RESEARCH IMPACT REPORT

LAND - GRANT UNIVERSITY RESEARCH

agInnovation NORTH CENTRAL

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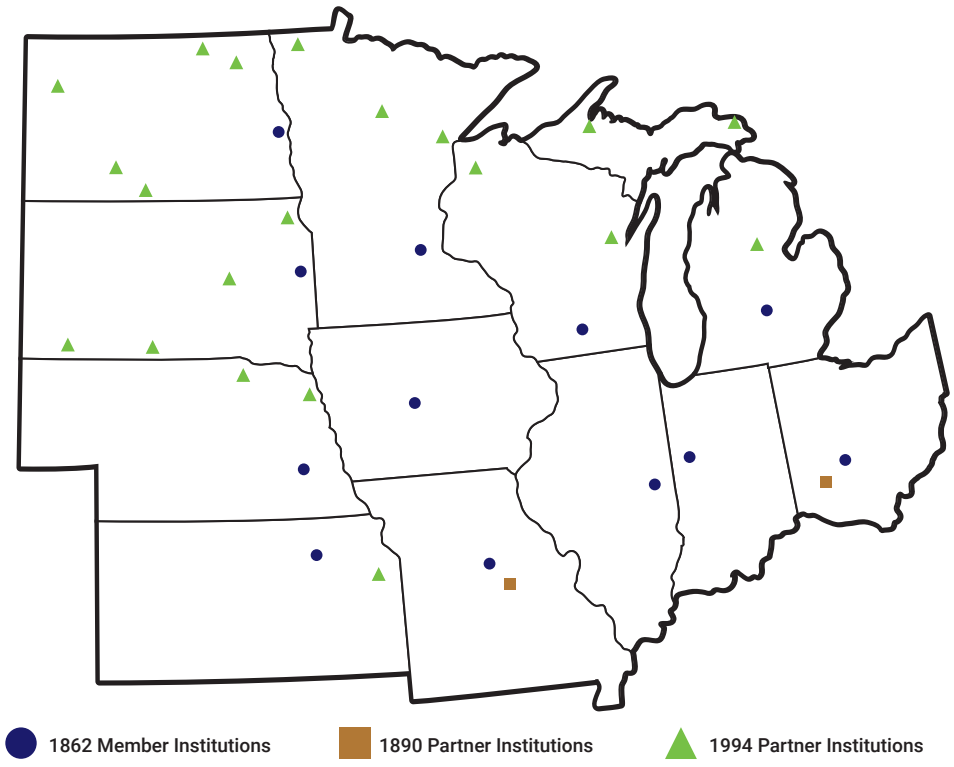

January 2025

DEAR FRIENDS AND STAKEHOLDERS,

It is our pleasure to share this booklet showcasing just a few examples of the exceptional research led by our land-grant institutions across the North Central Region. These efforts drive innovation, strengthen agricultural resilience, and deliver both immediate and long-term benefits to our farmers, food systems, and communities.

As America's heartland, the North Central Region is not only the backbone of U.S. food and agriculture but also a hub of cutting-edge research and technological advancement. Our diverse landscapes and farming practices enable pioneering solutions that ensure food security, protect our natural resources, and enhance quality of life. With increasing pressures from extreme weather and resource limitations, our institutions remain at the forefront, developing science-driven strategies that support farmers, ranchers, food processors, and rural and urban communities alike.

Our region's research network includes researchers from 1862, 1890, and 1994 land-grant institutions across 12 states: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. Through collaboration with federal agencies, private industry, and key stakeholders across the food system, we identify the most pressing challenges and deliver data-driven solutions that ensure resilient, profitable agricultural systems while enhancing natural resources and economic vitality. Our work not only strengthens American agriculture but also contributes to global innovations that address food security and stability in an increasingly complex world.

This vital research is made possible through state, federal, and private investments, with federal funding serving as the foundation — yielding an extraordinary 20:1 return for every taxpayer dollar.

We invite you to celebrate the scientific excellence of our region through the stories in this booklet, which highlight the transformative impact of our research.

Sincerely,

SHIBU JOSE
Chair

JEANETTE THURSTON
Executive Director

1862 Land-grant Institutions

Multi-state center provides mental health support for farmers, agricultural workers

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FUNDING SOURCE: USDA NATIONAL INSTITUTE FOR FOOD AND AGRICULTURE

Why This Work is Important:

Agricultural producers and farm workers experience stressful working conditions that result in higher rates of anxiety and depression than the general population. Farm workers report stress due to economic conditions, finances, environment, and interpersonal relations. At the same time, access to mental health care is often lacking in rural areas. With the region's 300,000+ farm workers – almost 40% of all U.S. agricultural producers – there is a clear need for mental health support.

How the Team Responded:

The North Central Farm and Ranch Stress Assistance Center (NCFRSAC) provides mental health assistance to agricultural producers, workers, and families in the Midwest. Under directives from the USDA, the center provides services in five main areas, including training programs, professional behavioral health services, a website clearinghouse, outreach to producers, and support groups. The NCFRSAC operates a telephone helpline with services in English and Spanish. Hotline staff respond to calls about stress and crisis, address legal and financial questions, and refer callers to appropriate resources. The center's website (farmstress.org) provides over 170 resources on stress, depression, anxiety, substance use, suicide, centers, services, and more. A major part of the center's outreach efforts consists of training people who interact with farmers to provide mental health support. Individuals in retail, banking, and other agricultural support fields learn about 'mental health literacy' — the ability to speak with people for whom they are concerned, intervene appropriately, suggest resources, and refer to professional services.

Results:

In the past three years, the network has trained over 11,000 agricultural supporters in mental health programming, trained over 18,000 agricultural producers in stress management and mental health awareness programming, engaged over 850 farmworkers in support groups, delivered more than 1,200 hours of professional behavioral health services, and fielded over 20,000 hotline calls from all 12 states. In addition to directly serving the farming community, the center facilitates empirical research on causes and correlates of farm stress. These studies have led to actionable insights to mitigate further stress in this important population. In three years, the NCFRSAC has successfully connected a group of partners to facilitate programs that support mental well-being in agricultural communities. The researchers suggest the network can continue to be responsive by modifying approaches and expanding resources as agricultural circumstances, such as commodity prices, farm policies, and climate conditions, continue to change.

Public Value:

The North Central Farm and Ranch Stress Assistance Center provides mental health assistance to Midwestern agricultural producers, workers, and families, a population burdened disproportionately by stress, anxiety, depression, and stigmas around mental health.

Artificial Intelligence (AI) solutions for agriculture's most pressing problems

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FUNDING SOURCE: USDA NATIONAL INSTITUTE FOR FOOD AND AGRICULTURE AND NATIONAL SCIENCE FOUNDATION

Why This Work is Important:

The agriculture industry faces the significant challenge of feeding and fueling a rapidly growing population, all while navigating a changing environment and limited land resources. Although traditional farming practices have evolved in many ways to become more sustainable and efficient, improvements are still needed to increase global food production, reduce environmental impacts, increase affordability, and enhance accessibility.

How the Team Responded:

The AI for Future Agricultural Resilience, Management, and Sustainability (AIFARMS) National AI Institute for Agriculture is tackling these challenges by leveraging dramatic advances in AI. The Institute is building low-cost semi-autonomous systems that augment human efforts to increase yields with lower environmental impacts, better soil health, and improved animal welfare. AIFARMS is also pioneering novel machine learning technologies to analyze sparse and diverse data across spatial and temporal scales and across agricultural practices. Finally, the Institute is committed to developing a skilled workforce with advanced knowledge and training in AI solutions to deploy and advance technological solutions in the real world.

