# 2019 Annual Report of Accomplishments and Results

| Kentucky |
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| University of Kentucky |
| Kentucky State University |

## I. Report Overview

The NIFA reviewer will refer to the executive summary submitted in your Plan of Work. Use this space to provide updates to your state or institutions as needed.

**1. Executive Summary** (Optional)

The University of Kentucky College of Agriculture, Food and Environment and Kentucky State University College of Agriculture, Communities, and the Environment were founded as land-grant institutions (1862 and 1890, respectively), offering access to knowledge and learning to enhance the lives of Kentuckians. The two programs are fundamentally interdisciplinary, applying the biological, physical, and social sciences to challenges in agricultural, food, and environmental systems. Our work encompasses farms and forests, food and fiber, families, and communities.

The University of Kentucky College of Agriculture, Food and Environment holds a unique position as the home of the Kentucky Agricultural Experiment Station and the Kentucky Cooperative Extension Service. The teaching, research, and Extension programs are part of a national system that maintains a statewide presence and links local, state, national and global issues. Kentucky State University Land Grant Program and College of Agriculture, Communities and the Environment (ACE) focuses on teaching, research, and Extension to address the needs of the small-scale and limited-resource farmers; minority and underserved/disparity communities, as well as diverse and at-risk youth. These research-based programs include identifying new and niche products and markets for small-scale, limited resource, and minority farmers, enhancing the availability and safety of locally produced nutritious foods, and reducing fertilizer and pesticide runoff to improve soil and water quality while reducing farmer and forester expenses.

Our vision as an Extension system is to be recognized for excellence in fostering learning that changes lives, discoveries that change the world, and opportunities that shape the future. Research and Extension, as full partners with expanding linkages throughout the University of Kentucky and Kentucky State University and with support from every Kentucky county, seek to 1) facilitate lifelong learning informed by scholarship and research, 2) expand knowledge through creative research and discovery, and 3) serve Kentuckians by sharing and applying knowledge.

Research and Extension seek to sustain the land-grant heritage of achievement in these challenging times, but the Commonwealth and the universities are undergoing many significant changes. As Kentucky continues to move from a tobacco-based agricultural economy and explores

new options and commodities, land-grant programs face increased demands and expectations. Technology is redefining the way people acquire and distribute information and how they solve problems. While urbanization is claiming farmland, it is also creating new markets for traditional and non-traditional agricultural products. Changing lifestyles and demographics are challenging us with opportunities for greater involvement in youth, family, and community programs.

With nearly 75,000 farms in the state, Kentucky is in the top 10 states for number of farms. Many of these farms are major producers of traditional agricultural commodities, such as livestock, tobacco, and grain. Some seek new opportunities in specialty crops and industrial hemp. Others are operated on a part-time basis or involve limited resources. The research and Extension programs at both land-grant institutions provide the breadth needed to address the state's diversity of agricultural operations and agroecosystems.

Whether it is preserving our rich agricultural tradition by helping farmers, food processors, and agribusiness cope with technical issues, reaching goals, or enhancing the life skills of families, our research, education, and Extension programs are helping shape the future of Kentucky's agriculture, food systems, and communities as well as the quality of life of its citizens.

Some of our 2019 accomplishments include: actively engaging over 200,000 youth in various Extension programs, which included forming a partnership between Kentucky's two land-grant universities to provide life skills training and workforce preparation for some of the state's most vulnerable young people; Affording youth with opportunities to attend camp classes that include leadership development, livestock, communication and science programs; Offered workshops to help Kentucky producers better assess the estimated energy reserves of cattle; Teaching basic cooking skills to youth with special needs; Aided over 1,000 community members in undertaking new leadership roles and opportunities; Offered the 'Chalk and Talk' program, which seeks to engage people in a creative and accessible way about their feelings, thoughts and views on their city's downtown; Hosted free relationship checkups to give couples the opportunity to discover their strengths and problem areas in their relationship; provided a Woodland Owners Short Course to connect professionals with landowners to help the owners achieve their particular management goals relative to recreation, timber harvesting, wildlife or food production; Offered internships to students interested in research at the new University of Kentucky Grain and Forage Center of Excellence; Continued hosting workshops and trainings on water quality to focus on the need for maintaining drinkable water; Provided nutrition education programs for children and parents, offering lessons about eating healthy, increasing physical activity, meal planning, budgeting, food safety and portion control; Attracting underrepresented and minority youth to the college as participants in the Jr. MANRRS leadership institute, where youth gained leadership skills and knowledge in agriculture, natural resources, science, technology, engineering, mathematics and related sciences, and hosted the first gathering for individuals interested in local grains.

Local foods initiatives remain a movement to advocate for fresher, healthier eating habits. Additional educational programs were provided in the areas of agriculture and the environment, animal science, farm production, and water quality. Programs for homeless and unstably housed youth resulted in youth gaining the life skills to become self-sufficient. Extension has also taken a proactive stance in addressing the opioid epidemic across the state. University of Kentucky Cooperative Extension Service recently received more than $1 million to help further the organization's statewide educational efforts in opioid prevention and recovery. As a result of our collaborations with volunteers and other stakeholders during the

2019 program year, the percentage of our contacts were in the following areas: Global Food Security and Hunger (25%); Life Skill Development (22%); Agriculture and Environmental Quality (23%); Leadership and Volunteerism (7%); Diet, Nutrition & Healthy Lifestyles (7%); Food Safety (5%); Sustainable Energy (5%); Childhood Obesity (2%); Social and Economic Opportunity (2%), and; Climate Change (2%).Kentucky State University Cooperative Extension Program remains dedicated to providing educational programs to the limited-resourced, minority farmers, and the underserved population in Kentucky. We have extended our program reach by providing parenting skills to grandparents who have custody of their grandchildren, educating the non-traditional, beginning farmers through our Third Thursday program, and creating awareness among Kentuckians on emergency and disaster preparedness procedures. We continue to strengthen our commitment to food security through our summer feeding programs and by building food production capacities among residents in food desert areas. Research programs at the University of Kentucky have resulted in strategies for precision farm management that can result in significant financial savings or returns, new targets for improving crop yields and protecting plants from pests, making sustainable use of biosolids and nanomaterials for fertilizers and providing new guidance for protecting pollinators. Kentucky State University is also addressing key critical issues for the state through research that supports small-scale farmers, such as livestock nutritional supplements that could improve animal production and performance while being more cost effective; diverse and alternative species (as alternatives to channel catfish) specifically suited to the regional production and marketing environments to support Kentucky and United States aquaculture; and alternative production systems such as aquaponics, which can be used to produce healthy fish and vegetables close to areas with the greatest need and demand.

