AGRICULTURE

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OUTLOOK

AG OUTLOOK '22

IFB President: Livestock farmers support food security in Illinois

By RICHARD GUEBERT JR.
Illinois Farm Bureau President

If you've ever driven through the Illinois countryside, you've likely seen a herd of cattle dotting the landscape. You might have wondered whether the animals that farmers raise benefit businesses and residents in our state.

Guebert

They do.

Livestock farms offer important sources of revenue for local businesses, strengthen the food supply, and continue to reduce impacts on the environment.

With livestock on one in three Illinois farms, animal agriculture is an economic engine for our state.

In 2019, livestock farms and related meat and dairy processors contributed more than $31.8 billion in economic activity, supported more than 91,000 jobs, and accounted for $4.7 billion in household income.

When many meat packing plants shuttered due to worker safety concerns at the height of the pandemic, the backlog of orders and limited processing capacity highlighted the critical role of food processors. Disruptions also demonstrated the need for investments in small and medium-sized meat packers, many of which stepped up to fill the supply chain gap.

Thanks to their efforts, Illinois' state licensed meat establishments processed more than 31 million pounds of meat to feed families across the state in 2020.

Illinois Farm Bureau recently partnered with Texas A&M University to offer Hazard Analysis Critical Control Points (HACCP) certification – a prevention-based approach to the safe production, handling and preparation of foods – to support the continued development of local meat packing companies.

As important as food processing facilities are, it's also important to remember that production starts on the farm.

More than 96% of the 71,000 farms in Illinois are family-owned and operated. For these farm families, producing quality meat and dairy products means providing nutritious protein sources for the community.

In 2020, Illinois farm families donated more than 250,000 pounds of food to local food pantries. Donations of pork, beef and dairy products offered resources to those in need, while also benefiting food processors in the community.

In addition to providing a steady supply of food for American families, farmers also continue to produce more with less.

Pig farmers today use 75% less land and 25% less water than they did 60 years ago, cattle farmers are producing 60% more beef with 40% fewer carbon emissions than 50 years ago, and each gallon of milk produced by dairy farmers creates 63% fewer carbon emissions than in 1944.

Innovative barn construction, rotational grazing on cover crops and manure management as fertilizer applications are among the practices farmers use to continuously improve soil and water quality on their farms.

By caring for animals in ways that also benefit the environment, farmers ensure a bright future for agricultural production on family farms and a steady food supply for all.

The next time you find yourself driving past a herd of cattle, or picking out food at the grocery store, I encourage you to think about the many ways livestock farms and related industries add value in our state.

(This op-ed was distributed through a cooperative project between Illinois Farm Bureau and the Illinois Press Association. For more food and farming news, visit FarmWeekNow.com.)

Agriscience students and visitors watch a sow and her litter at Streator Township High School. The students transformed the school's greenhouse into a nursery where two sows farrowed. Students are caring for the little pigs until they are weaned and moved to Brockman Farms. (Photo by Riley Hintzsche)

Streator ag students gain real-life skills, life lessons from pig project

By KAY SHIPMAN
FarmWeek

> ***"This project brings exposure to students that may have never touched a pig, while at the same time, teaching the real-life decisions pork producers have to make on their farms."***
>
> Gwen Heimerdinger, ag teacher

Two sows are teaching Streator Township High School ag students and many other people, including 4,800 Think OINK fans on Facebook.

For a sixth year, agriculture teacher Riley Hintzsche is providing agriscience students hands-on lessons about hog production from artificial insemination to farrowing to moving weaned pigs from the school's temporary nursery. By providing their sows, Mark and Sara Mitchell of Brockman Farms are also educating others about the pork industry.

"The Think OINK project has taught me real-life skills by showing us how a pig is born and teaching us how to care for a pig, how to keep a pig healthy and keep it alive," said Zach Walkling, an agriscience student.

This year, students are comparing experiences with two sows for the first time and learning about animal differences as well as a variety of lessons. But the images and lessons about animal husbandry and livestock care extend far beyond the school grounds.

Over the years, the sow celebrities have drawn visits from school board members, administrators and students who aren't in ag classes. Thousands watch and comment on videos, photos and updates on the Think OINK Facebook page. Visit facebook.com/ThinkOINK40.

Sara Mitchell explained she and her husband value the opportunity to teach young people and demonstrate the work and care needed to raise hogs. "Everyone in the pork industry has a way to impact the livestock industry," she said, adding that Think OINK has been their chance to represent the industry "even though we're a small, niche producer."

Hands-on experiences

In September, Hintzsche's 16 students, mostly sophomores, helped artificially inseminate a sow on Brockman Farms. A second sow later joined the project. About a week before the pigs' due date, they were moved into the school's greenhouse that was transformed into a nursery by the students.

Since arriving in January, student ag teacher Gwen Heimerdinger has witnessed excitement among students, faculty and the community. "This project brings exposure to students that may have never touched a pig, while at the same time, teaching the real-life decisions pork producers have to make on their farms," Heimerdinger said.

The pigs "draw a new audience for us" and help recruit students to study ag, said Hinztsche, a 2021 National Teach Ag Champion, one of only three across the U.S.

To share responsibilities for the sows and their litters, the students divide work among spatial, feeding, cleaning and piglet committees. Just as on a farm, extra jobs pop up. Students stepped up to bottle feed three pigs that weren't thriving among one sow's initial litter of 18.

The class will wean the pigs at three to four weeks before returning them to Brockman Farms at four to five weeks of age.

In the interim, Mitchell and Hintzsche help students learn about processing piglets. While students handle tasks like notching ears, a local veterinarian castrates the animals, Mitchell explained.