AIFARMS
Artificial Intelligence for Future Agricultural Resilience, Management, and Sustainability

Results:

AI advances for agriculture driven by AIFARMS are helping farmers improve efficiency, cut costs, and promote sustainability. Joint academic research and farmer/ industry projects have led to the development of an autonomous cover crop robot and specialty crop weeding robot that are aiding farmers. Additionally, a generative AI platform, CropWizard, is enabling extension specialists, commercial agronomists, and soon, farmers, to investigate solutions to problems in agricultural settings. CropWizard research is developing reasoning capabilities for data-driven decision-making, including precision agriculture. Foundational AI advances are enabling more effective and easier genomic, phenotyping, livestock, and soil health approaches. AIFARMS is also partnering with organizations such as the Jackie Joyner-Kersee Food, Agriculture, Nutrition Innovation Center (JJK FAN) to prepare the next generation of technology and agriculture professionals to tackle critical challenges with confidence and creativity.

Public Value:

The AIFARMS Institute is pioneering research and workforce development for a new generation of affordable AI-driven tools that will enhance agricultural sustainability, optimize productivity, improve animal welfare, and equip the next generation of agricultural professionals.

Iowa State University scientists identify gene that could lead to resilient dwarf corn

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FUNDING SOURCE: USDA NATIONAL INSTITUTE FOR FOOD AND AGRICULTURE

Why This Work is Important:

Root and stalk architecture can impact yield and resilience to stress in crops, including corn. Dwarf varieties are becoming more popular, as they can maintain or increase productivity, while improving water and nutrient use efficiency and better resisting high winds. These characteristics are becoming more important with increasing frequency of extreme weather conditions.

How the Team Responded:

It took seven years for a research team led by Iowa State University to thoroughly characterize the functions of the plant gene ZmPILS6. They succeeded in identifying it as a hormone transporter that influences numerous traits of agronomic significance, including plant growth. When "knocked out" of modified, mutant plants, its absence suppressed root lateral formation and plant height.

Results:

The research has led to a provisional patent for its potential to be used in breeding programs to create short stature corn that is still highly productive and can enhance the crop's resilience.

Public Value:

The new research is "foundational" basic research to understand a gene that impacts numerous, complex growth traits, which evolution has conserved through many plants, from algae to maize. It also links to genetic resources that can be used to improve breeding programs.

Iowa State University lab study shows zinc's potential to fight threats from antimicrobial resistance

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FUNDING SOURCE: USDA NATIONAL INSTITUTE FOR FOOD AND AGRICULTURE

Why This Work is Important:

Antimicrobial resistant (AMR) infections are a growing threat to human health. Millions are diagnosed with AMR infections every year and 35,000 people die from them, according to the Centers for Disease Control and Prevention. Genes responsible for antimicrobial resistance can spread from microbe to microbe through circular genetic material called plasmids, a transfer that often occurs in the gut. When bacteria transfer AMR genes, they can transfer resistance to multiple drugs, which means a person can develop a resistant infection even before they receive an antibiotic. Stopping the transfer of plasmids could dramatically slow the spread of AMR genes.

How the Team Responded:

Iowa State University microbiologist Melha Mellata's lab team, including graduate student Logan Ott and undergraduate Chloe Smith, tested a variety of readily available supplements for their potential ability to inhibit plasmid transfer in gut bacteria.

Results:

The researchers found a sharp drop in plasmid transmission in AMR bacterial strains exposed to the zinc supplement. Further analysis showed the zinc induced over-expression of replication genes—likely overloading and inhibiting the process—inhibiting specific proteins required to build the bridge that bacteria use for the transfer of antimicrobial resistance. As a result, the process of transmission was disrupted. While higher doses of zinc correlated to lower levels of plasmid transmission, lower zinc concentrations also reduced plasmid transmission. This finding is important, since at lower concentrations, the zinc can be expected to have minimal effect on beneficial bacteria in the gut microbiome. Further studies are required to determine the applicability of this approach in live animal models.

Public Value:

This research strongly suggests that zinc, an inexpensive, readily available supplement, could play an important role in fighting serious and growing public health threats from antimicrobial resistance and support the longer-term effectiveness of antibiotics.

K-State focuses beef research on animal health, environmental safety

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FUNDING SOURCE: USDA NATIONAL INSTITUTE FOR FOOD AND AGRICULTURE AND THE USDA BEEF CHECKOFF PROGRAM

Why This Work is Important:

In 2024, the beef cattle industry contributed approximately $11.6 billion to the Kansas economy, according to the Kansas Department of Agriculture. In a state where the cattle population doubles that of its human counterparts, the industry's viability is significant to the nearly 20,000 Kansans employed by the beef cattle business. Kansas State University and its beef cattle specialists are dedicated to studying best practices for feeding, grazing and other areas to enhance cattle well-being and the environment, ensuring a prosperous future for this crucial industry and the state.

How the Team Responded:

Currently, pioneering research at Kansas State University's Beef Stocker Unit examines various phases of cattle production. Researchers have analyzed the relationship between diets and liver abscesses in feedlot animals, the impact of shade on cattle comfort, and the best time to burn grazing lands to control the noxious weed, *Sericea lespedeza*. K-State Research and Extension beef cattle nutrition and management specialist, Dale Blasi, notes that a significant project is studying the use of a practice called limit feeding. Additionally, beef systems specialist, JaymeLynn Farney utilizes GPS-capable ear tags at K-State's Southeast Research-Extension Center to monitor daily cattle activities.

Results:

Limit feeding reduces the amount of hay or grass fed to cattle from 45% to 13% of the diet and increases the use of such co-products as wet corn gluten feed, Sweet Bran and wet distillers' grains (a by-product of ethanol production). In turn, Blasi said, producers can improve the performance of animals, reduce manure from these same calves, and lower their water consumption by 1.35 gallons per head per day. Farney said GPS devices monitor and restrict the movement of cattle in real time – potentially making physical fences unnecessary – and these ear tags can also collect highly useful and timely information related to reproduction.

Public Value:

These findings suggest limit feeding can increase the efficiency of the inputs needed to produce beef, reducing production costs as well as feed and water demands. Additionally, GPS devices can help manage an operation's labor, which may be one of agriculture's top issues looking ahead. These devices also ease the adoption of rotational or area grazing, increasing forage consumption and protecting rangeland by decreasing localized overgrazing.

TAPS: Integrating farmers' grassroots knowledge, K-State research excellence, and industry innovation for holistic farm management solutions

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FUNDING SOURCE: USDA NATURAL RESOURCE CONSERVATION SERVICE AND PRIVATE INDUSTRY SUPPORT FROM MORE THAN 27 PARTNERS AND SPONSORS

Why This Work is Important:

Kansas agriculture faces critical challenges, including water depletion and market volatility. Addressing these issues requires data-driven solutions that balance environmental and economic sustainability. The Testing Ag Performance Solutions (TAPS) program merges grassroots knowledge with university expertise, equipping producers, researchers, and industry leaders with practical tools. By fostering resilience in water-limited regions and preserving the Ogallala Aquifer, TAPS serves as a global model for innovation and community-driven solutions.

Results:

The 2024 TAPS Sprinkler-Irrigated Corn Competition at K-State's Northwest Research-Extension Center in Colby brought together 98 participants from 34 teams across 8 states. They tested farm management skills in crop insurance, technology, hybrid selection, planting, irrigation, nitrogen application, and grain marketing under challenging conditions, including low rainfall and bare soil. Despite these obstacles, yields ranged from 87 to 238 bushels per acre. Awards recognized excellence in profitability, input efficiency, and grain yield.

Beyond the competition, TAPS hosted four in-person events with over 250 attendees. Innovative industry partnerships provided farmers with risk-free access to advanced technology, expert advice, and opportunities to build coalitions for sustainability on the High Plains. Online, TAPS reached nearly 40,000 people, generating over 135,000 impressions and fostering discussions on innovation and sustainable agriculture.

