R. Benson.



The KSU-Chappell™ variety made its debut at the Third Thursday Thing sustainable workshop event. Dr. Lang-Chappell, now 93, and her daughters, Kathy and Camille, were among the 100 individuals who attended the event honoring the family. Lang-Chappell has dedicated her life to serving others and has spent her career helping individuals with mental and developmental disabilities. She helped secure funding for and built a 40-unit housing complex in Chicago and has taught at the University of Illinois Jane Adams School of Social Work and around the world.

Her husband, Roy Chappell, was a prestigious Tuskegee Airman who protested unequal treatment of African-Americans in the military. His actions led President Harry Truman to end segregation in the armed forces.

The KSU-Chappell™ pawpaw is a mid-season ripening cultivar that is extremely vigorous and high-yielding. KSU-Chappell™ bears large fruit (250 grams on average) with a creamy, sweet, mild, banana-pineapple flavor with floral notes, and a low percent seed (5 percent seed by weight). Trees of KSU-Chappell™ will be available for purchase from licensed nurseries. A list is available at kysu.edu/pawpaw.

The Land Grant Program began its pawpaw research program in 1993 and is now home to multiple orchards and the USDA-National Clonal Germplasm Repository for Pawpaw, which stores seeds of pawpaw trees from around the world. Today, Land Grant Director Dr. Kirk Pomper heads up the pawpaw research program at the university. Current research efforts are directed at improving propagation methods, developing orchard management recommendations, conducting regional variety trials, understanding fruit ripening and storage techniques, and germplasm collection and characterization of genetic diversity.

To learn more about pawpaw, contact research and Extension associate Sheri Crabtree at sheri.crabtree@kysu.edu.



DID YOU KNOW?

- Pawpaw fruit is creamy and mildly sweet, like bananas or mangos.
- Pawpaws can be used to make baked goods, ice cream, jam, beer and wine.
- Pawpaw trees are small, about 15-20 feet tall, and should be planted 8-10 feet apart.
- The trees are pollinated by flies and beetles and fruit from late August to early October.



Protecting *the* HERD

MEAT GOAT RESEARCH AIMS TO IMPROVE BREEDING VALUES, ROTATIONAL GRAZING PRACTICES, RECOVERY FROM PARASITES

- *KYSU is home to a meat goat breeding herd of around 100.*
- *Researchers work to improve breeding practices to provide producers with the most economically important traits.*
- *Current research continues in areas of rotational grazing and nutritional supplements.*

Researchers at Kentucky State University's (KYSU) Land Grant Program are evaluating kidding rates, rotational grazing methods, and nutritional supplements to combat internal parasites in order to help Kentucky producers care for the 57,000 head of meat goats across the state.

KYSU's Harold R. Benson Research and Demonstration Farm is home to Boer, Savanna and Spanish breeds and their crosses. Currently, Dr. Ken Andries, associate professor of animal science in the College of Agriculture,

Communities, and the Environment, and his staff use Savanna and Spanish sires for breeding and maintain pure bred of these two breeds. The breeding herd stays at around 100 breeding age does and kids in the spring.

Researchers are evaluating expected breeding values for the number of kids weaned in order to increase the number of kids weaned per doe. Dr. Andries and his team use the values to create two selection lines, a high line and a low line, for