Kentucky Critical issues include: Life Skills Development; Nutrition & Healthy Lifestyles; Food Safety & Security; Agriculture, Environment & Natural Resources; Leadership & Community Engagement; Economic & Financial Well-being; Small Farm Development

## II. Merit and Scientific Peer Review Processes

The NIFA reviewer will refer to your Plan of Work. Use this space to provide updates as needed or activities that you would like to bring to NIFA's attention.

| Process | Updates |
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| **1. The Merit Review Process**<br><br>**See Plan of Work** | No updates |
| **2. The Scientific Peer Review Process**<br><br>**See Plan of Work** | No updates |

## III. Stakeholder Input

The NIFA reviewer will refer to your Plan of Work. Use this space to provide updates as needed or activities that you would like to bring to NIFA's attention.

| Stakeholder Input Aspects | Updates |
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| 1. Actions taken to seek stakeholder input that encouraged their participation with a brief explanation | No updates |
| 2. Methods to identify individuals and groups and brief explanation. | No updates |
| 3. Methods for collecting stakeholder input and brief explanation. | No updates |
| 4. A Statement of how the input will be considered and brief explanation of what you learned from your stakeholders. | Information from stakeholders continue to drive research and Extension protocol. It remains essential to our research and educational programs. A few additional things that we have learned from stakeholders include:<br><br>Health disparities: Stakeholders have provided information that obesity remains a dilemma across the state<br><br>Substance Use: Kentuckians said substance use and its related effects was the most significant issue facing the commonwealth today in Extension's recently released community assessment survey. |

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| | **Communication and Expressive Arts: Over 20,000 Kentucky youth reported developing the confidence to speak in front of groups**<br><br>**Rural Health Needs: Focus groups discussions from a community health needs assessment revealed that over the course of a three-year period, 19 hospitals (out of 33 participating) increased community and individual educational programs relating to diabetes, nutrition, obesity, heart health, cancer, and wellness.**<br><br>**Agriculture/Agribusiness: Over 30,000 residents completing the Extension Community Assessment survey reported that higher levels of support for agriculture and agri-businesses is needed, as well as efforts toward sustaining family farms.** |

## IV. Planned Program Table of Contents

## V. Planned Program Activities and Accomplishments

Please provide information for activities that represent the best work of your institution(s). See Section V of the Guidance for information on what to include in the qualitative outcomes or impact statements. Add additional rows to convey additional accomplishments. You may expand each row as needed.

| No. | Title or Activity Description | Outcome/Impact Statement | Planned Program Name/No. |
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| **1.** | **Increasing School/Kindergarten Readiness** | "School-readiness" is a broad term that refers to multiple precursor cognitive, physical, and social-emotional skills that indicate whether young children are prepared to learn and thrive in the school environment. A wide body of research shows a strong foundation in school readiness is indicative of school success. However, in the state of Kentucky, only 50% of children are deemed "school-ready" when they enter Kindergarten. These numbers indicate a need for more activities that support school-readiness by building multiple skill sets simultaneously. Family and Consumer Sciences Extension aimed to equip county agents with curriculum and conduct research to combat the issues. The Stories, Songs, and Stretches! © program was used to boost school readiness by simultaneously activating young children's emerging physical literacy, and social emotional learning skills through the intentional use of yoga-inspired movement and stillness. The program brings together children ages 3 to 6 and their adult caregivers to engage in a 30-45 minute program that shares books, music, movement, yoga poses, and mindfulness. To date, 40 county agents across the state have been trained and are qualified to teach this program in their county. In Hardin County, more than 80% of the parents or caregivers have reported seeing an increase in dramatic play from their child when at home. More than 60% reported an increase in speech and language skills since attending the program.<br><br>More than 80% reported an increase in social skills. | Life Skill Development |

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| **2.** | **Promoting Resilience among Unstably Housed Youth** | Youth must have their basic needs met first for them to be able to absorb and apply life skills. When homeless youth are given the same opportunities and support as other youth, research shows that they are successful at applying chosen life skills, such as acquiring employment, communication skills, completing a GED or high school diploma, and more. The purpose of the Project YES program was to provide life skills programs for homeless and unstably housed youth in Jefferson County, Kentucky. The primary goal was for target youth to increase the number of critical life skills they possess to become more self-sufficient (e.g., workforce prep, communication & conflict resolution). Findings for the long-term outcomes delineated on this grant are as follows:<br><br>All participants stated they need support from others to help them as they apply life skills. A "web of support" is the most integral piece for applying the life skills they learn. Participants reported whether their experience with the CYFAR program would help improve their situation. Participants also agreed that they learned pertinent life skills that will help them become successful in life and find ways to access useful resources. Participants reported on the post-test that the program taught them many different relational and workforce soft skills in the program. Staff at the youth center observed 100% of participants were able to put in practice at least one skill they learned during the program. More than 22 youth gained employment directly through the support of program staff or resources. Approximately 88% have been able to maintain employment or school attendance for at least 6 months. During the reporting year, 11 homeless participants gained access to stable housing with the assistance of site staff. Two youth accepted referrals to a GED program, and one obtained their GED. Eleven participants from the YDC site attended higher education classes. At the end of the reporting period, 35 young adults still active at the YDC site were working or attending school. Due to programming and outreach efforts, over 240 individuals, organizations, and businesses have gained knowledge on how to support youth in crisis, have assisted teaching life skills, or provided resource information. | Life Skill Development |

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| **3.** | **KYSU's Life skills program focus on building career paths among minority youth** | Minority teens are at a disadvantage for academic and life-long success due to other risk factors such as low economic status, cultural and linguistic barriers, limited parental education, specific race, and geographical location. In Hardin County, Kentucky State University Cooperative Extension Program focused on enhancing life skills for teen audiences and those who are minorities. Participants were taught resume and cover letter writing techniques. They were also exposed to various careers in Agriculture, STEM, and other related fields. Each participant had a chance to explore the requirements for starting a career in their area of interest.<br><br>A total number of 74 teens participated in the program; 58 of these were minorities and 60 were females. Over 90% of the youth reported they were able to apply skills of writing for future use. All program participants were able to identify careers that spark their interests. In one of the brainstorming exercises in the program, participants were able to work together in teams to come up with messages that can combat bullying through the use of art. One participant who was interested in becoming an entrepreneur mentioned, "I want to be my own boss, I want to own restaurants." She liked the idea of being able to learn more about leadership and how to make tough business decisions. Participants also mentioned they had interest in other career paths such as being a Forensic Anthropologist and a Pilot. Future programs would introduce teens to the foundations of financial literacy and money saving techniques. | Life Skill Development |
| **4.** | **Empowering Leaders to Strengthen Families** | Kentucky has gained national attention for having the highest rate of child abuse in the nation (Cobbin, 2019). There are 9777 children in foster care in Kentucky; of which 1557 reside in the Southern Bluegrass Region of the state (CHFS, 2019). Kentuckians struggling with substance abuse disorder themselves, or within their families, have increased tremendously over the last few years. Substance abuse accounted for over 50% of cases related to child abuse and neglect in Kentucky (CHFS, 2019). Opioid overdose continues to be a major public health problem in the United States and in Kentucky.<br><br>Strengthening Kentucky (SKY) Families Parenting program began approximately 14 years ago in response to a community need to assist with increasing parenting skills for families of color. Over the years, the program has evolved to include all families. The Kentucky State University Strengthening Kentucky Families (SKY) | Leadership & Volunteerism |

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| | | Parenting Education program provides instructional information on relevant issues that help divert crises when parenting infants through young adults for families in the Lexington/Fayette County region of Kentucky. SKY Families offers a six program in which participants meets twice weekly for an hour and a half.<br><br>In 2019, participants were taught skills from the Nurturing Parenting Community Curriculum, to impart skills that aid in the reduction of child abuse and neglect. SKY program serviced 20 families with 17 completing the program. Overall, 234 hours of service and 133 contacts were made with the following ethnic breakdown: 67 whites, 66 blacks, and 4 Hispanics. Of these numbers, 47 women and 86 males representing a total number of 66 children, attended the program. Overall, participants strongly agreed that they had a better understanding of how to nurture their children, how to keep their children safe and healthy, use of alternatives to spanking, how to handle conflict, how to solicit help from others, and how to deal with stress and anger. | |
| **5.** | **Northern Kentucky Ag Leadership Program** | One of the five goals of the Campbell County Farmland Workgroup is to "Develop Agriculture Leaders." The lack of agriculture leaders is a major concern by most farm organizations such as the KY Cattlemen's Association, KY Farm Bureau and even the UK Cooperative Extension Service. To address this issue, Agriculture and Natural Resource Agents from Boone, Kenton, Campbell and Pendleton Counties developed and hosted the Northern KY Agriculture Leadership program. One of the foci of this program was to recruit younger farmers who would benefit from an agriculture leadership program and become agriculture leaders in their county and our NKY area. Extension Agents designed and implemented an eight-session program that addressed such topics as: effective leadership, diversity, communication skills, agribusinesses, working with local state and federal legislators, and policy organizations. Participants were asked to develop a project as part of this leadership program. They chose to use social media and focus their efforts in raising the awareness of agriculture in Northern KY. The young leaders developed a website called Where You Live NKY. This group of young leaders is using this website to post information about local markets, individual farmers and local farming issues. They presently have 75 regular followers. | Leadership and Volunteerism |