The Kansas Water Institute's TAPS RFP supports interdisciplinary research on Kansas water challenges. Leveraging TAPS data, projects focus on bilingual water sustainability initiatives and enhanced soil moisture estimation integrating satellite data. The initiative also inspired the Wildcat Hackathon, engaging 49 students from 16 academic departments in developing real-world use cases rooted in TAPS competition data. These efforts highlight TAPS' role in shaping water sustainability, technology, and social dynamics in western Kansas.

Public Value:

The TAPS program transforms agricultural education by blending virtual gamification with real-world competition. Through interactive tools and field trials, participants apply agronomic, economic, and technological strategies to real farm decisions fueling innovative solutions. Its citizen science framework empowers producers and stakeholders to develop innovative, economically and environmentally sustainable solutions for resilient agriculture in Kansas and beyond.

MSU research details how analyzing historical crop yields can reveal key soil health insights

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FUNDING SOURCE: USDA NATIONAL INSTITUTE FOR FOOD AND AGRICULTURE

Why This Work is Important:

Research from Michigan State University AgBioResearch scientist Bruno Basso shows how evaluating historical crop yields across distinct areas of agricultural fields can provide farmers with essential information on soil health characteristics and carbon sequestration. For years, Basso has worked with farmers around the world to develop and implement methods of analyzing spatial and temporal data — which assesses crop management across space and time — to increase yields while lessening negative environmental impacts. For this project, researchers sought to determine the relationship between historical crop yields and soil health, with the hypothesis that high-performing regions of fields have higher-quality soil and vice versa.

How the Team Responded:

Basso said that to obtain this data previously, it required intensive soil sampling across large areas to account for the variability. This is prohibitively expensive for most farmers at the scale needed to gather reliable information. Researchers are aiming to reduce the reliance on traditional soil testing by using historical yield data and a novel analysis metric known as yield stability zones. These zones leverage both yield level and stability — the consistency of yield — over time, offering a more nuanced understanding that accounts for small-scale, in-field variability.

Results:

Ten commercial corn and soybean fields in Michigan, Illinois and Indiana were used in the study. Management practices varied across fields and were not controlled during the research. Scientists identified yield stability zones in each field using high-resolution, gridded yield monitor data downloaded from harvesting machines. The yield history of each field ranged from 11 to 18 years. Soil samples were also collected and analyzed. The research team scrutinized the data both regionally and locally, considering variations in management practices. Researchers found that yield stability zones successfully identify differences in areas of fields based on statistically distinct relative soil organic carbon and relative soil health.

Public Value:

These findings suggest that yield stability zones can identify the feedback relationships between soil formation, soil organic carbon accumulation, soil health and yield potential, particularly in terms of increased water and nutrient holding capacity. Basso said the analysis is relevant across various soil types and management practices, and this information can help farmers act more efficiently.

Developing low-cost sensors to help farmers irrigate more efficiently, manage diseases

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FUNDING SOURCE: USDA NATURAL RESOURCES CONSERVATION SERVICE

Why This Work is Important:

Unpredictable precipitation is one of the most challenging elements of being a farmer. Not enough moisture, and plant growth is hindered. Too much can saturate the soil while setting the stage for diseases to thrive. Recently, Michigan growers have experienced both extremes. Some of the driest and wettest months on record have occurred in the last few years. For plant diseases such as tar spot in corn and white mold in soybeans, periods of high moisture are particularly problematic. In drier times, when diseases may be less prevalent, farmers often look to irrigation to supplement lagging rainfall. But fine-tuning these systems can be tricky, and too much added water can lead to unintended disease consequences.

How the Team Responded:

To address possible over-irrigating, Michigan State University researchers have developed and are testing an irrigation technology called Low-Cost Monitoring System (LOCOMOS). The work is led by Younsuk Dong, an assistant professor and irrigation specialist in the Department of Biosystems and Agricultural Engineering. With LOCOMOS, the in-field sensors measure soil moisture, leaf wetness and other environmental conditions. The data is then analyzed by software that generates precise irrigation recommendations and delivers them to growers via an easy-to-use smartphone app. The development of the system and app was facilitated through a partnership with the MSU Innovation Center.

Results:

Thus far, in the corn and soybean fields, Dong said LOCOMOS has enhanced irrigation water use efficiency while not increasing disease incidence. Compared to the growers' typical irrigation schedule, LOCOMOS boosted profits for a 100-acre field by $7,700 for corn and $1,300 for soybeans each year. The profits included improved yields and reduced energy costs associated with pumping water. In the tomato field, sensor-based scheduling saved 30% on water use versus the grower's typical irrigation method.

Public Value:

This research shows that precision irrigation can save on water use and improve farmer income. Adoption of this technology can help farmers save money and conserve water, thus protecting an important natural resource.

Novel probiotic-Centric strategies for *Salmonella* control in commercial turkey production: UMN researchers and students make DNA sequencing breakthroughs that apply to agriculturally important species and disease vectors

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FUNDING SOURCE: USDA NATIONAL INSTITUTE FOR FOOD AND AGRICULTURE

Why This Work is Important:

For decades, *Salmonella* has posed a significant challenge to the poultry and food industries globally, impacting public health and leading to substantial economic losses. Present in the environment of poultry production, *Salmonella* enters the poultry intestinal tract through feed, water, air, and other sources, often contaminating meat during processing. This results in foodborne illnesses and costly product recalls.

How the Team Responded:

With antibiotics no longer used in turkey production for growth promotion, University of Minnesota researchers explored innovative non-antibiotic approaches to *Salmonella* control. Two probiotics, *Lactobacillus* (host-specific) and *Propionibacterium* (non-host-specific), were tested for their effectiveness. Extensive in vitro, ex vivo, and in vivo studies were conducted, including nutrient broth testing, microbiome analysis, and developing novel turkey models for research.

Results:

The project yielded significant findings, including the development of two probiotics for *Salmonella* control in turkeys. These probiotics demonstrated consistent benefits in cecal microbial modulation without adverse production effects, emphasizing their gut-health-friendly properties. Comparative studies also evaluated their efficacy alongside existing vaccines. These outcomes paved the way for industry-level testing, offering promising non-antibiotic solutions for over 600 family farms in Minnesota. The research supports improved turkey production, enhanced food safety, and greater economic value for turkey products locally and nationally.

Public Value:

While focused on Minnesota's turkey industry, this research has far-reaching implications for the broader poultry sector in the United States. By extending these findings to broiler chickens and layers, the work addresses public health concerns, reduces *Salmonella*-related infections, and bolsters the poultry industry with science-backed, sustainable strategies. These efforts contribute to a safer food supply chain and a more resilient agricultural economy, benefiting the public both immediately and over the long term.

UMN researchers and students make DNA sequencing breakthroughs that apply to agriculturally important species and disease vectors

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FUNDING SOURCE: USDA NATIONAL INSTITUTE FOR FOOD AND AGRICULTURE

Why This Work is Important:

The lack of reference genomes for agriculturally important species and disease vectors hampers research into their biology, limiting our ability to manage crop pests, livestock health, and wildlife conservation. With advancements in affordable genome sequencing, researchers can now fill critical gaps in genomic data. This effort is vital for farmers, conservationists, and public health experts seeking to address emerging agricultural challenges and protect biodiversity.

How the Team Responded:

Using innovative nanopore sequencing technology, a team of University of Minnesota researchers and graduate students created high-quality genomes for key species, including the Soybean Gall Midge, Carpenter Ant, Pallas's Cat, Scarlet Macaw, and Przewalski's Horse. Sequencing ticks from northern Minnesota also revealed disease vectors impacting public health. The deployment of an Oxford Nanopore P2 Solo sequencer, which reduces mammalian genome sequencing costs to $1,000, positioned our lab as a leader in accessible genomics. We extended our expertise by supporting other researchers through the newly established University-wide Nanopore Working Group.