Demonstrating animal care

When Think OINK was new, Facebook posts surfaced thousands and thousands of questions and comments, including negative ones, according to Hintzsche. "Now a lot of questions and comments come from people who have watched for years," Hintzsche said. "Maybe some who were against it are now advocates because they've seen the care (given to the pigs) and understand."

Mitchell continued: "Now we have an army of educated students. They have posted the animals are stress free because they are well cared for, and they refute negative comments."

If an ag student wants to own a pig, the Mitchells work with that individual. "We've had students get Think OINK pigs who never had ag before," she said. "Some were successful, and others learned pigs are a lot of work and didn't repeat that again."

Think OINK has also benefited Brockman Farms. Mitchell said they gained customers who bought pork directly from their operation and were able to connect consumers with other local hog farms.

For ag students like Walkling, knowledge is the biggest reward. "This project has taught me so many different things to use in the real world," he said, "and I am so grateful to have two awesome teachers (Hintzsche and Heimerdinger) who give us the opportunities to do things like this."

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USDA announces Supplemental American Rescue Plan funding available for LAMP

WASHINGTON, D.C. – The U.S. Department of Agriculture (USDA) has announced supplemental American Rescue Plan Act funding for the Local Agriculture Market Program (LAMP). The program will receive a total of $130 million in supplemental American Rescue Plan (ARP) Act funding to promote competition and create more and better markets for local and regional food producers by expanding and strengthening opportunities to sell to institutions, such as universities, hospitals, and settings operated by local, tribal, and state governments. The supplemental ARP funding is divided into $65 million for fiscal years 2022 and 2023 each.

In fiscal year 2022, LAMP will receive a total of $97 million in competitive grant funding to help local and regional food entities develop, coordinate and expand producer-to-consumer marketing, local and regional food markets and local food enterprises. The total includes the first $65 million of supplemental ARP funding and $32 million in funds provided through the 2018 Farm Bill. Of the $97 million, LAMP's Farmers Market and Local Food Promotion Program (FMLFPP) will receive $57 million and the Regional Food System Partnerships (RFSP) will receive $40 million.

"Through these grant programs we are able to maximize opportunities for economic growth and ingenuity in the local and regional food system. These grants have generated new income sources for small, beginning and historically underserved farmers; increased local food access across rural and urban communities; and provided platforms for value-added and niche products to shine," said Agriculture Secretary Tom Vilsack. "This year, we are excited to further develop market opportunities for producers by focusing on farm to institution. Expanded access to and local food purchasing within institutional markets could be a major boon for small and mid-sized producers located throughout the country."

FMLFPP is implemented through two funding opportunities: the Farmers Market Promotion Program (FMPP) and the Local Food Promotion Program (LFPP). FMPP supports direct to consumer markets like farmers markets and CSAs and the LFPP supports indirect to consumer markets like food hubs and value-added product incubators. Both programs require a 25% cash or in-kind match of the Federal portion of the grant.

RFSP supports public-private partnerships that build and strengthen viability and resilience of local or regional food economies. Projects focus on increase the availability of locally and regionally produced agricultural products and alleviating unnecessary administrative and technical barriers. Projects can cover the planning and design of a local and regional food economy as well as implementing or expanding an existing one. This program requires 25% cash match of the Federal portion of the grant.

AMS encourages applications that serve smaller farms and ranches, new and beginning farmers and ranchers, underserved producers, veteran producers, and/or underserved communities. For grants intending to serve these entities, applicants should engage and involve those beneficiaries when developing projects and applications.

AMS offers RFA webinars for new applicants to help walk them through the RFA while also providing helpful hints on what has made past recipients successful. For registration information visit the AMS Grant Webinars website. Additionally, Frequently Asked Questions are posted on the AMS Grants website, and grants management specialists are standing by to answer any incoming questions and emails during regular business hours.

Applications must be submitted electronically through www.grants.gov by Monday, May 16, 2022, at 11:59 p.m. Eastern Time.

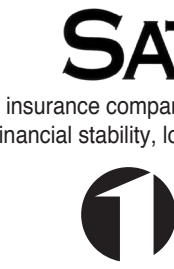
Any grant application submitted after the due date will not be considered unless the applicant provides documentation of an extenuating circumstance that prevented their timely submission of the grant application. Read more in AMS Late and Non-Responsive Application Policy (PDF, 246 KB).

For more information about grant eligibility and previously funded projects, visit the below webpages or use the contact information.

USDA touches the lives of all Americans each day in so many positive ways. To learn more, visit www.usda.gov.

Illinois Grazing specialist receives Conservation Award

CHAMPAIGN — Matt Bunger was recently recognized as the Pastureland Conservationist of the Year at the American Forage and Grassland Council (AFGC) event. The National Pastureland Award is given each year to recognize employees of USDA's Natural Resources Conservation Service (NRCS) who show outstanding service to NRCS, to their clients, and to science through development and implementation of sound technology transfer on grazing land resources.



Bunger

Bunger has more than 33 years of service with NRCS with over 15 years as a Grazing Specialist. He currently serves as the Illinois State Grazing Lands Specialist. During his career, Bunger worked with agricultural groups and public agencies to build the grazing infrastructure in Illinois. In addition, Bunger's influence extends beyond Illinois borders as he helped create and update grazing conservation practice standards, guidance documents, and training curriculum used throughout the region.

Bunger has been a mainstay speaker at State and Regional grazing conferences for years. He goes to great lengths to support and promote the benefits of grazing for clean water and healthy soils as well as profitability strategies designed for beef, dairy, and other livestock operations. Bunger has connected and built NRCS partnerships with countless people and customers to the betterment of our planet's natural resources.

According to State Conservationist Ivan Dozier, Illinois NRCS is grateful to have such an outstanding advocate for grazing over the years. "Matt's conservation efforts and impact on the landscape will be recognized for years to come. Congratulations again, Matt Bunger."

With new food packaging labels on grocery store shelves, what do you need to know?