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| | | The age group of the four Campbell County participants ranged from 23 to 46. New leadership roles that these individuals are now serving on include: President and Director of the Campbell County Cattle Association, Chair and member of the Agriculture Development Council and member of the Extension Service Agriculture Council. Due to this program and the commitment of these four individuals the future for Campbell County agriculture leadership is much brighter. | |
| **6.** | **KYSU cultivates Ag Leaders through Multi-state Program** | Kentucky State University Cooperative Extension Program collaborated with Southern University (lead institution), North Carolina A&T State University, South Carolina State University, and Prairie View A&M University to conduct a series of seven (7), two-year leadership training programs for small farmers. Nominated by all the 1890 Land Grant Institutions, 20 to 40 small farmers were selected to participate in each of the seven sessions.<br><br>The nine (9) farmers from Kentucky who participated in the 1890 Small Farmer Leadership Institutes (on different years) became leaders within their communities, Kentucky, and nationally. One now serves on the Kentucky State Extension Council and many local boards. Another has served on the advisory committee of the KY Governor's Office of Agricultural Policy, the local Extension Council as well as the Organic Association of Kentucky (OAK), and the Kentucky Pastured Poultry Association. An additional farmer served as a farmer delegate to the national Council for Agricultural Research, Extension and Teaching advisory committee, organized the South Lexington Farmers Market, served on the KSU Third Thursday Advisory Committee, and has served on numerous local and state committees. Another received the National Goat Producer Award from the 1st National Goat Conference. She also teaches about goats and farm animals during the local school Ag Days and assists with KSU Third Thursdays when needed. Lastly, one opened two local fresh food and meat markets, including restaurants where they serve local produce in Munfordville and Louisville, KY. | Leadership & Volunteerism |

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| **7.** | **Taking Control of Diabetes** | Diabetes costs Kentuckians 3.85 billion annually. According to 2016 Kentucky data, more than 13.1% of Kentucky adults have been diagnosed with diabetes – an increase of 50% since 2000. If these trends continue, 1 in 3 Kentuckians will develop diabetes sometime in their life. Those with diabetes lose an average of 10-15 years of potential life and can develop serious complications such as cardiovascular disease, blindness, kidney failure, and non-traumatic lower extremity amputations.<br><br>Due to limited resources available in the county, community members and local healthcare providers frequently look to the local Cooperative Extension Service for information for individuals managing diet-related chronic diseases. Nutrition is the cornerstone of diabetes management and the Extension program. Taking Ownership of Your Diabetes helps Kentuckians manage their own or that of a loved one's diabetes through nutrition education. This series was hosted, and outcomes were reported by the Family and Consumer Sciences Agent in 21 counties across the Commonwealth. Diabetes support groups are the primary audience for this program.<br><br>As a result of the program, 300 participants reported they utilized a diabetes-specific meal plan to manage carbohydrate intake and increase fruit and vegetable consumption. A major component of diabetes self-management is keeping blood sugar levels in the normal range. As a result of the program, 398 and 464 people shared they checked their blood sugar at least 1 time per day and had their A1C (long-term measures of blood sugar) checked in the past year, respectively.<br><br>It is well-established that losing just 5-7% of weight can improve the health of individuals with diabetes. Because of the program, 212 individuals took part at least 150 minutes of physical activity each week and 258 individuals implemented at least 3 healthy eating practices to help address their weight (e.g. portion control). As a result, 156 individuals reported losing at least 5% of their body weight as a result of the program.<br><br>Finally, as stated above the primary aim of Taking Ownership of Your Diabetes is to increase self-efficacy of skills necessary for diabetes self-management. This was achieved as indicated by the 231 individuals who were able to set at least | Diet, Nutrition & Healthy Lifestyles |

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| | | one goal and accomplish that goal related to managing their diabetes all on their own. | |
| **8.** | **Healthy Choices for Every Body** | According to the Centers for Disease Control and Prevention, Kentucky's self-reported prevalence of obesity among adults is 31.6%, among the highest in the United States. Prevalence of related diseases, such as diabetes, cardiovascular diseases, asthma, and some cancers, is directly proportional. More than 11% of Kentucky's adult population is diabetic. According to the American Heart Association, heart disease and stroke are the leading causes of death in Kentucky, accounting for 28% of deaths. To address these issues, UK and KSU EFNEP and SNAP-Ed Nutrition Education Program Assistants deliver nutrition education to limited resource adult audiences in Kentucky using the Healthy Choices for Every Body (HCEB) curriculum. HCEB teaches limited-resource adults about planning nutritious meals on limited budgets, safe food-handling practices, and appropriate food preparation skills needed for a healthy lifestyle. Topics on physical activity and practical ideas for adopting a physically active lifestyle are included in each lesson. Participant outcomes were measured using the EFNEP NEERS evaluation tool and Kentucky Behavior questionnaire. The pre/post evaluation of 5,656 graduates resulted in the following program outcomes:<br><br>66% showed gains in their daily consumption of water (i.e., drinking at least 6 cups every day).<br><br>52% drank soda less often and 46% drank other sweetened beverages less often.<br><br>66% consumed low fat milk and dairy products more often.<br><br>47% increased the cups of fruits consumed per day (by average of 0.75 cups).<br><br>47% increased the cups of vegetables consumed per day (by average of 0.65 cups).<br><br>67% reported being more cautious in thinking about healthy choices when deciding what to feed their families. | Diet, Nutrition & Healthy Lifestyles |

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| | | 77% showed improvements in using Nutrition Facts to make food choices. | |
| **9.** | **On the Mend: Combating the Opioid Crisis** | The latest data on the opioid epidemic paints a dire picture for the state of Kentucky. In 2017, overdose mortalities rose for at least a tenth consecutive year, totaling more than 1,500 deaths. In response, the state has begun exploring new and innovative alternatives to the traditional modalities of treatment and recovery.<br>Research indicates that for people with substance use disorders, and particularly for those who have become justice involved, the risk of relapse is highest during the first 90 days following release from treatment and/or incarceration. Therefore, it is imperative that these alternative approaches offer support to people in early recovery.<br>In cooperation with a Judge, who presides over drug court in Bourbon, Scott, and Woodford counties, UK Cooperative Extension developed the Beyond program to provide recovery capital to drug court participants. Recovery capital refers to the sum total of resources that a person can leverage to support their recovery. As a part of the program, participants attended bi-weekly sessions at their county extension office to access recovery capital programming related to addiction education, employability/soft skills, personal finance, nutrition, and parenting. The foundational approach to the Beyond program was to mobilize existing strengths within Cooperative Extension, and particularly within Family and Consumer Sciences Extension, to positively impact the lives of people in recovery. To date, at least 30 drug court participants have been served in their respective counties. The social, judicial, and healthcare costs recuperated by society when 30 individuals in a community are able to sustain recovery is so profound as to be difficult to calculate. | Social & Economic Opportunity |
| **10.** | **Assisting Hospitals in Identifying Community Health Needs** | With the passage of the Affordable Care Act in 2012, not for profit hospitals are required to complete a Community Health Needs Assessment (CHNA) every three years. The process of completing an assessment and generating a report can be burdensome to any size hospital, but especially to a small, rural hospital with limited staff and resources. As a result, the Community Economic Development | Social & Economic Opportunity |