Results:

Reference genomes for these species have been published in the NIH genome database, enabling global access for researchers. The Soybean Gall Midge genome, developed as part of a classroom exercise, supports efforts to mitigate this emerging crop pest in the Midwest. The reduced costs and increased accessibility of genome sequencing empower smaller labs and foster collaborative research across the University of Minnesota. Students, researchers, and conservationists now have the tools to advance pest management, biodiversity studies, and livestock health strategies.

Public Value:

Affordable and accessible genome sequencing accelerates scientific discovery, leading to practical solutions for agriculture, public health, and conservation. These efforts benefit farmers, producers, and communities by improving pest control, protecting biodiversity, and promoting sustainable livestock practices. The ongoing work with agricultural pests and cattle stress management underscores the immediate and long-term public value of genomic innovations.

Understanding the molecular signatures of a fetal overgrowth syndrome in humans and cattle

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FUNDING SOURCE: USDA NATIONAL INSTITUTE FOR FOOD AND AGRICULTURE

Why This Work is Important:

A fetal overgrowth syndrome afflicting both humans (Beckwith-Wiedemann Syndrome, or BWS) and cattle (large offspring syndrome) is more likely to occur in children and calves conceived via assisted reproduction. The offspring afflicted can have malformations, including tumors and abnormal organ development, that can even lead to death; cesarean section is usually required for delivery. However, very little information exists as to why this syndrome occurs and at what point during embryonic or fetal development it arises.

How the Team Responded:

Animal Sciences researchers at the University of Missouri searched for molecular signatures descriptive of this fetal overgrowth syndrome, its development and progression, via control and affected animals. The long-term goal is to develop interventions to prevent or ameliorate the characteristics observed in this condition and to determine why the use of assisted reproduction increases its incidence in offspring. Findings in cattle were communicated to specialists in BWS to see if they also translate to human cases.

Results:

Researchers determined that the syndromes were characterized by alterations in DNA methylation, transcription and chromatin configuration. Now, development of therapeutic and preventative treatments for fetal overgrowth conditions can proceed, knowing the molecular etiology and progression of the syndrome. Both animal and human health will benefit from the findings. Data about why assisted reproduction increases the likelihood of fetal overgrowth is still being analyzed.

Public Value:

Knowing how to lessen either the occurrence or the symptoms of fetal overgrowth will benefit the health of both animals and humans, in addition to the bottom line for cattle producers.

MU expands outreach and technical assistance to Missouri landowners for conservation practices through NRCS grant

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FUNDING SOURCE: USDA NATURAL RESOURCES CONSERVATION SERVICE

Why This Work is Important:

Quality conservation practices can improve crop productivity and water quality for producers and their surrounding communities, but there is a gap between research and implementation, especially when trying to effectively stack multiple conservation practices.

How the Team Responded:

The Missouri Agricultural Experiment Station (MOAES) contains four Research, Extension and Education Centers (REECs) throughout the state. MOAES administration sought to place dedicated staff at each REEC to become liaisons between producers and researchers to increase the use and effectiveness of conservation practices.

Results:

A new model for public outreach and technical assistance was created by hiring eight new staff positions, with two new staff members – one focused on outreach and one focused on technical assistance -- based at each REEC. Accessibility to the latest NRCS research and practices was increased by geographically placing these new personnel at each REEC. The new staff members work in tandem as the outreach personnel increases awareness of NRCS conservation practices and the availability of technical assistance and the technical assistance personnel works one-on-one with producers and landowners to tailor plans to their individual needs. So far, administrators estimate they have reached 100,000 individuals through outreach efforts.

Public Value:

A new model for public outreach and technical assistance is helping bridge the gap between researchers and landowners to improve crop productivity and water quality through effective NRCS conservation practices.

Platte River-High Plains Aquifer long term agroecosystem research (PR-HPA)

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USDA PARTNER AND FUNDING SOURCE: USDA AGRICULTURAL RESEARCH SERVICE

Why This Work is Important:

The Platte River watershed is home to native grasslands, fertile soils, and one of the largest aquifers in the world. Farms and ranches are the economic engine for the region but challenges to these agroecosystems exist that include extreme weather events, maintaining topsoil, and preserving water resources.

How the Team Responded:

The research team at the PR-HPA, managed jointly by the USDA-ARS and UNL, are evaluating novel methods and technologies to improve our water and air, build soil health, and increase producer income. These include greenhouse gas measurements from fields and animals, innovative fertilizer research, and research testing animal housing and management.

Results:

Key findings include assessment of how variations in precipitation affect carbon exchange processes in grassland ecosystems, identification of variables affecting the accuracy of digital cameras in estimating vegetation characteristics, and evaluation of model predictions against observational data to enhance understanding of carbon and energy dynamics in agricultural landscapes. As technology develops in this area, the research indicates increased accuracy in field-scale soil water content estimation using globally available datasets and advanced methods.

Public Value:

The project is designed to provide real world solutions for increased agriculture profitability, sustainability, and resilience for crop and beef production systems. Multidisciplinary research teams are opening the way for new partnerships and technology development that focus on animal and plant productivity under extreme climate conditions, different soil conditions, water and nutrient use efficiencies, diverse production and environment conditions, GHG evaluation, and sustainability indices. These new innovations developed for the Long-Term Agroecosystem Research network will ensure our Nation's food supply becomes more resilient, more resourceful, and more sustainable for future generations.

USDA support for the U.S. drought monitor and climate hub activities for 2024-25

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FUNDING SOURCE: USDA OFFICE OF THE CHIEF ECONOMIST

Why This Work is Important:

Managing and planning for drought is truly a wicked problem. Already the world's most costly and deadly hazard, this will only increase in the years and decades to come given a growing global population and competition for water resources. The National Drought Mitigation Center (NDMC)'s mission is to help society reduce the impacts of drought on people, the environment, and the economy. This cooperative agreement with the USDA-OCE covers the operational production of the weekly U.S. Drought Monitor (USDM), econometrics of drought and water markets, as well as collaborative efforts with the USDA Climate Hubs aimed at building resilience to drought today and into the future.

How the Team Responded:

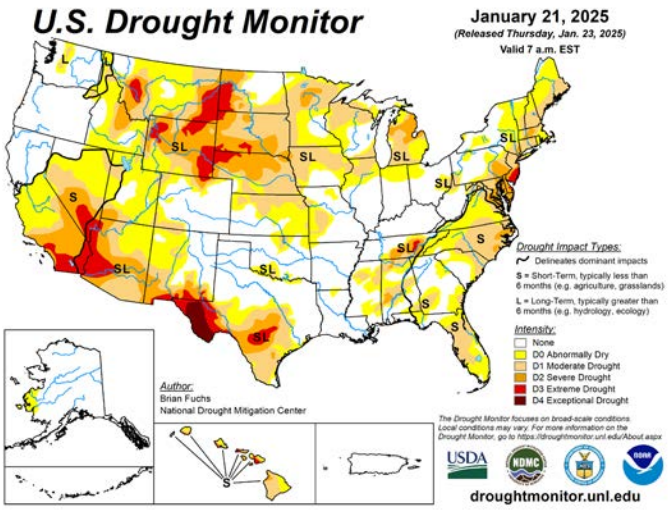
The NDMC is dedicated to providing services and usable information for the public, agricultural producers, media, resource managers and policy makers in Nebraska, the U.S., and the world. The USDM is housed and maintained at the NDMC as part of a collaboration with USDA and NOAA.

Importance and Impact:

The largest impact associated with this work is the weekly operational development, housing, services and archiving of the USDM. As a matter of routine operations each week, the NDMC generates over 38,000 maps for over 580 geographic regions across the United States, U.S. Virgin Islands, Puerto Rico, and the U.S. Affiliated Pacific Islands. This results in the delivery and dissemination of just under 2 million maps a year, which generates ~10GB of new data each week. We currently have over 58 million maps available in our user accessible archive. Impact: The NDMC is respected as "the" global drought go-to authority. In the 25 years since the NDMC and partners established the USDM, it has helped focus the national dialog around drought, making it possible for policy makers, producers, media, and others to share a current understanding of the location and intensity of drought across the nation.