❑ Label must contain presence of bioengineered food or ingredients

By KATIE ZELECHOWSKI
Illinois Farm Bureau

Didn't think companies could fit one more label on food packaging covered from front to back in emblems and claims? Guess again.

Thanks to a recent labeling law, companies must indicate the presence of bioengineered food or ingredients on product packaging. Two moms and food sector experts explain what the new labels mean for grocery shoppers, and the technology behind them.

"I'm a mom of young kids myself. I've got an almost 6-year-old and an almost-2-year-old so, I completely sympathize with moms and parents at the store who are just like 'I don't know what to feed my kid'," said Leia Flure, a registered and licensed dietitian and University of Illinois Extension nutrition education specialist.

Congress passed the National Bioengineered Food Disclosure Law in 2016, with a mandatory compliance date of this year. Administered by the U.S. Department of Agriculture (USDA), the standard ensures food manufacturers disclose whether foods contain or may contain bioengineered, also known as genetically modified or GMO, ingredients using text or symbols on product packaging.

Shoppers might be surprised to learn that many of the products they've been eating for years have been improved through biotechnology. But the presence of new labels shouldn't stop them from making the same purchase decisions.

"Scientific research has shown time and time again that bioengineered foods are just as safe as their non-engineered counterparts," Flure said. She helps inform consumers about the science behind food production by contributing to GMOAnswers.com. She also consults for Bayer Crop Science.

For people who need a place to start, Flure suggests looking past random food package labels to read the nutrition facts panel on the back. That's where consumers will find details about how products affect their health.

"I think it's important to look for foods that are higher in fiber, higher in vitamins and minerals, and lower in things like saturated fat and sodium," she said.

It's also important to note that bioengineered labels don't always apply to every ingredient in a product. A veggie pizza made with only two GMO ingredients will be labeled as genetically modified, even if the other ingredients might've been grown using organic or conventional products and practices.

Starting this year, regulated food manufacturers, importers and certain retailers must disclose the presence of bioengineered ingredients via text, symbol, electronic or digital link, and/or text message to consumers. (Photo by Katie Zelechowski of Illinois Farm Bureau)

"I'm not entirely sure that bioengineered as a rebranding of GMO will be bought by consumers, literally and figuratively," Flure said. "There might be some unintended consequences; I think it could potentially undermine people's trust in the food system."

While people might be unfamiliar with the terminology, innovative agricultural production techniques have been used for decades.

Sarah Gallo, vice president of agriculture and environment for the Biotechnology Innovation Organization (BIO), said biotechnology has continued to grow because more companies, farmers and even consumers recognize its benefits, like reducing food waste and decreasing the carbon footprint of growing food.

"We can always do a better job talking about those environmental benefits and how the pressure to continue to feed a population that's growing is going to need to have innovation as part of the solution – and I think there's a good history to demonstrate that," Gallo said.

BIO's member companies work across food systems, ag practices, biofuels and industrial-based processes to develop technology that improves products.

For example, biotechnology has been credited for saving the papaya from a devastating virus, seed that produces crops requiring less tillage and pesticides, and helping to lead the charge developing COVID-19 vaccines.

"Disruptive tech" developed by these, and other, companies continue to transform the American food system to increase food access and address climate change, according to Gallo.

"More of the technology that's coming into the market on the food side, and even on the industrial side, is really consumer-focused," Gallo said. "The reasons these products are coming to market are not only for the benefit of farmers but also for consumers and thinking about how they directly interact with the technology in their daily lives."

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Illinois research shows how dicamba could be safely used in sweet corn

URBANA – Many agronomic weeds are developing resistance to available herbicides, making them harder and harder to kill. With few effective chemicals left and no new herbicide classes on the horizon, farmers are going back to older products that still offer the promise of crop protection.

Dicamba has been on the market since the 1960s, but the herbicide is only used on about 17% of corn acres in the U.S. It still appears to be effective on waterhemp and its troublesome weedy relatives, but dicamba isn't currently labeled for use in sweet corn because of known sensitivity issues in the crop.

"Twenty years ago, herbicide sensitivity was the number one pest management concern in the sweet corn industry. There were a lot of important hybrids that had adverse responses," says Marty Williams, a USDA-ARS ecologist and adjunct professor in the Department of Crop Sciences at the University of Illinois. Williams co-authored the new study in Weed Science.

But scientists know a lot more now about the genes that help corn safely metabolize dicamba and other herbicides. So it was time for Williams and his research team to take another look at the risk of sweet corn injury from dicamba. And their recommendations offer practical guidance beyond sweet corn.

"The gene that confers tolerance to dicamba and other herbicides in sweet corn is the same as in field corn, so our study system is representative of other types of corn," Williams says.

The gene in question – Nsf1 – is a cytochrome P450 involved in detoxification of multiple herbicide families in plants. With two functional copies of the gene, corn fights off dicamba's cellular attacks before they can cause injury. But mutant versions of the gene also exist in some corn lines. Plants with two mutant copies of the gene are highly sensitive to dicamba, while mutant-functional gene pairings offer intermediate protection.

Chris Landau, a postdoctoral researcher working with Williams, confirmed these patterns in sweet corn by applying dicamba to three hybrids representing functional, mutant, and intermediate genotypes. He applied the herbicide at three growth stages, V3, V6, and V9, and mixed the herbicide with the safener cyprosulfamide in half the treatments.

"Ours is the first study in corn to simultaneously evaluate the combination of genotype, application timing, and safener on dicamba injury," Landau says.

As expected, sweet corn with mutant and intermediate Nsf1 genes showed more dicamba injury than corn with two copies of the functional Nsf1 gene. The study also showed dicamba application at the latest timing, V9, caused injury regardless of genotype, suggesting earlier applications are safer for all sweet corn lines. The safener eased symptoms somewhat, but didn't erase injury altogether.