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| | | Initiative of Kentucky (CEDIK) created a process for Extension Specialists and staff to assist hospitals in Kentucky to complete this IRS requirement.<br><br>This year marks the third cycle of CHNA's for hospitals and CEDIK staff completed reports for 26 hospitals. During the process, 857 in person contacts were made in Kentucky communities through steering committees, focus groups and key informant interviews. In addition, 8,387 community surveys were collected and analyzed to help identify the unmet health needs that need to be addressed.<br><br>After unmet health needs were identified and prioritized by local steering committees, each hospital created an implementation plan with specifics on how to address the needs over the next three years. The most common health needs that emerged across the majority of the hospitals: Substance Use Disorder (prevention and treatment), Tobacco use and Tobacco related diseases, Mental Health, and Obesity (including obesity related chronic diseases).<br><br>Each hospital board of directors reviewed the report results and voted to approve the assessment and implementation plan. CEDIK will continue to provide guidance as hospitals implement their plans and collect data to report their successes over the next three years. In addition, more hospital CHNA's are planned for completion in 2019-2020. | |
| **11.** | **Small Beginning Farmers learn Beekeeping** | The United State Department of Agriculture reported a 16% decrease in honey bee colonies in 2018. About one-third of food production is dependent on bee pollination, which accounts for about 15 billion dollars of the United States economy. The Bee Informed Partnership estimated a 34% decrease in honey bee colonies in Kentucky.<br><br>To combat the decreasing bee colonies in Kentucky, Kentucky State University Cooperative Extension Program with the University of Kentucky Extension, provided bee production lessons to beginning beekeepers. Participants participated in a 5-part lesson that introduced them to bee production, bee protective gear, sustainability in bee production, bee diseases and pest, and honey marketing. These classes were taught in 5 counties in the state. | Social & Economic Opportunities |

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| | | Over 225 individuals were reached through the program. Prior to the program, one-third of these individuals had bee colonies and learned how to sustain their production. In addition, 65% planned to own honey bee colonies and about half of them connected bee production to potential increase of food production in their gardens. Participants also reported to now have the confidence to start a bee colony. | |
| **12.** | **Promoting Social Connections and Community Pride** | Monroe County for 4-H Youth Development partnered with the Tompkinsville Monroe County Chamber of Commerce and the City of Tompkinsville to bring the Vietnam Memorial Traveling Wall to Tompkinsville. Extension further coordinated with Monroe County Board of Education so that all schools would be able to visit the exhibit. The target audience for the exhibit was all Monroe County and surrounding county citizens with a special emphasis on reaching out to local Vietnam Veterans. It was estimated that over 7,000 people visited the exhibit. High school students who were enrolled in advance placement history helped visitors locate the names of their family members and friends who were listed on the wall. Teachers prepared special lessons with their middle and high school students so that when they visited the exhibit, they had a specific name to find. Students then researched the individual to learn more about their service. The most significant outcome of the exhibit was that for the first time, our local Vietnam veterans gathered together as a group. It was expressed more than once that finally they were given some recognition for their service and that talking to each other about their experiences helped them to heal and to form new support structures. This exhibit gave those who are unable to travel to the memorial in Washington, D.C. an opportunity to learn from the wall by visually seeing the names listed and for the family members of those listed, it was a public recognition of their grief and sacrifices. | Social & Economic Opportunities |
| **13.** | **Using Social Media as a Tool for Increasing Accessibility for Horticulture Extension Program** | Many people are not able to attend the KYSU's horticulture program for a variety of reasons such as work, tight schedules, family obligations, travel; some reported difficulty in participation due to mobility and health issues and/or sensitivity to heat and cold. In 2019, technology was utilized to help mitigate these issues. For the first time, we pilot tested the use of social media coverage by live streaming the whole program via Facebook. A virtual tour of pawpaw orchard was live | Social and Economic Opportunities |

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| | | streamed and participants who were unable to go outside for the tour could see the orchard in real time. 6 of the 150 in-person attendees were unable to go on the tour and they stayed inside to view from the screen. The live video reached 5,747 people with 2,333 video views and 52 people engaged with the program by providing real-time comments and asking program-related questions.<br><br>Program participants reported an increased knowledge of pawpaw production. One virtual participant said, "I am so thrilled to find the Facebook broadcast could be viewed! I missed out yesterday because I was at work but was able to come home and start watching it last night and now this morning, I've put it live-streamed into my TV and watching the rest of it. I cannot thank you guys enough for doing this! Those of us who can't be there because of variety of reasons are really going to learn a lot! I wanted to express my appreciation for the level of technology that you guys are using to share everything about pawpaw. It seems that you have a wealth of information but also a way to share it that makes learning fun." | |
| **14.** | **Improving Hay Quality** | During the fall of 2017, the Campbell County Agriculture Council identified the need for more in-depth forage production programs. After a second meeting, the Master Haymaker Program (Spring 2019) became the foundation for more intensive forage production programs for Campbell County and other Kentucky farmers.<br><br>After a very productive Master Grazer Program (five-part series/52 participants) during the spring of 2018, county agents worked with a forage specialist and the UK Pasture Evaluation team, to test the pastures for endophyte tall fescue and the percent ergovaline (toxins). These results were showcased during the field day along with weed control strategies and rotational grazing practices. A Fencing School was also held with 34 participants. One participant made the comment: "I have fenced for 40 years and I had no idea how much there was to know about fencing." These three programs reinforced the management practices needed for improved grazing and pasture management.<br><br>The Master Haymaker program was held with 36 participants. This six-week series focused on establishment, variety selection, forage species, soil and fertility, hay harvesting equipment and weed control. Based on a post program survey, approximately 70% of those attending the program said they plan on | Agricultural & Environmental Quality/Global Food Security and Hunger |

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| | | implementing each of the following hay production practices over the next two years: soil testing and apply lime or fertilize according to test, use UK forage variety trial publications to select certified seed, use the UK weed control publications to implement a weed control program, forage test hay and renovate hay fields with legumes. Sixty Five percent of participants rated the program as excellent with 35% rated the program as above average. Before the program 50% of the producers rated their knowledge of hay making as average and after the program, 75% rated their knowledge of hay production as above average. | |
| **15.** | **Soybean Establishment** | In 2018 soybean seed companies and seed producers endured a particularly challenging year with the production of 'seed' soybean. 'Seed' soybean are the soybeans that were produced in 2018 to provide seed for producers to grow in 2019 for commercial production. Excessive, frequent rains made harvest of 'seed' soybean impossible. It is well known that multiple cycles of wetting/drying of soybean, which occurred in 2018, greatly reduces the vigor of soybean seed. This reduced vigor is of great concern for commercial producers, because the vigor of a seedling can be used to predict field emergence of soybean. In order to inform Kentucky producers of the potential for low seed vigor and essentially poor stand establishment county agents were informed of this potential problem and presented this information at numerous county and national presentations during the winter/spring of 2019. As encouraged in these materials, many Kentucky producers responded by submitting samples for vigor testing at the UK Seed Testing Lab. According to the Seed Testing Lab, vigor tests in the spring of 2019 increased by 350% for the same time period in 2018. The vigor ratings provided by the Seed Testing Lab will allow producers to adjust soybean seeding rates to ensure optimal stand establishment for the 2019 soybean crop. | Agricultural & Environmental Quality/Global Food Security and Hunger |
| **16.** | **Soybean Nematode Coalition** | Soybean cyst nematode (SCN) is one of the top yield reducing pests on soybeans, causing great economic losses all around the world. The SCN Coalitions is a multi-state group of Extension specialists, university researchers and agricultural company representatives who are trying to bring attention to the growing threat of soybean cyst nematodes. This is the second coalition, with the first one | Agriculture & Environmental Quality/Global Food Security and Hunger |