Public Value:

As for the USDM impact on farmers and ranchers both here in Nebraska and across the U.S., it triggers relief through the Farm Service Agency's Livestock Forage Disaster Program. Since the USDM was first included in the Farm Bill in 2008, the USDM has provided for the science-based distribution of more than $13 billion (see figures 1 and 2) to livestock producers alone.



In addition to USDA-FSA, other federal agencies using the weekly USDM include: USDA Risk Management Agency, Office of the Chief Economist, Forest Service, Natural Resources Conservation Service, NOAA's National Weather Service and National Integrated Drought Information System, Internal Revenue Service, Centers for Disease Control and Prevention, Federal Emergency Management, Federal Energy Regulatory Commission, Bureau of Reclamation, Bureau of Land Management, Environmental Protection Agency and the Federal Reserve Board. In addition, the USDM is used by several states as part of their drought monitoring activities and services.

Genetic improvement of stress tolerance in common bean through genetic diversity and accelerated phenotyping

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FUNDING SOURCE: USDA NATIONAL INSTITUTE FOR FOOD AND AGRICULTURE

Synopsis:

The dry bean breeding program at North Dakota State University (NDSU) aims to enhance global food security by developing improved dry bean varieties that can withstand environmental challenges such as drought, excessive heat, and flooding while maintaining resistance to diseases. Since its establishment in 1980, the program has released more than 20 varieties across multiple market classes. The demand for dry beans continues to grow due to increased interest in plant-based protein sources, making the program's work essential for farmers, the food industry, and consumers alike.

Why This Work is Important:

More than 40% of the dry beans produced in the United States come from North Dakota, with pinto, navy, black, kidney, great northern, small red, and pink beans being the most commonly grown market classes. The need for climate-resilient crops is increasing due to shifting environmental conditions and global food security concerns. The breeding program addresses these challenges by developing varieties that meet the demands of both growers and consumers, ensuring sustainability in dry bean production.

How the Team Responded:

The NDSU dry bean breeding program, led by Juan Osorno, integrates traditional breeding techniques with advanced genomic tools to improve seed yield, quality, disease resistance, and environmental adaptability. The program collaborates with researchers like Phil McClean to incorporate DNA technology, data science, genomics, and high-throughput phenotyping, including drones and robotics. This approach has enabled the identification of genetic markers associated with key traits, including disease resistance and stress tolerance. Additionally, the program is working on the "slow-darkening" trait, which enhances iron availability and reduces cooking time, improving the nutritional and commercial value of dry beans.

Results:

The breeding program has successfully developed and released more than 20 dry bean varieties tailored to the needs of growers in North Dakota and Minnesota. The use of molecular markers has improved the selection of disease-resistant genetic lines, addressing issues such as white mold, bean rust, anthracnose, common bacterial blight, and fusarium. The slow-darkening trait, which improves both nutritional value and consumer appeal, is a recent breakthrough. The program's impact extends beyond the region by enhancing both domestic and international dry bean markets.

Public Value:

The NDSU dry bean breeding program plays a crucial role in strengthening food security by developing resilient, high-yielding, and nutritionally valuable dry bean varieties. By equipping farmers with improved cultivars that can withstand environmental challenges and disease pressures, the program supports sustainable agriculture and enhances economic opportunities for growers. As consumer demand for plant-based proteins increases, the advancements made by the NDSU breeding program contribute to a healthier, more sustainable food system both locally and globally.

Regional integrated modeling of farmer adaptations to guide agroecosystem management in a changing climate

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FUNDING SOURCE: USDA NATIONAL INSTITUTE FOR FOOD AND AGRICULTURE

Synopsis:

This project developed integrated climate-economic models and adaptive strategies to enhance agroecosystem resilience in the eastern corn belt region. Results support climate-smart agriculture, sustainable land management, and rural economic development while equipping future leaders with critical interdisciplinary skills.

Why This Work is Important:

The eastern corn belt region (ECBR) of the United States is facing increasing climate variability, including higher temperatures, more extreme precipitation events and droughts, and longer growing seasons. These changes pose significant challenges to farmers and land managers as they strive to balance agricultural production with environmental sustainability. A lack of integrated tools to assess and adapt to these impacts jeopardizes food security, water resilience, and regional agroecosystem sustainability.

How the Team Responded:

This project developed an innovative regional modeling approach that integrates climate projections, farmer behavior, and land management practices. Stakeholder engagement was central to the process, with a Stakeholder Advisory Team (SAT) guiding model development and scenario planning. The team produced various databases and refined their regional economic and ecological models. Educational products were created to disseminate findings to farmers, extension educators, and policymakers.

Results:

The project enhanced understanding of climate-agroecosystem interactions and identified practical adaptive strategies for the ECBR. Outputs included a fully specified regional economic model and scenario-based analyses of crop yields, carbon sequestration, and water quality outcomes. The project presented training opportunities for graduate students and postdoctoral scholars in interdisciplinary modeling, equipping them with critical skills for addressing variable and extreme weather. Findings were shared through 8 peer-reviewed publications, 11 conference presentations, and multiple stakeholder workshops, reaching farmers, conservation groups, and policymakers across the region.

Public Value:

This project contributes to climate-smart agriculture by providing decision-makers with tools to evaluate and implement adaptive strategies, ensuring food security and water resilience in the ECBR. The outcomes promote sustainable farming practices and improve ecosystem services, benefiting rural communities, policymakers, and future generations.

Prediction and management of Asiatic garden beetle, a pest of corn and other field crops in the Great Lakes region

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FUNDING SOURCE: USDA NATIONAL INSTITUTE FOR FOOD AND AGRICULTURE

Synopsis:

This project addressed the growing threat of the Asiatic garden beetle (AGB) to corn production in the Great Lakes region by developing integrated pest management (IPM) tools, including scouting procedures, action thresholds, and chemical efficacy data. Results provide farmers with practical information to mitigate financial losses and promote sustainable pest management practices.

Why This Work Is Important:

The Asiatic garden beetle (AGB) has emerged as a significant pest of corn in the Great Lakes region, including Ohio, Michigan, and Indiana, over the last decade. Historically a turf and ornamental pest, AGB now threatens corn yields, causing substantial economic losses for farmers. With no established scouting recommendations, thresholds, or control methods, farmers lack the tools needed to manage this pest effectively. Addressing this issue is critical to ensuring sustainable corn production and mitigating future crop losses.

How the Team Responded:

This project developed IPM tools to address the AGB threat by creating and validating scouting procedures to identify AGB infestations before planting, establishing action thresholds to guide pest management decisions, evaluating the efficacy of chemical controls, and disseminating findings through extension education, including field guides, webinars, and field demonstrations.

Field and laboratory trials across Ohio and Michigan informed IPM development, while extension activities engaged hundreds of farmers and crop advisors in adopting recommended strategies.

Results:

The project produced practical tools for managing AGB, including scouting protocols, action thresholds, and chemical efficacy data. A field guide summarizing findings was distributed to over 2,000 farmers and industry professionals, results were shared at 17 extension events, and five peer-reviewed journal articles were published. This work trained two graduate students and eight undergraduates in entomological research, contributing to workforce development in pest management.

Public Value:

This research provides farmers with effective, research-based tools to mitigate the impact of AGB, ensuring sustainable corn production and reducing economic losses. The outcomes contribute to national food security and sustainable agriculture by addressing a growing pest of potential national significance.