"For almost every injury metric we looked at, including ear breakage, ear length, total ear mass, kernel mass, and others, the safener helped," Landau says. "It also consistently lowered injury at the earlier timings, V3 and V6, but that effect wasn't as profound as the V9 application."

The results indicate dicamba could be used safely in sweet corn, given a few caveats (and approved labeling by the U.S. Environmental Protection Agency): Apply with safeners before V9, and avoid applying in sweet corn with mutant Nsf1 genes, if possible.

"This work really establishes what's needed for more utility of dicamba in sweet corn," says co-author Aaron Hager, associate professor and Extension specialist in crop sciences. "That includes working with breeders in their continued efforts to get rid of the sensitive alleles. Also, we know application timing is going to be important, as it is in field corn. We know now that safeners can bring some margin of increased selectivity in sweet corn. The work lays the foundation for the industry to use a tool that has not been widely used in this particular cropping sequence."

The article, "Significance of application timing, formulation, and cytochrome P450 genotypic class on sweet corn response to dicamba," is published in Weed Science [DOI: 10.1017/wsc.2022.5]. Co-authors include Chris Landau, Mark Bernards, Aaron Hager, and Marty Williams.

The Department of Crop Sciences is in the College of Agricultural, Consumer and Environmental Sciences at the University of Illinois Urbana-Champaign.

For corn ethanol, most greenhouse gas emissions can be mapped to the fuel's production, transportation, and combustion, but a large portion of the greenhouse gas calculation can be traced right back to the farm.

Greenhouse gas data deep dive reaches a new level of 'reasonable and true'

URBANA – For the most accurate accounting of a product's environmental impact, scientists look at the product's entire life cycle, from cradle to grave. It's a grand calculation known as a life cycle assessment (LCA), and greenhouse gas emissions are a key component.

For corn ethanol, most greenhouse gas emissions can be mapped to the fuel's production, transportation, and combustion, but a large portion of the greenhouse gas calculation can be traced right back to the farm. Because of privacy concerns, however, scientists can't access individual farm management decisions such as fertilizer type and rate.

Nitrogen fertilizer data are an important piece of the calculation because a portion of these fertilizers wind up in the atmosphere in the form of nitrous oxide, a highly potent greenhouse gas. Corn nitrogen fertilizer data are publicly available at the national and state levels, but scientists argue this level of resolution masks what's really being applied on farms across the country and could lead to inaccurate LCAs for corn ethanol.

In a new study from the University of Illinois and the U.S. Department of Energy's Argonne National Laboratory, researchers developed the first county-level nitrogen application datasets for corn, dramatically improving the accuracy of greenhouse gas calculations for the crop.

"Having good data is really important to foster both a shared discussion and greater confidence in LCAs. We've seen some abuses of life cycle analysis using really crude numbers, downscaling big averages that can really vary a lot. So even though the county level still isn't as precise as we would like, it's a big accomplishment to get to that scale," says Michelle Wander, professor in the Department of Natural Resources and Environmental Sciences at Illinois and co-author on the study.

Hoyoung Kwon, principal environmental scientist in the Systems Assessments Center at Argonne and co-author on the study, says the protocol and findings will help the agricultural and bioeconomy community better understand the impacts of high-resolution nitrogen fertilizer data on corn-based biofuel LCAs.

"Nitrous oxide makes up about half of the total greenhouse gases associated with corn farming," Kwon said. "Now we can differentiate nitrous oxide emission associated with corn farming on the county level, and can show how much these emissions vary with location and farming practice."

Yushu Xia, who led the analysis and recently finished her doctoral program with Wander, used two approaches to determine county-level nitrogen fertilizer and manure usage.

The first, which Xia calls the top-down approach, was a bit like putting a puzzle together using different-sized pieces. At the county level, she found data for nitrogen fertilizer and manure inputs, but the numbers were aggregated across all crops, not corn specifically. The state level dataset included fertilized area in corn, so it was a matter of matching county with state. The state dataset also included nitrogen inputs, but aggregated them across fertilizer types. Data validation, or double-checking state and country information, therefore became another puzzle.

"For the top-down approach, we used data derived from fertilizer sales, information compiled by the Association of American Plant Food Control Officials. So we assume these numbers are relatively accurate; somebody actually bought that nitrogen. Yushu went through painstaking effort, basically using that crop data layer like a jigsaw puzzle to figure out how much corn is where and in what rotation over time. And then also for the manure: How many animals are there? Where are they? What kind of animal waste and how much? It's literally a budgeting effort to try to find out what's reasonable and true," Wander says.

Xia's second approach took corn yield, crop rotations, and soil properties from the county level and estimated nitrogen inputs based on the amount of nitrogen it would take to achieve that yield. Comparing the results of the two approaches told Xia farmers are applying nitrogen in excess of what's needed.

"Nationally, the weighted averages of corn nitrogen inputs based on corn planted area exceeded nitrogen needs by 60 kilograms per hectare, with a nitrogen surplus found in 80% of all U.S. corn producing counties," Xia says.

Excess application was most pronounced in the Midwest, followed by the Northern Plains. The Southeast and Northwest had comparatively low nitrogen application rates and surplus levels. Western states were more variable overall.

Xia says the technique can be useful beyond nitrous oxide emissions estimations.

"Our approach can also be used to estimate nitrogen leaching, ammonia emissions, other greenhouse gas emissions, or the water and carbon footprint. These data improvements can really help to create and utilize better ecosystem models and life cycle analysis."

Kwon indicates the new approach could potentially be used by policymakers at the national level.

"The EPA's national greenhouse gas inventory report currently uses state-level nitrogen fertilizer data to generate national estimates of nitrous oxide emissions from fertilizer. If they apply these high-resolution county-level data, they can refine those numbers on a national scale."