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| | | beginning in 1997. The reintroduction of the coalition is to help spread awareness that SCN has started to evolve and current management methods are not enough to help combat the yield loss from SCN. This year, UK Extension was able to have a table at the Farm Machinery Show at the Kentucky Soybean Board booth to spread awareness and management methods for soybean cyst nematode. At the booth, several info graphs on SCN, as well as a Farmer's Guide to Soybean Diseases were distributed.<br><br>In order to find out what information is currently out in the public, Extension specialists created a survey to find out how many acres of soybeans a participant was growing, and their management techniques for soybean cyst nematode. There were a total of 67 participants from 10 states and Canada representing between 24,000 to over 68,000 acres of soybeans. Almost one-third of the participants had never tested their fields for SCN and only 14 people regularly test their fields for SCN. Over half of the people surveyed do use resistant varieties, but one of the main factors to the growing threat of SCN is that the SCN population is becoming resistant to the most commonly used source of resistance.<br><br>This is an important first step to gauge the information that is currently out to the target audience and more effectively educate farmers on different means of managing SCN. | |
| **17.** | **Integrated Pest Management** | According to the USDA – NASS State Profile of Kentucky the value of vegetable and fruit production totaled $7.8 million in 2012. In addition, there were 29, 963 farms in Kentucky with sales of less than $2,500 each year, which makes up 39% of total farmers in the state. These small-scale growers are faced with the same challenges as large-scale commercial producers, such as diseases, insects, and weeds. These factors can negatively impact yield, reducing farmers' income and access to local food for consumers. Growers utilize integrated pest management (IPM) strategies to reduce the impact of these pests. IPM is a combination of techniques that includes both pesticide applications coupled with cultural controls. This mix of techniques is particularly important for small-scale growers, as these producers often cannot afford the high costs of numerous pesticides and equipment. Due to the reliance on an IPM approach, small-scale growers must be educated on the various techniques for management and proper pesticide safety | Agricultural & Environmental Quality/ Climate Change |

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| | | and application. As a means to train agents on IPM practices specifically targeting small-scale growers, the IPM Best Practices for Small-Scale Producers Hands-On Training was established through the support of an IPM grant. This program will be provided for a total of 3 years and aims to train 15 agents each year. University of Kentucky Extension Specialists from the Departments of Plant Pathology, Entomology, and Horticulture provided programs on pesticide safety, sprayer calibration, evaluation of good spray coverage, and cultural crop management considerations for both vegetable and fruit crops. During year 1 of the program, 16 agents participated in the training. A pre- and post-survey found increases in agents' level of confidence in advising clients in the areas of pesticide safety (21%), reading and interpreting agrochemical labels (11%), calibrating a sprayer (65%), evaluating spray coverage (64%), mixing a spray tank (25%), applying appropriate cultural management techniques (33%), augmenting spray schedules according to recent weather patterns (45%), and vole control (86%). As a result of the training, agents indicated an intent to implement further education on pesticide safety and sprayer calibration as part of their programs. Agents listed a wide range of anticipated impacts for their growers as a result of this program, with the most common being monetary savings to growers and increased efficacy of chemicals. | |
| **18.** | **Protecting Pollinators in Urban Environments** | With a greater than 80% loss of eastern migrating populations over the last 25 years, the iconic monarch butterfly has inspired tremendous public interest in habitat restoration, not just on public and private conservation sites, but also in back yards and on farms. Urban landscape entomologists set out to determine the optimal design for supporting monarch utilization and conservation. Researchers measured the monarch use of 22 preexisting citizen-planted Monarch Waystations in relation to those gardens' design, composition, and location as well as the colonization of three experimental gardens containing an identical mix of milkweeds, nectar sources, and non-host grasses, but planted in different spatial layouts. They also compared oviposition on isolated milkweeds and milkweeds that were visually obstructed by non-host vegetation. | Agricultural & Environmental Quality |

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| | | They discovered that monarch eggs and larvae were 2.5 to 4 times more abundant in gardens with milkweeds planted around their perimeter as opposed to those in which milkweeds were surrounded by or intermixed with the other plants. They also found more eggs and larvae on milkweed plants in gardens that had 100 meters of unobstructed north-south access.<br><br>Female monarchs laid significantly more eggs on standalone milkweed plants as opposed to milkweeds that were visually "camouflaged" or physically blocked by adjacent non-host plants. These findings have contributed to updates for pollinator garden and Monarch Waystation design guidelines that will help make the urban homeowner's contributions to monarch habitat restoration more rewarding and of greater potential value to monarch recovery. | |
| **19.** | **Minimizing Antimicrobial Risk to Ecosystems and Human Health from Biosolids Used as a Soil Amendment** | Antimicrobial resistance is recognized as a potentially serious threat to animal agriculture and human health. Biosolids from municipal wastewater treatment plants can be a significant potential source of antimicrobials to the environment through their use as a soil amendment to improve fertility and overall quality. Hazard risks are largely dictated by the rates at which antibiotics desorb and diffuse from the solid phase to the solution phase. Soil scientists investigated how antibiotics in biosolids behave in soils and factors that affect how available they are in solution. By using diffusive gradients in thin film samplers (DGT), they found that 5-16% of total tetracycline and ciprofloxacin in typical biosolids could be released from the solid to solution phase, which was promoted by high concentrations of dissolved organic carbon compounds in the biosolids that competed with antibiotics for common sorption sites. This is a higher release rate than has been seen using conventional methods that require a much higher ratio of solution to solids. Fortunately, researchers also found that tetracycline sorption by biosolids and livestock manures can be increased up to 40 times by treating with alum (aluminum sulfate), an amendment commonly used to reduce phosphate concentrations in water at wastewater treatment plants. By increasing antibiotic sorption, intra-particle diffusion and release from biosolids and livestock manures are greatly impeded. Further, they found that antibiotics released from organic amendments are rapidly and strongly sorbed by fine textured soils (i.e. high amounts of clay-sized particles) which would pose lower hazard risks. The results of this work with contribute to best management | Agricultural & Environmental Quality |

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| | | practices for the use of biosolids and livestock manure as a soil amendment for both commercial farming operations and home gardeners. | |
| **20.** | **Improving Irrigation for Sustainable Crop Production** | In Kentucky grain cropping systems, it is essential to apply irrigation water site-specifically in order to minimize environmental damage and maximize the profitability of irrigation. Soils in the region are known for their pronounced spatial variability. This contributes to over-irrigation in clay zones that can reduce yields while causing loss of water and nutrients through surface runoff and rapid deep drainage in other zones. Modern technology allows for site-specific irrigation through GPS-based pivots, GIS-based soil surveys and soil water monitoring, but producers need guidance on the best ways to use these technologies on their farms.<br><br>UK soil scientists developed an approach to derive a clay content map in a farmer's field that is based on soil sampling combined with non-invasive scanning of the soil's electrical conductivity (EC). The EC was measured quickly (6h a/hr) using a VERIS machine. They compared soil sampling densities between 4 samples per ha and 1 sample per 2 ha and found that, when combined with a dense data set of EC measurements, the quality of the clay content map did not decrease substantially by reducing the soil sampling density to 1 sample per 2 ha. This result is encouraging for farmers and provides a reasonable method to obtain important soil information for variable-rate irrigation and nitrogen fertilization. They also developed a delineation scheme to divide a farmer's field into site-specific management zones for variable rate irrigation. With the scheme, they avoided surface runoff of irrigation water, and through lower irrigation rates in clayey soil zones, which are primarily located in backslopes, water was better able to infiltrate. Though further validation across more fields is needed, this work provides significant progress toward creating attractive and affordable best management practices for irrigating Kentucky grain crops. | Agricultural & Environmental Quality/Global Food Security |