PURDUE UNIVERSITY

Advancements in genomic research reveal alternative transcription initiation sites in thousands of soybean genes: Using advancements in genomic research to fill in the gaps of the original soybean reference genome

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USDA PARTNER AND FUNDING SOURCE: USDA AGRICULTURAL RESEARCH SERVICE AND NATIONAL INSTITUTE FOR FOOD AND AGRICULTURE

Why This Work Is Important:

Researchers at Purdue University have made significant advancements in genomic research related to soybean plants. They discovered thousands of alternative transcription initiation sites (TIS) in soybean genes, which could have important implications for plant biology and agriculture. By studying these alternative TIS, they revealed how different regions of genes are activated, providing deeper insights into how soybean genes are regulated. This research could ultimately lead to more efficient breeding strategies, enhancing soybean crops to be more resilient and productive, especially in response to environmental challenges.

How the Team Responded:

In 2020, the development of the Survey of Transcription Initiation at Promoter Elements Sequencing (STRIPE-seq) technique offered Ma's lab an effective, efficient, faster and more affordable way to identify transcription initiation sites across the entire soybean genome. It also provided information about the relative abundance of every mRNA copy, which gives clues as to how much a gene is expressed in different tissues and times.

Results:

"We have found nearly 7,000 genes that have the alternative transcription initiation within the coding sequences. These alternative transcription initiation sites tend to be tissue-specific and associated with histone modifications," Ma said.

Public Value:

Currently, Ma is coordinating with USDA Agricultural Research Service (ARS) on making this research data accessible for others, just as he did with the original reference genome. The group is adding the data to SoyBase, a collaborative online database for soybean research.

The public value of this research lies primarily in its potential to improve agricultural practices and food security. By uncovering alternative transcription initiation sites in soybean genes, the study enhances our understanding of how genes are regulated, which can lead to:

- ***Improved Crop Breeding:*** Knowledge of gene regulation can help scientists breed soybeans that are more resilient to environmental stresses like drought or pests, leading to more stable food production.
- ***Increased Crop Yields:*** By targeting specific genes that control growth and stress responses, this research could contribute to developing soybeans with higher yields, benefiting farmers and meeting the growing global demand for food.
- ***Environmental Benefits:*** More resilient soybeans could reduce the need for chemical inputs like pesticides and fertilizers, promoting sustainable farming practices.
- ***Advancing Genomic Research:*** The findings also contribute to the broader field of plant genomics, which can be applied to other crops, potentially improving agricultural productivity across various species.

Overall, the research has the potential to directly impact food security, environmental sustainability, and the efficiency of agricultural systems, making it highly valuable to the public.

TOMI project turns a decade of data into tools and strategies for tomato farmers

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FUNDING SOURCE: USDA NATIONAL INSTITUTE FOR FOOD AND AGRICULTURE

Why This Work Is Important:

The Purdue-led TOMI (Tools and Models for Integrated) project has received a $3.5 million grant to transform over a decade's worth of data into new tools and strategies for improving agricultural management. The project focuses on developing advanced models and data-driven strategies to optimize the use of resources in agriculture, like water, nutrients, and land, to enhance productivity and sustainability. By integrating cutting-edge technology and long-term research data, the project aims to offer farmers improved decision-making tools to tackle challenges like resource shortages, extreme and variable weather, and environmental impacts.

How the Team Responded:

Hoagland's lab team has looked back to the wild ancestors of tomato plants from South America to better understand the genetics of the crop and find lost traits that would be useful for modern varieties, like disease resistance. The team found that, even though these wild ancestors do not produce big or flavorful tomatoes like modern varieties, they form beneficial relationships with microbial populations in the soil that help them fight pathogens.

Results:

The TOMI team is finding markers in the genomes of these wild ancestors that correspond to greater microbial associations. Then, with selective breeding, they are bringing that trait and others back into modern tomato plants. Some advanced lines from their breeding program are already in trial with organic seed companies.

Public Value:

The public value of this research includes:

Sustainable Agriculture: By developing strategies to use resources more efficiently, the project helps reduce waste and environmental impact, promoting more sustainable farming practices.

Better Decision Tools for Farmers: Farmers will have access to new technologies that allow them to make more informed decisions, leading to increased crop yields and more efficient use of resources.

Addressing Extreme and Variable Weather: The project's emphasis on resource optimization can help farmers adapt to changing and extreme weather conditions, such as unpredictable weather patterns or droughts.

Improving Food Security: By enhancing farming practices and productivity, the project can contribute to securing a more reliable and abundant food supply.

Overall, the research holds significant potential for improving agricultural sustainability, productivity, and resilience, benefiting both farmers and the wider public.

Evaluating Red Sunflower Seed Weevil susceptibility to pyrethroid insecticides

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FUNDING SOURCE: USDA NATIONAL INSTITUTE FOR FOOD AND AGRICULTURE

Why This Work Is Important:

The red sunflower seed weevil (RSSW) is a major insect pest in North and South Dakota, threatening sunflower production, which contributed $301 million to South Dakota's economy in 2022. If unmanaged, RSSW can damage up to 80% of developing sunflower seeds, requiring frequent insecticide applications to keep populations below economic thresholds. Historically managed with organophosphates and pyrethroids, only pyrethroids remain available following the 2021 EPA decision on chlorpyrifos. However, since 2017, South Dakota entomologists have reported field failures of pyrethroids, with research confirming reduced susceptibility in weevil populations.

How the Team Responded:

To address this challenge, SDSU Extension conducted field research and provided science-based guidance on pest identification, scouting, and management. In 2022, red sunflower seed weevils were collected from 28 fields in South Dakota and additional locations in North Dakota to evaluate insecticide susceptibility. Tests showed reduced susceptibility to lambda-cyhalothrin and esfenvalerate in most locations, with a PBO synergist increasing mortality by approximately 18%. A dose-response study confirmed resistance in multiple counties, prompting further research into alternative management strategies, such as adjusting planting dates. SDSU Extension has shared these findings through statewide meetings, reaching an estimated 3,676 participants.

Results:

South Dakota producers and crop consultants have increased their knowledge and have become more aware of RSSW resistance issues in South Dakota. Information provided to stakeholders on what insecticide products are most effective and which products to avoid allows for more effective treatment of RSSW populations. Combined with the potentially viable management strategy of earlier planting, producers in South Dakota can reduce yield losses associated with RSSW.

Credit: Frank Peairs, Colorado State University, Bugwood.org licensed under a Creative Commons Attribution 3.0 License.

Public Value:

Due to educational presentations and publications from the SDSU Extension team, South Dakota benefits by having more profitable sunflower producers. Improving the RSSW's pest management practices is impactful. In turn, this can increase the quantity and quality of sunflowers produced in South Dakota.

Water quality and water quantity projects in South Dakota

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FUNDING SOURCE: USDA NATURAL RESOURCES CONSERVATION SERVICE AND SOUTH DAKOTA NUTRIENT RESEARCH AND EDUCATION COUNCIL

Why This Work is Important:

Agriculture is a key economic driver in South Dakota and the Midwest, but its impact on water quality is under scrutiny. While it can contribute to water issues, agriculture also offers solutions through in-field (e.g., cover crops, no-till) and edge-of-field (e.g., constructed wetlands, riparian buffers) best management practices (BMPs). Tile drainage, a controversial topic in South Dakota, often fuels debate driven by emotion rather than data. Addressing these concerns requires research-backed assessments of tile drainage impacts on water quality and resilience.

How the Team Responded:

The Water Quantity project brings together 13 different organizations from across the agricultural/environmental spectrum and SDSU Research and Extension to work with local farmers to determine impacts of a range of soil moisture management practices in approximately 20 fields.

An SDSU Extension Water Management Engineer leads two research projects:

1. Water Quantity – Supported by an $870,000 NRCS Conservation Collaboration Grant, this project unites 13 organizations and five SDSU disciplines to develop a roadmap for water resilience in collaboration with local farmers.
2. Water Quality – A $200,000 grant from the South Dakota Nutrient Research and Education Council funds research assessing tile drainage's impact on nitrate and phosphorus loss.