The results could also help farmers make more informed management decisions.

"Fertilizer prices are sky high right now, so since our results suggest some farmers are over-applying up to a third of their nitrogen, they could probably back off a bit and save some money," Wander says.

The article, "Developing county-level data of nitrogen fertilizer and manure inputs for corn production in the United States," is published in the Journal of Cleaner Production [DOI: 10.1016/j.jclepro.2021.126957]. Funding was provided by the U.S. Department of Energy and USDA's National Institute of Food and Agriculture.

The Department of Natural Resources and Environmental Sciences is in the College of Agricultural, Consumer and Environmental Sciences at the University of Illinois.

AG OUTLOOK '22

Illinois farms gain new options to sell foods directly

By KAY SHIPMAN
FarmWeek

The new year opened new markets and options for Illinois farmers and food entrepreneurs to sell their homemade products directly to consumers.

The changes make it easier for those who make food or drinks in their home kitchen, or an appropriate kitchen located on the farm, to sell directly to consumers. The Home to Market Act rules took effect Jan. 1 and were signed into law by Gov. JB Pritzker last year.

"There are way more avenues than there were in 2021," said Mary Liz Wright, a University of Illinois Extension nutrition and wellness educator. Wright discussed the rules during the Illinois Specialty Crop Conference in January.

Previously limited to selling at farmers markets, farms and home bakers may now sell at fairs, festivals and pop-up events, according to Wright. They may also sell non-perishable products online directly to consumers within Illinois. Out-of-state online sales are prohibited.

Wright emphasized a direct-to-consumer focus underscores the law's underlying principle of product traceability back to its origins. She explained that is why the rules do not allow sales to restaurants, grocery stores or distributors that would sell to customers.

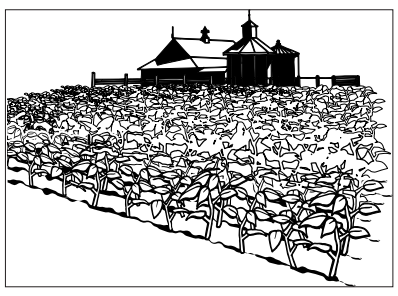
What homemade foods and drinks can be sold? Wright said the rules specify which ones are prohibited.

Prohibited foods and drinks include:

• Meat, poultry, dairy and eggs, except dairy and eggs used as ingredients in nonhazardous baked goods

• Garlic in oil or oil infused with garlic

• Low-acidic foods, such as soups, vegetables or food combinations



• Wild, harvested mushrooms

• Alcoholic beverages and kombucha.

Wright explained home cooks may acidify low-acid foods they plan to sell. A list of acidified or fermented foods would include tomatoes, pickles, sauerkraut and chilled coleslaw. For example, an acidified tomato recipe would include a tablespoon of bottled lemon juice or two tablespoons of vinegar or one-fourth teaspoon of citric acid.

"We encourage people follow a tested USDA or Cooperative Extension recipe," Wright added.

Home to Market Act rules specify home-canned foods for sale must be done in a proper, safe manner with boiling water, a vacuum-sealed mason jar with a two-piece lid. Jars must be sterilized in boiling water for 10 minutes.

State-approved canning methods for low-acidic foods are a boiling water bath or pressure canning. "This is to kill potential deadly bacterium," Wright noted.

The new rules also expanded sale opportunities for frozen and chilled foods and drinks. Chilled products must be kept at a temperature of at least 41 degrees Fahrenheit. Wright suggested that could be accomplished with dry ice or chunks of ice. Frozen foods must be maintained at a temperature of 32 degrees or lower.

The new rules update state labeling requirements to ensure important information is included for consumers and that the labels are prominent on packages and at the point of sale.

Wright emphasized each label must provide the required information. "This is essential and what health departments will look for," she said.

A label must include the seller's name, county of operation, the product's common food name, the processing date and the seller's health department registration number.

Every label must also include the following language: "This product was produced in a home kitchen not subject to public health inspection that may also process common food allergens. If you have safety concerns, contact your local health department."

Labels must list all ingredients, including any food coloring, artificial flavors and preservatives. Those must be listed in descending order by weight as common names. In addition, allergen information, such as milk, eggs or wheat, should be included as specified in federal labeling requirements.

Wright explained posting label information on a placard at the point of sale as well as a product label. For online sales, the information needs to be posted online in a spot where consumers will see the product.

Potential customers may sample the product under the new rules. Wright explained two options for offering samples. Prepare and pre-package samples at home and bring them to the site. Samples may be made on-site, but the seller needs to first get a certificate from the local health department and meet sanitation requirements.

(This story was distributed through a cooperative project between Illinois Farm Bureau and the Illinois Press Association. For more food and farming news, visit FarmWeekNow.com.)

Illinois Conservation Fund launches program to help young farmers 'starting from scratch'

SPRINGFIELD – The Illinois Conservation Fund has kicked off the Working Farms Fund program to enable new and young farmers to secure farmland for local food production.

Because land is expensive and scarce, too many farmers are leaving the profession and small and medium farms are being converted to other uses, said Emy Brawley, state director for the Illinois Conservation Fund.

"Inability to access farmland is the number one reason that people are leaving agriculture," Brawley told Illinois Radio Network.

"The people who are looking for land are not inheriting a farm. They are starting from scratch," she said.

This new generation of farmers is interested in being close to metro markets where they can work value-add, higher margin farms, Brawley said.

Demand for local food is growing every year. In the past 10 years, local food sales have increased from $5 billion to $20 billion nationwide.

The Illinois Conservation Fund's Working Farms Fund is designed to be an innovative solution. The Fund acquires small and mid-sized local farms (20 to 500 acres) that are threatened by development and matches the land with farmers. The farmer gets a patient pathway to eventual ownership, while a conservation easement protects the land. A revolving loan fund then rolls the purchase dollars forward to the next farm.