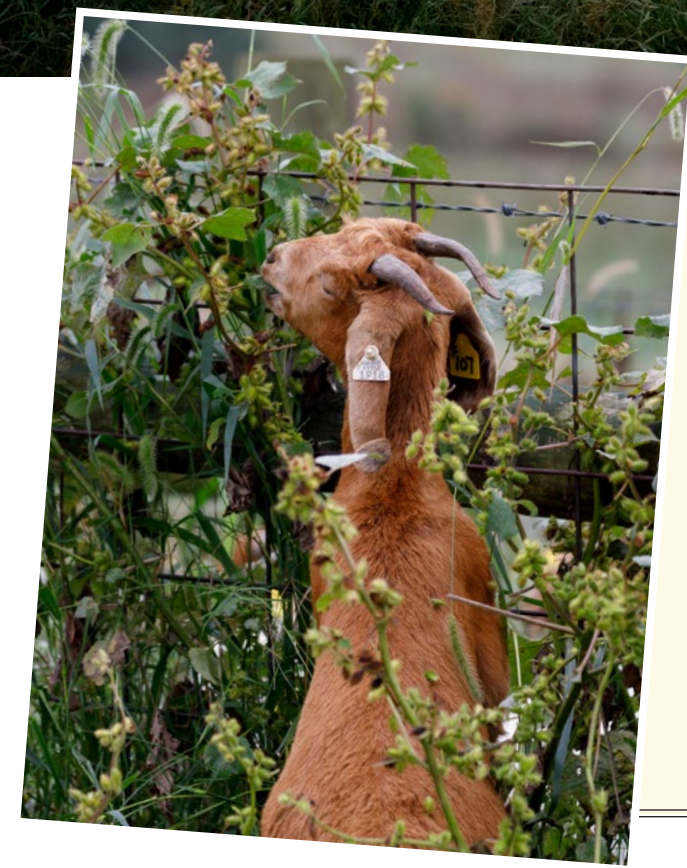




this trait and evaluate the number of kids weaned per doe in each line as well as kid performance data within each line. The results of this research will help evaluate a tool for selection for reproduction and survival to weaning, which is the most economically important traits for meat goat producers.

Other animal science research includes the evaluation of three different intensities of rotational grazing on animal and forage performance. Researchers evaluate 14-day, seven-day and four-day rotation systems on animal performance, parasite infection rates, forage productivity, and forage quality over three years. KYSU researchers know that rotational grazing can increase the quality of forage available and utilization of forage by animals, which can improve performance. They also know that improving nutrition and rotation can reduce parasite loads in goats. The expected outcome is a better recommendation for producers as to the value of rotational grazing to their production system.

New research efforts will evaluate different nutritional supplements for improving recovery after natural infection with internal parasites in the meat goats. Dr. Andries and his team plan to use two nutritional supplements that reduce the time to recover red blood cells in goats, which is the primary impact of the most critical parasite in meat goats. There has been no research on the effectiveness of these products in goats or for post-parasite recovery rates. KYSU hopes to be able to provide producers with good data about the effectiveness of using these products. They will look at several blood factors to determine if the product is effective.



DID YOU KNOW?

A female goat is known as a doe or nanny, a male goat is known as a buck or billy. Goats under a year are kids. Twins are normal for birth in goats so the herd numbers can grow rapidly.

CARING FOR OUR GOATS

KYSU staff put our goats through the handling system monthly to check for parasite infections and do a general health check to make sure the goats are in good condition. The only time this is not done is during kidding. We deworm all does at kidding and use selective deworming the rest of the year. As a result, we do not have a lot of parasite problems within our goats.



- *KYSU researchers use drones to survey land and provide land use analysis and trends.*
- *Drone technology can help farmers understand their land in new ways.*
- *KYSU works with growers and state agencies on proper use of drone technology.*

technology to survey and map large areas of land. Drones allow farmers, foresters, landowners and our researchers to survey more than 100 acres a day, whereas surveying a land area that size by foot would require up to a few weeks.

Dr. Richard Cristan, assistant research professor of forestry in KYSU's College of Agriculture, Communities, and the Environment, works with his team to study the regeneration of plants in areas impacted by the emerald ash borer, *Agrilus planipennis*. The emerald ash borer is an invasive species that has nearly eradicated the state's population of mature ash trees. Dr. Cristan's team utilizes drones to determine canopy

Drones—or unmanned aerial vehicles—are gaining in popularity across a wide variety of professional fields. At Kentucky State University (KYSU), researchers use this cutting-edge

DRONE TECHNOLOGY
ALLOWS FOR NEW AND
EFFICIENT ANALYSIS OF
FORESTS AND LAND USE

RESEARCHING *New Heights*

Drones are defined as unmanned aerial vehicles. Researchers use them to help farmers analyze land use and track growth in forested areas.



Dr. Richard Cristan and Mr. Andy Ong demonstrate proper technique and safety measures at a KYSU agriculture field day. OPPOSITE TOP: Dr. Richard Cristan studies forest growth and land use management. OPPOSITE BOTTOM: Dr. Buddhi Gyawali and Jeremy Sandifer use drones and Geospatial Information Systems to help farmers determine the potential for their land.



DID YOU KNOW?

The emerald ash borer was first discovered in the United States in 2002. Since its discovery, it is estimated that the beetle has killed over 30 million forest and ornamental trees, causing both significant economic loss and serious concern for the survival of several ash species in North America.

WHAT IS A DRONE?