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| **21.** | **Safety Alliance Training** | The FDA Food Safety Modernization Act (FSMA) is a federal law transforming the nation's food safety system. The "Standards for the Growing, Harvesting, Packing, and Holding of Produce for Human Consumption", aka "Produce Safety Rule (PSR)," established for the first time, science-based minimum standards for the safe growing, harvesting, packing, and holding of fruits and vegetables grown for human consumption. The rule is part of the agency's ongoing efforts to implement the FDA Food Safety Modernization Act. The final rule went into effect January 26, 2016. Growers need to attend PSA Grower training in order to fulfill FSMA Produce Safety Rule regulatory requirement. A UK specialist, as the PSA lead trainer for the state, conducted eight different PSA grower trainings across Kentucky. A total of 203 participants, which included growers from the Amish and Mennonite population, and 16 senior food science students from University of Kentucky participated and successfully completed the program. Pre-test data showed that 29 percent of the participants scored 70% or above, but the post-test data showed significant increase in knowledge, with 90 percent of the participants scoring 70% or above. | Food Safety |
| **22.** | **Safety among Home-based Micro-processing** | The Homebased Microprocessing Program is a collaborative effort between the University of Kentucky Cooperative Extension Service, the Kentucky Department of Agriculture, and the Kentucky Food Safety Branch. The program enables Kentucky farmers to increase farm profits by allowing the production of certain value-added products in their home kitchens. Participants must grow an ingredient in the products they make, and the products must be canned using a water bath canner or a pressure canner.<br><br>Each participant in the program must complete a 5-hour training workshop focused on canning principles. Workshop participants learn to differentiate between low acid and high acid foods and safely can fruits and vegetables using USDA tested recipes. Participants also learn general food safety and sanitation principles. Training workshops are held at Extension offices across the state each year between February and April. This year 25 homebased microprocessing workshop trainings were offered and 123 participants received certificates. An additional 15 individuals attended the workshop for informational purposes. | Food Safety |

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| | | After completing the training, participants are required to have recipes approved by the University of Kentucky, verify their water source and complete an application to sell products from the KY Food Safety Branch. There are currently 161 homebased microprocessors certified by the Food Safety Branch to sell canned goods in Kentucky. This is a 13% increase from the previous year. | |
| **23.** | **Addressing Food Insecurity through EFNEP Programming** | In order to help address food insecurity, UK and KSU EFNEP and SNAP-Ed Nutrition Education Program Assistants delivered nutrition education to limited resource adult audiences in Kentucky using the Healthy Choices for Every Body (HCEB) curriculum. HCEB teaches limited-resource adults about planning nutritious meals on limited budgets, safe food-handling practices, and appropriate food preparation skills needed for a healthy lifestyle. Participant outcomes were measured using the EFNEP NEERS evaluation tool and Kentucky Behavior questionnaire. The pre/post evaluation of 5,656 graduates revealed the following program outcomes:<br><br>35% improved their food security status by being less likely not to have enough food for the month.<br><br>64% reported improvements in comparing prices before buying foods. | Global Food Security & Hunger |
| **24.** | **Extension Builds Food Security Capacity in Christian County** | In 2018, the United State Department of Agriculture (USDA) reported that 37.2 million people lived in food-insecure households. Kentucky, among 12 other states, has a food insecurity rate that is above the national average. In 2019, about 13,850 individuals in Christian County were found to be food insecure by the County Health Ranking and Roadmaps in Kentucky.<br>To address this need, Kentucky State University Cooperative Extension Program partnered with community educators and leaders to develop an urban community garden at the Aaron McNeil House in Christian County. The historic Aaron McNeil House in Hopkinsville, KY provides crisis relief services including a food assistance program to assist individuals and families that are food insecure. | Global Food Security & Hunger |

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| | | KYSUCEP assisted in providing education and building food production capacities in the community.<br>A total of 2,953 households were serviced and individuals increased their knowledge of healthy living and the role of urban gardening in building a healthier and stronger community. In addition, 870 children and 314 adults, age 60 years and older, were serviced. Kentucky State University, through Extension programs, will continue to combat hunger and build sustainable food production capacities in Kentucky. | |
| **25.** | **Farmers Market Promotes Food Security** | The Cumberland County Farmer's Market had a wonderful season. Three vendors now have multiple high tunnels each. This allows them to extend their market season. The market offered four new programs this season:POP Club, Prescription Program, Pantry Program, and Summer Feed. POP, Prescription, and Pantry were all in conjunction with the Cumberland County Health Coalition. POP Club started first at the market in April. This program was designed once a month for kids to attend the market, complete an activity, have access to fresh local foods and do a tasting of fruits and vegetables in season. If they completed both they received two $2.00 vouchers ($4.00 total) to spend at the market that day. The guardian that brought them also received a $5.00 voucher to spend that day. This program brought in on average 29 participants (adults and kids) each month (April through August). For the prescription program, the market worked with a local pharmacy. The pharmacy referred patients who were, had a family history of, or borderline diabetic, heart disease, or high blood pressure, to the Extension Office to pick up packets of vouchers to spend. The packet consisted of six vouchers, two per month (June, July, and August) worth $5.00 each. The market had 16 of 19 complete the program. One major success from the program, was a gentleman diagnosed as pre-diabetic at the beginning and with diet changes, was able to stay off medication and lost over 30 pounds. The Pantry Program was led by the SNAP-ED assistant. Market vendors were able to sell fruits and vegetables directly to the local food pantry for them to offer to clients. The program lasted eight weeks and had 109 clients go through to completion. A total of 352 meals were served through the program. Lastly, the Summer Feed program was conducted at the elementary school during the summer months. Vendors were able to sell directly to the school board. Students enjoyed 194 pounds of fresh | Global Food Security & Hunger |

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| | | fruits and vegetables. For all the programs, a total of $2,336.53 went back into the market. | |
| **26.** | **Economic Effects of Adaptive Behavior with Precision Agriculture Technology** | Kentucky farmers want information on how they can fully exploit opportunities for using precision agriculture that are not necessarily immediately obvious. By considering management decisions using precision agriculture in a holistic way, producers may be able to increase net returns, reduce production risk, and improve environmental stewardship. Agricultural economists used a whole-farm model to investigate the effects of precision agriculture technology adoption and production practice adaptation upon economic, environmental, and agronomic efficiency for a representative Kentucky grain farm. Farm machinery economics explored within the project include autonomous machinery, high-speed planting, harvest logistics and poultry litter injector adoption. The agro-environmental interfaces with precision agriculture technology explored through the research include carbon footprint alteration, policy effectiveness and optimal Conservation Reserve Program (CRP) enrollment.<br><br>Applied research related to the economic potential of high-speed planting on a representative Kentucky grain farm was conducted for a 1000 ha corn and soybean operation. Evidence supporting the hypothesis that precision CRP enrollment can be an optimal enrollment strategy was discovered, with net returns that were almost 22% greater than the next best alternative of foregoing CRP participation for this case study. Therefore, precision CRP enrollment might encourage environmental improvement by persuading producers to enroll some land that might not otherwise be put into CRP. Guidelines for delineating precision CRP recommendations were developed by melding economic analysis with yield maps to offer opportunities for enhanced profitability by improving enrollment in the CRP. The results from this research, along with previously reported results showing high-speed planting scenarios with positive returns, are being used in extension programming for grain farmers. | Global Food Security & Hunger |