The goal is to protect 10,000 acres of farmland in the next 20 years and support 150 farm businesses as they become successful and independent.

"We are very excited about this model," Brawley said. "It has the potential to protect farmland near metro areas from conversion to non-farming uses. It will also help ambitious and diverse farmers scale up their operations and meet the demand for food in our population centers."

Even though Illinois has some of the best farmland in the world, only 4% of food consumed in the state is grown there. The pandemic has reinforced the importance of local food for national security, Brawley said.

"A more local food system, anchored to the city, is much safer in times of shock," she said.

The goal of the Working Farms Fund is to help young farmers find affordable land, while at the same time protecting threatened farmland, she said.

"Illinois continues to lose high-quality farmland in metro-influenced counties to urban and rural development," Brawley said.

In the past 20 years, half the farmland in metro Chicago that had been growing food was converted to other uses.

"That land close to the metropolitan market is the land that grows food and it's the land that young farmers want," Brawley said.

The majority of new and young farmers in Illinois today are not legacy farmers. Seventy-five percent of them come from non-farming families.

Ukraine farmer shows great resolve amid the Russian invasion

By DANIEL GRANT
FarmWeek

Ukrainian farmer Kohctahtuh Xomehko showed the kind of determination and fortitude currently on display by his fellow countrymen and women during an online meeting with farmers in the Midwest.

Kohctahtuh (pronounced Konstantine) said his "heart is in great pain" but he's extremely confident the Ukrainian army can defeat the invading Russians. He also showed the same resolve when asked if farmers in Ukraine will still be able to plant this year's crops amid the war.

Xomehko

"I'm 100% sure we can win because it's about people, not just weapons," Xomehko said from his farm during a Zoom call hosted at the Macon County Farm Bureau in Decatur attended by several board members and media.

"We're together working – all the people in Ukraine," he said. "I understand our army is not that big, but we're very motivated. There are people you know who are dying. We'll never forgive the Russians."

Ukraine farmers are helping their army by providing and transporting diesel fuel and fabricating metal objects for the army to flatten tires on Russian vehicles.

Ukrainian farmers also plow a majority of their fields, which has made it difficult for some Russian tanks to cross without getting stuck.

When asked how other nations, including the U.S., can help resolve the conflict, Xomehko called for air support.

"We need support to close the air. We don't need soldiers," he said.

But thus far the North Atlantic Treaty Organization has rejected Ukraine's demand to implement no-fly zones.

Meanwhile, reports suggest roughly 2 million Ukrainian refugees had fled the country in recent weeks. But Ukrainian farmers remain determined to produce their crops this year.

"Yes. 100% we'll be planting, spraying and fertilizing," Xomehko said when asked about his spring plans to grow crops including corn, soybeans and wheat. "But, there is no area in Ukraine that is 100% safe. We have areas with more bombs, and areas with less bombs."

The online meeting with Xomehko was made possible in part by Loran Steinlage, an Iowa farmer and field engineer for DAWN Equipment, and Macon County Farm Bureau Board member Paul Butler, who is in an international grain marketing group.

DAWN provides ag equipment parts to farmers in Ukraine but pulled its employees out of the country just weeks before the war broke out.

"I'm worried about $5 diesel and how high our fertilizer prices will go," Butler said. "But our problems are pretty small in comparison."

Scott Irwin, University of Illinois ag economics professor, said war in Ukraine will also continue to have a widespread effect on world markets for some time.

"There are really two issues," Irwin said in a recent U of I farmdoc video. "One is with old crop. Trade estimates suggest there's 600 million bushels of corn already contracted (from Ukraine). It's trapped and I don't see any way that will get out of there very easily for weeks and maybe months.

"There's even bigger problems with what will end up getting planted (in the Black Sea region) this spring," he noted. "It could potentially put a huge hole in global grain balance sheets."

Irwin suggested the U.S. needs to think "outside the box" in these extraordinary times and consider measures such as possibly opening up acres in the Conservation Reserve Program for a year to increase domestic crop output.

(This story was distributed through a cooperative project between Illinois Farm Bureau and the Illinois Press Association. For more food and farming news, visit FarmWeekNow.com.)

AG OUTLOOK '22

CROPSR: A new tool to accelerate genetic discoveries

Commercially viable biofuel crops are vital to reducing greenhouse gas emissions, and a new tool developed by the Center for Advanced Bioenergy and Bioproducts Innovation (CABBI) should accelerate their development — and genetic editing advances overall.

The genomes of crops are tailored by generations of breeding to optimize specific traits, and until recently breeders were limited to selection on naturally occurring diversity. CRISPR/Cas9 gene-editing technology can change this, but the software tools necessary for designing and evaluating CRISPR experiments have so far been based on the needs of editing in mammalian genomes, which don't share the same characteristics as complex crop genomes.

Enter CROPSR, the first open-source software tool for genome-wide design and evaluation of guide RNA (gRNA) sequences for CRISPR experiments. CROPSR was created by scientists at CABBI, a Department of Energy-funded Bioenergy Research Center (BRC). The genome-wide approach significantly shortens the time required to design a CRISPR experiment, reducing the challenge of working with crops and accelerating gRNA sequence design, evaluation, and validation, according to the study published in BMC Bioinformatics.

> ***"CROPSR provides the scientific community with new methods and a new workflow for performing CRISPR/Cas9 knockout experiments. We hope that the new software will accelerate discovery and reduce the number of failed experiments."***
>
> – Hans Müller Paul, University of Illinois

"CROPSR provides the scientific community with new methods and a new workflow for performing CRISPR/Cas9 knockout experiments," said developer Hans Müller Paul, a molecular biologist and Ph.D. student with co-author Matthew Hudson, Professor of Crop Sciences at the University of Illinois Urbana-Champaign. "We hope that the new software will accelerate discovery and reduce the number of failed experiments."