Results:

The Water Quantity project evaluates soil moisture management practices on 20 fields, serving as a model for conservation efforts statewide. The Water Quality team collects weekly drainage samples from 20-25 tile outlets to identify nutrient loss risks. To support producers, SDSU Extension developed:

- A podcast (14 episodes, 1,000+ listens across six states) on conservation drainage, with a second season funded by the South Dakota Nutrient Research and Education Council.
- A conservation drainage video series with three animated overview videos, funded by a USDA NIFA grant.
- The Nutrient Loss Calculator is a web app helping farmers and agronomists assess nutrient loss from tile drainage, attracting interest from individuals and companies like Prinsco.

Public Value:

Improved soil health enhances water retention and movement, reducing both drought stress and flood risks. The Water Quantity project provides a scalable model for conservation. Understanding nutrient loss risks allows farmers to implement targeted conservation practices, reducing economic losses and downstream water impacts.

Understanding nutrient partitioning and social competition to improve genomic selection for feed efficiency in dairy cattle

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FUNDING SOURCE: USDA NATIONAL INSTITUTE FOR FOOD AND AGRICULTURE

Why this work is important:

Wisconsin's $43 billion dairy industry is important to the state's economy, farmers and consumers of, but the sustainability of the industry needs to be addressed to continue producing milk in a manner that is viewed favorably by consumers and supports farm businesses and rural communities. Land and water resources are also at stake and must be protected. Sustainability can be addressed in multiple ways, including through dairy cow nutrition. Feeding behaviors, such as how frequently and how much dairy cattle eat, and feed efficiency, such as dairy cow metabolism and nutrient utilization, vary from cow to cow and can be influenced by multiple factors. Research in this area is needed to understand how cows differ in efficiency in order to implement strategies to improve feed efficiency and inform decisions regarding management strategies and facilities on dairy farms.

How the team responded:

A research team at the University of Wisconsin–Madison led a multidisciplinary, collaborative effort to improve the feed efficiency and welfare of lactating dairy cows. Genomic selection, nutritional physiology and animal behavior were utilized in three separate experiments at Arlington Agricultural Research Station. The first evaluated the effects of parity, or the condition of having offspring, on competition behavior at the feed bunk, feeding patterns and feed efficiency. The second experiment was like the first, but cows were given a choice between feeding spaces shared with others of the same verses mixed parities. A third experiment explored how feed bunk stocking density affected competitive behaviors, feeding patterns and behavioral consistency.

Results:

Researchers found in the first experiment that when lactating cows were placed in in mixed-parity groups (versus same-parity groups), researchers saw greater feed bunk competition, altered feeding patterns and less feed efficient cows. In the second experiment, multiparous (2+ lactations) cows tended to prefer mixed-parity bins for the first visit. Primiparous (first lactation) cows tended to be involved in more competition and ate faster at same-parity bins. Through the third experiment, researchers found that cows were involved in the most competition at a 2 cows:1 bin stocking density, but experienced the highest rate of competitive contacts per minute of eating time at a 4:1 stocking density. As stocking density doubled, cows remained consistent during a short 1-hour test for competitive behaviors and feeding patterns but showed no consistency with feed efficiency throughout the trial.

Public Value:

Results from each of the three trials highlighted important behavioral implications of certain grouping strategies and high stocking densities at the feed bunk. These implications could be important for dairy producers to consider when making management decisions on-farm. They also provide critical pieces of information for others in the dairy industry to consider, including dairy scientists, animal nutritionists, and animal welfare and behavior experts looking to improve feed efficiency.

1890 Land-grant Institutions

CENTRAL STATE UNIVERSITY

Alternative plant systems for Ohio: Sustainable sweet potato production in northern climates

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USDA PARTNER AND FUNDING SOURCE: USDA AGRICULTURAL RESEARCH SERVICE AND NATIONAL INSTITUTE FOR FOOD AND AGRICULTURE

Why This Work Is Important:

Crop diversification helps Ohio agricultural operations by allowing product divergence and offsetting commodity market swings. However, agricultural dynamics over the past 25 years in Ohio show an increasing shift toward larger farms under monocropping systems. While this has increased crop productivity, adverse effects such as exposure and susceptibility to risks, environmental issues, and consolidation of small-scale production are being observed. Alternative crops are being explored for Ohio, with sweet potato being a species of interest. Ohio climate is not absolutely conducive to crop production, so varieties better suited to cooler climate are needed.

How the Team Responded:

The goal for research within this project is to explore and develop alternative crops and crop diversity that will be adopted for agricultural production in Ohio. Central State is in a unique position to test and develop suitable sweet potato varieties for northern production.

Results:

Cold tolerance response of ten sweet potato genotypes was investigated in a climate chamber, subjected to controlled shock treatments at 5°C. The relations of photosynthetic activity that the plants showed after experiencing cold shock and recovery were analyzed as potential indicators. Plants that were able to reconstitute their photosynthetic activity after experiencing a cold shock are shown to be more cold-hardy than those that did not. Six varieties were identified that are expected to be cold hardy. The study indicates variability in the stress response of sweet potato varieties to cold shock, showing the possibility of selecting for cold-tolerant varieties using in vitro settings. These findings provide cold hardiness data for more intensive studies on the overall viability of these candidates as new hardy varieties for northern agriculture. Field testing of varieties is ongoing.

Public Value

The project represents a collaboration with other 1890 institutions as well as the USDA-ARS. Local agricultural operations have participated in the research. Public response has shown great interest and potential in this research for Ohio agriculture.

CSU researchers demonstrate low-cost multi-tasking robot for small scale specialty crops

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FUNDING SOURCE: USDA NATIONAL INSTITUTE FOR FOOD AND AGRICULTURE AND OHIO DEPARTMENT OF AGRICULTURE

Why This Work Is Important:

As a high-value specialty crop, raspberries provide crop alternatives for small to medium sized farms and provide an entry into fruit production for beginning farmers. Most small-scale raspberry farm operations depend on manual labor for operations like soil preparation, weed management, crop care, harvest, and irrigation management. Manual mowing of grass between the raspberry rows and manually controlled drip irrigation requires persistent and repetitive labor to mow and to control the irrigation which adds to the input cost.

How the Team Responded:

Researchers at Central State University including undergraduate students with minority backgrounds developed robotic solutions for small-scale raspberry farms to automate labor intensive tasks of mowing and irrigation management. A low-cost robotic mower assisted smart drip irrigation system was developed, tested and demonstrated. The robot was able to cut down manual labor by automatically mowing the grass between the raspberry rows and it also collected soil moisture data from raspberry rows to automate the irrigation.

Results:

The robot was tested for 2023 and 2024 seasons in the field conditions. Soil moisture data, manual labor hours saved, and water usage data were collected. It was demonstrated that Robot flawlessly closed the loop of soil moisture data collection from raspberry rows while mowing, wireless transmission of data to irrigation controller, irrigation automation, and irrigation management. Moreover, soil moisture data was used in real time to make irrigation scheduling decisions.

Public Value:

Agriculture has seen a lot of technological advancements in the last few decades. These advancements have not always been an economically viable option for small or medium farm operations which produce one-third of the world's food from 24% of gross agricultural land. The precision Agriculture lab at Central State University focuses on developing and infusing emergent technologies in agricultural systems with special focus to develop low-cost technological solutions which can make small-scale farming more efficient and highly profitable.

USDA's nearly $1.7 million award to Lincoln University is helping to advance resilient livestock winter feeding in Missouri

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FUNDING SOURCE: USDA NATURAL RESOURCE CONSERVATION SERVICE

Why This Work is Important:

The cost of production of winter forage represents by far the largest expense for livestock producers, with a large commitment to machinery cost and maintenance. While large-scale farmers may be able to afford to invest in the current seasonal agricultural system, small- and medium-sized farmers — such as beginning, minority, veteran, women and young farmers — struggle due to the large financial investment required in machinery, storage and labor.