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| **27.** | **Plant Protection Strategies for Soybeans Using Defense Signaling Pathways** | Plant diseases have a devastating impact on agricultural production every year and annual worldwide crop losses due to disease have been estimated in excess of $100 billion. Plant protection strategies involving the induction of intrinsic defense responses offer viable alternatives to existing chemical and cultural methods and have the potential to protect against a broad spectrum of pathogens. Developing such sustainable crop protection approaches requires knowledge of the signaling mechanisms involved in defense. A team of plant pathologists at UK previously showed that glycerol-3-phosphate (G3P) plays a key role in regulating systemic acquired resistance (SAR) to a variety of pathogens in soybean. More recently, they used soybean lines knocked-down for expression of conserved plant defense genes to examine their potential involvement in promoting/inhibiting soybean interactions with root-nodulating bacteria. They assessed the expression of known defense-related genes in soybean root tissue at various time points post rhizobium inoculation and determined the effects of silencing those genes on root nodulation by rhizobia. The accumulation of G3P throughout the plan was also monitored.<br><br>Results of this work showed that G3P-regulated immunity in the plant shoots and foliage is triggered when the plant's roots interact with incompatible nitrogen-fixing bacteria. When the non-desirable bacteria try to enter the plant, a signal is sent up the roots and through the plant for G3P to be produced in the leaves where it triggers the plant's defenses against pathogens. The P3G generated in the leaf was shown to then travel down to the root where it helps the plant exclude entry of inefficient nitrogen-fixing bacteria. The discovery of this root-shoot-root signaling pathway has important implications for both improved nitrogen fixation in soybean and the creation of agricultural products that can enhance disease resistance without negatively affecting the plant. | Global Food Security & Hunger |
| **28.** | **Manufactured Nanomaterials as Targeted Fertilizers** | Manufactured nanomaterial fertilizers with coatings tuned to make them highly targeted are believed to have potential for use in agriculture. However little is known about how coating properties influence nanomaterial behavior in soil or how nanoparticles move through plants. More information is needed to fully understand the potential for environmental risk as well as their utility for agricultural applications. UK researchers developed methods for synthesizing zinc oxide (ZnO) nanoparticle fertilizers with different coatings tuned to different | Global Food Security & Hunger |

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| | | types of soil. They investigated the behavior of nanoparticles with polymer and phosphate-based coatings in soils with a variety of different chemical characteristics including different pH values, phosphorus concentrations and organic matter amounts. They selected particles to test as a fertilizer when growing wheat in a zinc deficient soil and evaluated the effects of the fertilizer on plant growth and amounts of zinc in the leaves, stems, roots and grain.<br><br>Results indicated that the affinity of the coatings for natural organic matter dictated their sorption and dissolution behavior. Researchers found that dextran coated ZnO nanoparticles had the highest affinity for soil organic matter and were therefore the most bioavailable due to their partitioning to soil pore water. Direct amendment of the soil with ZnO nanoparticles did not enhance Zn content in grain, indicating that this may not be a viable method for micronutrient fertilization. However, the team determined that wheat could be biofortified by adding dextran or dextran coated ZnO nanoparticles as a seed treatment at the time of planting. This research presents a potential new coating technology for seed companies to enhance micronutrient availability to plants, while also providing valuable insight into the potential utility of nanomaterials for soil amendments for both the agriculture chemical industry and potential users. | |
| **29.** | **Insights into Plant Reproduction to Help Improve Crop Yields** | Production of more food with less land is an urgent matter for sustaining the more than nine billion people projected to populate the world by 2050. Seeds such as corn, rice, soybeans and wheat contribute more than 60% of world population's calories directly or indirectly by livestock feed. Though tremendous improvements in crop yield have been accomplished by breeding, fertilizers, pest-control, and irrigation, limitations to seed size and number produced by plants must be addressed to truly maximize yields. This is challenging since plants naturally balance energy allocation by adjusting the seed phenotypes so that the manipulation of either trait affects the other, negatively limiting yield increases. Though the molecular mechanisms of how plants control these seeds traits is largely unknown, there is an increasing amount of research indicating that the early phase of endosperm development is the key to controlling the final seed size with fewer changes in the seed number. | Global Food Security & Hunger |

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| | | A plant biologist at UK has established live-cell imaging methods to visualize dynamic endosperm development in the model plant *Arabidopsis thaliana* and investigated actin filament (F-actin) dynamics during the early phase of endosperm development. They identified that F-actin plays an important role in the endosperm development and that manipulation of F-actin dynamics can alter the final seed size. One of the manipulations tested by the researchers generated seeds with a 20% increase (area), which is significant. This new insight provides a target for creating new approaches to increasing the size of seeds without tradeoffs in seed number for critical seed crops. | |
| **30.** | **Enhancing Plant Growth Through the Cytokinin signaling pathway** | Hormones are of essential importance for agriculture because they control most aspects of plant growth. A better understanding of plant hormone responses can increase our ability to alter plant growth to improve agricultural yields. Cytokinins are an important class of plant hormones that control the seed yield and shelf life of crop species and by understanding how plant cells respond to these hormones, new and efficient approaches to control these critical yield determinants can be developed. Plant biologists at UK have investigated how the cytokinin signal promotes the activity of a family of key response activators in the final stage of the response pathway.<br><br>The cytokinin response mechanism was investigated by focusing on the role of auxin in determining cytokinin signaling intensity. Researchers found that auxin acts as an inhibitor of cytokinin signaling. Cytokinin signaling was increased in auxin resistant mutant backgrounds and this increased signaling was associated with semi-dwarfism of the shoot, decreased lateral root formation, and increased anthocyanin accumulation, all three developmental and physiological processes that are known to be promoted by cytokinin. These cytokinin-related traits involved a specific family of cytokinin response activators, suggesting that auxin either directly inhibits their action or inhibits the activity of one or more components upstream in the cytokinin response pathway. Collectively, these results show that the cytokinin response mechanism is under auxin control throughout the entire plant body. These results provide a new perspective on the interaction between the plant hormones auxin and cytokinin and this information can provide new strategies for future crop improvement since both play essential | Global Food Security & Hunger |

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| | | roles in plant developmental and physiological processes including the ripening of fruits, the ageing of shoot organs, seed yield, and shoot and root size. | |
| **31.** | **Discovery of an Emerging Disease in Industrial Hemp** | Kentucky was one of the first states to embrace the opportunities for pilot scale research in industrial hemp created by the 2014 Farm Bill. With cultivation prohibited in the U.S. prior to 2014, there was a tremendous void of information regarding cultural practices, variety selection, disease and pest management and economics to help guide growers in our state. Both the University of Kentucky and Kentucky State University have taken leadership roles to help fill this void for Kentucky and U.S. producers.<br><br>A disease first reported by hemp producers starting in 2014 causes leaves to turn brown, dry out, and twist. It has been shown to cause plant stunting, reduced bloom size, and necrosis of the plant's calyx leaves. UK plant pathologists began monitoring disease progression and set out to identify the disease. Identification was initially a struggle because it was caused by an uncommon fungus that had not previously been described in scientific literature. Researchers were able to sequence the entire genome of five isolates plus individual genes of five others. They confirmed this to be a new fungal disease with a high degree of genetic variability. The disease, called hemp leaf spot, starts as small, round spots on leaves and the amount of damage to the crop depends on when infection occurs. Producers have reported the disease as early as July 1, and such early infections can cause complete crop loss. Incidents of the disease have been increasing and in the most recent growing season it was reported in at least 9 Kentucky counties and five other Eastern states. The results of the research to date will help inform ongoing studies of how the pathogen behaves and potentially lead to controls for this new disease on a crop that has gained much momentum across the U.S. in the last five years. | Global Food Security & Hunger |
| **32.** | **Promoting Healthy Pollinator Habitats** | In the past five to 10 years, researchers estimate that pollinator populations have declined between 30 to 60%. While much of the attention has focused on dwindling honeybee populations due to colony collapse disorder, native bee populations, butterflies including the monarch, and many other pollinator species, are also on the decline. Habitat loss due to urban and suburban sprawl is one of the main reasons. | Climate Change |