To better meet the needs of crop geneticists, the team built software that lifts restrictions imposed by other packages on design and evaluation of gRNA sequences, the guides used to locate targeted genetic material. Team members also developed a new machine learning model that would not avoid guides for repetitive genomic regions often found in plants, a problem with existing tools. The CROPSR scoring model provided much more accurate predictions, even in non-crop genomes, the authors said.

"The goal was to incorporate features to make life easier for the scientist," Müller Paul said.

Many crops, particularly bioenergy feedstocks, have highly complex polyploid genomes, with multiple sets of chromosomes. And some gene-editing software tools based on diploid genomes (like those from humans) have trouble with the peculiarities of crop genomes.

"It can sometimes take weeks or months to realize that you don't have the outcome that you expected," Müller Paul said.

For example, a trait may be regulated by a collection of genes, particularly one involving plant stress where backup systems are useful. A scientist might design an experiment to knock out one gene and be unaware of another that performs the same function. The problem may not be discovered until the plant matures without altering the trait in any way. It's a particular issue with crops that require specific weather conditions to grow, where missing a season could mean a year-long delay.

Using a genome-wide approach allowed the scientists to tailor CROPSR for plant use by removing built-in biases found in existing software tools. Because they are based on human or mouse genomes, where multiple copies of genes are less common, those tools penalize gRNA sequences that hit the genome in more than one position, to avoid causing mutations in places where they're not intended. But with crops, the goal is often to mutate more than one position to knock out all copies of a gene. Previously, scientists sometimes had to design four or five mutation experiments to knock out each gene individually, requiring extra time and effort.

Hans Müller Paul, a molecular biologist and Ph.D. student, left, with co-author Matthew Hudson, Professor of Crop Sciences at the University of Illinois Urbana-Champaign.

CROPSR can generate a database of usable CRISPR guide RNAs for an entire crop genome. That process is computationally intensive and time-consuming — usually requiring several days — but researchers only have to do it once to build a database that can then be used for ongoing experiments.

So, rather than searching for a targeted gene through an online database, then using current tools to design separate guides for five different locations and doing multiple rounds of experiments, scientists could search for the gene in their own database and see all the guides available. CROPSR would indicate other locations to target in the genome as well. Researchers could select a guide that hits all of the genes, making it much easier and quicker to design the experiment.

"You can just hop into the database, fetch all the information you need, ready to go, and start working," Müller Paul said. "The less time you spend planning for your experiments, the more time you can spend doing your experiments."

For CABBI scientists, who often work with repetitive plant genomes, having a gRNA tool that allows them to design functioning guides with confidence "should be a step forward," he said.

As the name implies, CROPSR was designed with crop genomes in mind, but it's applicable to any type of genome.

"CROPSR is also based on human genes, as the data availability for crop genes just isn't there yet," Müller Paul said, "but we're looking into some collaborations with other BRCs to provide a more capable prediction based on biophysics to help mitigate some of the issues caused by the lack of data."

Going forward, he hopes researchers will record their failed results along with successes to help generate the data to train a crop-specific model. If the collaborations pan out, "we could be looking at some very interesting advancements in training machine learning models for CRISPR applications, and potentially to other models as well."

The study's other co-authors are Dave Istanto, former CABBI graduate student with Hudson in the U of I Department of Crop Sciences; and Jacob Heldenbrand, former CABBI research programmer with the National Center for Supercomputing Applications at Illinois. Hudson and Müller Paul are also affiliated with the Illinois Informatics Institute and the Carle R. Woese Institute for Genomic Biology.

AG OUTLOOK '22

U of I study clarifies nitrogen's impact on soil carbon sequestration

URBANA – Soil organic carbon is a cornerstone of soil health. It improves soil structure while enhancing water- and nutrient-holding capacity, key factors for any agricultural production system. To build it up, farmers incorporate crop residues into soils.

So why, despite decades of residue inputs, is soil organic carbon diminishing in corn production systems? Short answer: it's the nitrogen.

"With intensive nitrogen fertilization, you may get more corn biomass and yield, which means you end up putting more residue into the soil. But you cannot keep that carbon in the soil," says Richard Mulvaney, professor in the Department of Natural Resources and Environmental Sciences (NRES) at the University of Illinois. "The nitrogen in the residues stimulates the microbes to burn carbon off through respiration. So you can put more in, but you can't keep it."

The concept that nitrogen fertilization affects residue decomposition – and therefore the incorporation of residue into soil organic matter stores – isn't new. But previous studies showed conflicting results. That's why Mulvaney and Tanjila Jesmin, a doctoral researcher in NRES, set out to clarify how residue quality and the form of nitrogen affect corn residue decomposition in a typical Corn Belt soil.

Thanks to the historic Morrow Plots at Illinois, the team was able to test residues from corn grown with and without high nitrogen fertilization.

"We designed an aerobic incubation study, adding these two residues to a typical cropped soil with or without two forms of nitrogen. We then observed the decomposition process by continuously measuring carbon dioxide production, as well as periodic measurements of enzyme activities and microbial biomass," Jesmin says.

The researchers found the presence of nitrogen – either exogenously applied to residue or already incorporated in growing corn tissue – accelerated residue decomposition and produced more carbon dioxide. The form of nitrogen applied, potassium nitrate or ammonium sulfate, made no difference.

"The carbon in corn residue comes from the atmosphere, and it returns to the atmosphere during decomposition. That's not an issue," Mulvaney says. "The problem is that when microbes have a high nitrogen supply, they also have a high demand for carbon as an energy source. With high nitrogen rates their demand may exceed the carbon supply in residues, which may cause them to attack stable organic matter. And therein lies the long-term problem."