How the Team Responded:

With the financial support from NRCS-Conservation Innovation Grant program, this project seeks to develop a new sustainable livestock winter feeding system by deploying a Solar Corridor Cropping System (SCCS). The concept of SCCS involves planting a high-energy grain crop in corridors with wider row spacing and a high-protein forage crop(s) between the rows. This approach provides a food source year-round for the livestock and allows the plants to use more than 90% of the available solar energy, resulting in greater production and increased crop yields. This novel crop production method provides grazing livestock with a more balanced and nutritious diet, which can lead to healthier animals and higher-quality animal products. Additionally, grazing in the SCCS system eliminates the need for expenses associated with machinery, grain, hay, forage harvest and storage as well as labor.

Results:

To achieve the project goals, project team members work in tandem with three experienced and established cattle producers, two minority (small ruminant) producers, and one beginning livestock producer. Additionally, research and demonstration plots have been established at two sites. One of these sites is a certified organic research and demonstration farm at Lincoln University of Missouri. The other site is a non-organic research and demonstration farm of University of Missouri-Columbia. To increase outreach, demonstrations of a grazing system in the Solar Corridor Cropping System (SCCS) are also implemented at three extension and education centers within the University of Missouri Agricultural Experiment Station located across the state. Forage quantity and quality, soil health, economic cost-benefit analysis data gathered from all sites and shared with livestock farmers in workshops and field days, including special one-on-one training sessions. Video for outreach stories are also being created for social media and YouTube channels. So far, the project team estimates to have reached more than 100 livestock producers through outreach efforts.

Public Value:

A new solar corridor-based winter-feeding system is not only helping produce healthier livestock by providing access to grazing in late fall and winter while meeting the energy and protein needs of livestock, but also making entry into livestock farming more accessible for all farmers, especially those who lack access to an affordable source of credit.

Disease identification and management in Missouri tomato and sweet potato production

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FUNDING SOURCE: USDA NATIONAL INSTITUTE FOR FOOD AND AGRICULTURE

Why This Work is Important:

Heirloom tomato and sweet potato present sustainable and profitable options for limited resource farmers in Missouri due to their high nutritional value, market opportunities and potential as food security crops. These crops are, however, prone to infection by various disease-causing organisms during growth and after harvest compromising their yield and/or quality and resulting in economic losses. Unfortunately, there is limited information on disease management in heirloom tomato and sweet potato production in small farms, and little to no research efforts targeting limited-resource farmers. This project therefore targets small-scale and limited-resource vegetable farmers in Missouri by identifying and educating the farmers on prevalent fungal diseases caused by soilborne pathogens and sustainable management options.

How the Team Responded:

This research aims to identify critical and emerging fungal diseases caused by soilborne pathogens affecting heirloom tomatoes and sweet potato in Missouri; and to use this information to evaluate cost-effective and sustainable disease management practices that can be used in an integrated approach.

Results:

Three heirloom tomato and four sweet potato cultivars were evaluated for their resistance to naturally occurring soil-borne fungal pathogens at Lincoln University's farms. During the growing season, incidence of disease on heirloom tomatoes was recorded and pathogen isolation was performed from symptomatic samples. Sweet potato storage roots were evaluated for post-harvest disease after harvest. The heirloom tomato cultivars varied in their reactions to disease, with the susceptibility of some cultivars being influenced by the farm location. These results make it possible to provide resistant cultivar recommendations to the farmers. At least 20 fungal isolates have been retrieved from the symptomatic tomato leaves and fruit, and these are in process of being identified. Diseased sweet potato storage roots have also been collected from sweet potato farmers in Central Missouri, and these will be used to isolate pathogens to use for cultivar resistance evaluations Field trials will be repeated and pathogen isolation and identification is on-going. Among one of our successful extension efforts was a disease diagnosis and management workshop held in September 2024 that brought together 30-plus farmers, researchers, extension specialists and local non for profits, to learn more about diseases of tomato and sweet potato.

Figure 1. Heirloom tomato cultivars being evaluated. From left to right, Mortgage Lifter, Brandywine and Cherokee Purple.

Figure 2. Sweet potato cultivars being evaluated. From left to right, White Bonita, Covington, Mahon Yam, and Murasaki.

Public Value:

These results have so far been shared at growers' conferences where public interest was demonstrated. The extension efforts conducted so far have also resulted in increased knowledge and awareness among the farmers which will ultimately result in improved disease diagnosis and management.

1994 Land-grant Institutions

Determining best practices to maximize yield of *Amelanchier* (Juneberries)

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FUNDING SOURCE: USDA NATIONAL INSTITUTE FOR FOOD AND AGRICULTURE

Why This Work Is Important:

Amelanchier or Juneberries, a resilient and traditional Mandan Hidatsa and Arikara food, medicine and materials source was significantly reduced due to the building of the Garrison Dam.

How the Team Responded:

Nueta Hidatsa Sahnish College (NHSC) is a land-grant institution located in the north central region. NHSC students and instructors collaborated to reestablish this important crop on the Fort Berthold Indian Reservation. Their research focused on identifying best practices for Juneberry production to optimize yield.

Results:

The data that has been collected through this research effort has been added to the long-term body of knowledge about Juneberries. Some of this data includes best management practices for production, transplant variables, nutritional value, pests, cultivar difference and pollinators.

Public Value:

This research not only supports the reintroduction of a culturally significant crop to its natural landscape but also provides hands-on lab and field experiences for students. These experiences are essential in showcasing the value of research and science careers in food, agriculture, health, and community resilience—helping to cultivate a future scientific workforce equipped to tackle emerging challenges.

Michigan State University Extension launches partnership to better serve tribal nations and communities

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FUNDING SOURCE: USDA NATIONAL INSTITUTE FOR FOOD AND AGRICULTURE

Why This Work Is Important:

The state of Michigan is home to four institutions in the land-grant system, including Michigan State University (MSU), an 1862 institution, and Bay Mills Community College, Keweenaw Bay Ojibwa Community College, and Saginaw Chippewa Tribal College as 1994 institutions.

How the Team Responded:

In October 2018, a collaborative partnership was launched between Bay Mills Community College (BMCC) and MSU Extension to better serve Michigan's Tribal Nations and communities through the Michigan Inter-Tribal Land Grant Extension System (MILES). Goals of MILES include addressing programmatic and research collaborations in areas such as enhancing agriculture production and marketing, developing leadership skills in both youth and adults, conserving natural resources, improving economic development programs, and creating stronger families through health and nutrition.

Additional goals of the MILES partnership include increasing input from Michigan tribal nations and communities on tribal Extension efforts, as well as improving collaboration among Michigan tribal nations, tribal communities, and MSU Extension on scholarly pursuits.

Results:

MILES strengthens tribal communities by supporting tribal sovereignty and connecting communities with the educational resources they want and need to solve community-identified problems through outreach and engagement. MILES, in conjunction with funding from the U.S. Department of Agriculture's Federally Recognized Tribes Extension Program (FRTEP), has led to MSU Extension creating new positions to build capacity for this important education and outreach. The MILES partnership has created new programming, successfully sought additional funding and resources to continue working collaboratively, and ensures the sustainability of tribal Extension efforts in Michigan.

Public Value:

The Michigan Inter-Tribal Land Grant Extension System (MILES) seeks to build an inclusive, responsive, and intentional land-grant system in Michigan that serves all Michigan tribal nations and communities. Through MILES, tribal nations and communities are linked with MSU Extension programs, staff, resources and expanded educational opportunities.

LAND - GRANT UNIVERSITY RESEARCH

agInnovation
NORTH CENTRAL

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