Drones are defined as unmanned aerial vehicles. The first documented use of "drones" was in 1839 when Austrian soldiers attacked the city of Venice with balloons filled with explosives.

gaps that are a result of ash tree loss. The drone captures images of the canopies, which are imported into Geospatial Information Systems (GIS) programs where the exact coordinates of the sites can be identified. This process allows researchers to quickly and accurately identify the areas where ground surveying is needed. The

results of this research show some species of ash regeneration and very little invasive species generation in areas impacted by the emerald ash borer with low levels of human disturbance.

Other recent and current research projects have also utilized drone technology. Dr. Buddhi Gyawali, associate professor of

geospatial applications, and his research team are working with landowners to map their land using drone and GIS technology in order to determine the best land use practices based on various factors including soil type and elevation. The team is working to educate different organizations about the potential use of drones to increase efficiency in this process and they have developed partnerships with organizations across Kentucky to encourage the use of drone technology in the field.

As the popularity of drone use by state agencies, farmers and foresters increases, researchers at KYSU are working to help educate, interpret and facilitate the proper and efficient use of this emerging technology.





Dr. Jim Tidwell, chair of the School of Aquaculture in the Kentucky State University College of Agriculture, Communities, and the Environment.

Banking *on* BASS

MORE THAN TWO DECADES OF AQUACULTURE RESEARCH BENEFITS LOCAL GROWERS

- *KYSU researchers have studied largemouth bass for more than 20 years.*
- *Largemouth bass can bring over \$6 per pound live, a potentially lucrative enterprise for producers.*
- *A new book of the university's research will publish in 2019.*



Largemouth bass are a popular fish species for both sport and food. This popularity creates an increased demand for the fish and a potentially lucrative enterprise for fish farmers. In some cases, largemouth bass can bring over \$6 dollars per pound (live weight). The primary food fish market for largemouth bass is the Asian market in New York City.

Kentucky State University's (KYSU) Land Grant Program began working with largemouth bass more than 20 years ago. Initial research began in an effort to determine the causes of the high mortality rates that the Kentucky Department of

Fish and Wildlife had observed in their hatcheries over the winter. Over the years, KYSU's research expanded to include reproduction, larval feeding, production methods, feed development and marketing. Dr. Jim Tidwell, professor and chair of the School of Aquaculture and Aquatic Studies in the College of Agriculture, Communities, and the Environment, has dedicated many years to better understanding this species and to helping producers across Kentucky successfully produce largemouth bass.

When the university began its research in the 1990s, there was little past research about the commercial production



Robert Mayer and his family transformed their Nelson County tobacco farm in the late 1990s into a largemouth bass production facility. They tried shrimp at first, but found the old distillery ponds on the property were better suited for fish. The Mayers partnered with Kentucky State University to do some research and production of largemouth bass and have since grown to be the largest producer of food-size largemouth bass in Kentucky.

of largemouth bass or growing the fish to larger sizes. Largemouth bass are naturally carnivorous—in their natural habitat they are usually the apex predator—making the rearing of mature largemouth bass in captivity more difficult than other species. In order to successfully grow these fish in captivity, largemouth bass must be feed trained. This means the fish must be taught to transition from a live diet to a floating fish pellet diet.

In 2019, KYSU aquaculture faculty and staff will publish a book summarizing all aspects of largemouth bass production including research and insights from commercial producers. The book, “Largemouth Bass Aquaculture,” includes 15 chapters and covers topics ranging from the natural history of the species to its harvest and transport. Authors from Auburn University, Mississippi State University, Tennessee Tech University, and two universities in China are collaborating with Kentucky State University on this work.



Leigh Anne Bright, Dr. Jim Tidwell and Shawn Coyle contributed to and edited the book, “Largemouth Bass Aquaculture.”



DID YOU KNOW?

Largemouth bass are naturally carnivorous. They become active predators when they are just two inches long. At this stage, the fish transition from feeding primarily on zooplankton and insect larvae to live insects and small fish.

Robert Mayer and his wife, daughter and son-in-law run Mayer Fish Farm in Nelson County, the state’s largest producer of largemouth bass. The Mayers primarily sell to Asian markets, and they sell the fish live. The majority go through markets in New York. Mayer says he hopes that largemouth bass production will continue on his farm for several generations. The family started producing the fish in partnership with Kentucky State University’s Aquaculture Research Center in the 1990s.



LAND GRANT PROGRAM