During the first month of soil incubation, residue carbon decomposition was more rapid in the presence than absence of nitrogen fertilizer. However, carbon dioxide production in the second month was slower for fertilized than unfertilized soil. By the end of the study, the total amount of carbon dioxide produced was greater with than without added nitrogen.

"It's like burning leaves in the fall. You put more leaves on the fire, and you get more flames. And so, with that added nitrogen, the residue goes more quickly early in the incubation. Then the fire dies down because you had already burned up the readily decomposable substrate. We get there sooner with nitrogen," he says.

The results explain why soil organic carbon fails to build in high-input cornfields and suggest farmers should avoid excessive nitrogen inputs to maintain soil organic matter.

According to the researchers, further studies are underway to evaluate the effect of mineral nitrogen on residue decomposition in soils with contrasting characteristics.

"Because our incubation utilized a single soil type, the findings might not be valid everywhere. With soils low in native fertility, intensive fertilization is often effective for increasing residue carbon inputs. We want to see if these inputs help to build soil organic carbon," Jesmin says.

The study, "Short-term effect of nitrogen fertilization on carbon mineralization during corn residue decomposition in soil," is published in Nitrogen [DOI: 10.3390/nitrogen2040030]. Dakota Mitchell is an additional co-author on the paper.

The Department of Natural Resources and Environmental Sciences is in the College of Agricultural, Consumer and Environmental Sciences at the University of Illinois at Urbana-Champaign.

Brian Diers, surrounded by soybean plants in a University of Illinois greenhouse, started his search for the Glyma.20G85100 gene 30 years ago as a graduate student.

Gene important in soybean protein content found after 30-year search

URBANA – Soybeans outmatch all other legumes as the protein powerhouses of the plant kingdom, providing a key protein source for humans and livestock around the world. And now, after 30 years, University of Illinois scientists have identified the gene with the largest impact on seed protein in soybean.

"Soybeans are around 40% protein, and this gene increases that about 2%. It doesn't sound like a lot, but compared to any other seed-protein gene that's been mapped for soybean, it's at least double," says Brian Diers, the Charles Adlai Ewing Chair of Soybean Genetics and Breeding in the Department of Crop Sciences and co-author of the study in The Plant Journal.

Co-author Matt Hudson, Professor of Bioinformatics in Crop Sciences, adds, "If we could put the high protein form of the gene into commercially grown varieties, we would be looking at a significant increase in protein for livestock and humans worldwide as even a single percentage point increase in protein concentration would represent millions of tons of protein. That's quite significant."

In 1992, then-graduate-student Diers published the first seed protein map for soybean. Although he identified the region of the genome where the gene might be located, it took three decades, many technological advances, and the publication of two soybean genomes to nail down the specific gene: Glyma.20G85100 , a gene without a known function but closely related to "clock and circadian timing" genes.

"It's satisfying to make the journey from being an eager young grad student, all excited about this finding, to finally determining what the gene is," Diers says. "But if I go back to myself 30 years ago, I could never have imagined it would have taken this long. But better late than never."

Pinpointing a gene like this is complicated because it's one of many quantitative trait loci: locations within the genome contributing to continuous traits like plant height, yield, or in this case, protein content.

Researchers have to grow the plants, measure protein content, and then drill down into the genome to find correlated genetic differences among plants with different amounts of protein. Those genetic differences might not be detectible, or they might only be traceable to large sections of the genome.

Diers says he originally mapped the gene to a section of a chromosome several million base pairs of DNA long. But by testing generation after generation of plants carrying the gene within smaller genetic regions, he slowly narrowed it down.

"We had to screen thousands and thousands of plants and then evaluate them with markers to see if we found an association. It was very laborious, and we had many students and postdocs working on this over the years," Diers says.

Like most genes, Glyma.20G85100 comes in multiple forms, or alleles. Depending on the allele found in a particular soybean line, seed protein content can be high or low. And, as it turns out, most commercial soybean lines contain the low-protein allele.

"Unfortunately, we found the high-protein allele has a deleterious effect on yield. So elite varieties, which are bred for high yield, generally have the low-protein form," Diers says.

The discovery of the gene is complicated by a murky link between the gene and its role in increasing protein content.

"We were hoping that when we finally found the gene, it was going to be involved in something obvious, for example, nitrogen fixation or nitrogen metabolism," Diers says. "But it turns out it really isn't what you would expect for a gene controlling a protein."

Instead, the gene appears to be part of the soybean plant's circadian machinery; the way the plant keeps track of time to maximize photosynthesis during the day, figure out when to flower and set seed, and many other processes.

"It's absolutely a standard part of the circadian clock that's conserved between nearly all plants. It looks like a transposon, or a jumping gene, landed in that circadian clock gene and inserted a whole bunch of new amino acids in the middle of the conserved domain," Hudson says. "It could be that the gene is involved in moving photosynthesis products into the seed or it could be some completely unrelated pathway. It's weird, and we really don't know."

Regardless of how it works, identifying the gene with the biggest single contribution to soybean protein content could have major consequences for global food security.

"If we can understand the mechanism, that should give us some clues as to how we can increase protein without decreasing yield," Diers says.

Hudson adds, "There are significant issues with protein deficiency in many parts of the world. Even a modest increase in protein could go a long way."

The study, "Fine mapping and cloning of the major seed protein QTL on soybean chromosome 20," is published in the Plant Journal [DOI: 10.1111/tpj.15658]. The work was partially supported by soybean check-off funding from the United Soybean Board and the North Central Soybean Research Program, and by the USDA National Institute of Food and Agriculture.

The Department of Crop Sciences is in the College of Agricultural, Consumer and Environmental Sciences at the University of Illinois Urbana-Champaign.

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