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| | | In order to help offset the loss of habitat for pollinators, Kentucky Cooperative Extension Service has partnered with County Conservation Districts to sponsor grants for County residents. Each grant recipient received 10 plants (a value of $50) to plant at their residence in Woodford County. These plants were a combination of milk weed and nectar plants selected by the master gardeners. This was the second year for the program. The Pollinator Grant Program was designed to encourage Woodford County residents to establish or expand gardens by planting native plants that will attract and sustain native bee, butterfly, and other pollinator species Over 30 participants attended the class and purchased native plants that the nursery brought to sell in addition to the grant recipients plants. All recipients were very excited to start or expand their gardens. In Whitley County, 4-H Youth Development and the Whitley County Beekeepers Association participated in educational session with Whitley County North Elementary School at the County Extension Office. There were 17 elementary school students ranging from kindergarten to 6th grade, 9 volunteers that included elementary school teachers and Whitley County Beekeepers. Multiple sessions were held that consisted of introduction to beehives, honey extraction, wrapping up with the display of two newly installed honeybee hives, pollinator garden display and a hike on a nature trail. Whitley County Beekeepers Association has installed two beehives and a honey extractor at the County Extension Office which has counted towards points for becoming a Kentucky 4-H Bee Ambassador Program Certified County. Activities are taught throughout the year during school enrichment programs educating children and adults on pollination, mason bee house construction, conservation and reconstruction of habitats, classroom butterfly lifecycle release, and so much more. | |
| **33.** | **Sustainable Winter-Feeding Program** | The winter of 2018-19 set records for rainfall. In one Kentucky County, the rainfall was especially felt by livestock producers. Excessive rainfall led to extensive damage of pasture fields and zeroed hay inventories on many livestock operations. The impact was not only felt by livestock but was also a detriment to water quality as excessive amounts of mud and erosion were observed on livestock farms. As a response, the Adair County Cooperative Extension Service hosted a series of educational programs to address the struggles livestock producers were facing. A winter-feeding workshop was conducted. An | Sustainable Energy |

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| | | assortment of hay feeding methods were discussed that not only reduced pasture damage but also improved animal performance while increased labor efficiency. Many of the projects are cost-share eligible through NRCS programs. A total of 24 producers attended the program.<br><br>In March, a forage workshop was taught by the Extension Agent discussing pasture repair options including perennials, annuals, and warm season crops. A total of 31 producers attended the program.<br><br>In late March, a series of farm tours were held showcasing different winter-feeding strategies for livestock. These included bale grazing, compost-bedded pack barns, hay feeding pads, and a dairy facility retro-fitted to a hay feeding facility. A total of 28 producers attended the tours.<br><br>Short-term impact of these efforts through follow-up interviews with participants revealed that 6 producers visited with NRCS on hay feeding structure projects and 25 producers are in process or planning to seed pastures with improved forages. | |
| **34.** | **KSU's Extension Voyage Experience Continues to Strengthen Community Bonds** | Civic groups in Frankfort, Kentucky continuously attempt to revitalize the town. Among the areas of concentration identified in their effort is the use of Kentucky River for tourism. In response to this need, Kentucky State University Cooperative Extension Program created a unique opportunity to merge water quality and conservation education with tourism by operating a vessel on the Kentucky River.<br><br>In 2019, the program serviced 2,288 participants. Program participants increased their knowledge on topics such as water quality, fish identification, and water conservation behaviors. The program also answered questions that were made relevant by the Clean Water Act. Participants were able to socialize and learn on the river and this is evident in the socializing and educating themes that emerged from interviews. A participant said, "it's great you all are doing this. It's been a long time since I went through the lock!" Another mentioned, "I've lived here more than 20 years and I didn't know that," referring to the major misconceptions regarding fish and other organisms in the Kentucky River. Youth participants had the opportunity to try out a fish identification procedure through simple visual matching activity. They also increased their knowledge on water conservation techniques in the home. | Sustainable Energy |

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| **35.** | **Physical Activity to Combat Childhood Obesity** | In Kentucky, 37.1% of children are overweight or obese, and 51% of Kentucky children are not exercising regularly. Kentucky has the 8th highest rate of childhood obesity in the nation. In Campbell County, adult obesity is 32%. Twenty-four percent of adults in the county are physically inactive. Healthy habits started in childhood are likely to continue into adulthood. In order to foster healthy habits among children in Campbell County, specifically lowering the obesity rate and increasing physical activity, the Campbell County Extension Service taught Yoga for Kids at Campbell Ridge Elementary School and Stories, Songs, and Stretches at Abby's Child Enrichment Center.<br><br>The family and consumer sciences agent and 4-H assistant partnered with the family resource coordinator at Campbell Ridge Elementary School to offer the University of Arkansas's Extension program, Yoga for Kids-A 4-H Healthy Living Program, to eleven 3rd-5th graders. The program was offered after school weekly for 5 weeks.. The children practiced poses and routines, breathing exercises and meditation, and engaged in fun, active games each time. After completing the series, children were able to take home their own yoga mat to continue their yoga practice. End of the series written evaluations showed that 73% of the participants had practiced yoga at home, 81% had shown yoga poses to their family and friends, and 100% thought yoga helped them relax. A one-month follow-up written evaluations showed that 81% had practiced yoga at home after the series ended, 91% said they were exercising more, 100% had practiced the meditation/relaxation techniques learned in class, and 100% stated that they felt they were living a healthier lifestyle since completing the yoga series. | Childhood Obesity |
| **36.** | **SNAP-Ed Improves School Nutrition** | Childhood obesity rate in the united states continues to increase over the years. According to the US Center for Disease and Control (CDC), about 13.7 million children and adolescents have been affected. Kentucky is among the states with high rate of obesity in children. To address this situation, Kentucky State University SNAP-ED program assistants partnered with public schools in Montgomery County and hosted a rookie cooking camp in Rowan county. | Childhood Obesity |

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| | | The cooking program in Rowan county went on for 3 days and participants were educated on preparing healthy food choices. Participants were taught basic cooking skills, meal etiquette, knife skills, and meal planning. On the last day of the camp, participants were able to apply all the skills they learned by cooking healthy meals for their parents. Parents mentioned they enjoyed the healthy food recipes that were cooked by their children. One parent said it was a great recipe and would make it in their home. After the program, a participant went on to cook another healthy recipe in her home and she tagged the Rookie Cookie Camp in a post on Facebook that evidently captured the moment.<br><br>In Montgomery county, participants were taught how to use MyPlate as a tool to understand differences between food groups and the importance of each group in the diet. They also learned how to make healthy food choices, especially deciding what to eat, what not to eat, how much to eat, and how to exercise. Upon completion of the program, 91% of participants improved in knowledge in one or more core areas. 19% improved on exercising, 38% eat more healthy snacks, 36% improved on vegetable consumption, 53% improved on dairy food, and 28% improved on fruit consumption. | |