# LaSalle County Farm Bureau

# Summer 2020 Virtual Field Day

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LaSalle County Farm Bureau®

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Isermann Farms

Illinois ACES College of Agricultural, Consumer and Environmental Sciences

Illinois NREC

Soil Health Partnership

## Speakers for the Virtual Field Day included:

**Lauren Lurkins**
*Director of Environmental Policy, Illinois Farm Bureau*

**David Isermann**
*President, LaSalle County Farm Bureau*

**Julie Hewitt**
*Executive Director, Illinois Nutrient Research and Education Council*

**Dr. Andrew Margenot**
*Assistant Professor, Department of Crop Sciences, University of Illinois*

**Jim Isermann**
*Field Manager for Northern Illinois and Wisconsin, Soil Health Partnership*

**Dr. Laura Christianson**
*Assistant Professor, Department of Crop Sciences, University of Illinois*

**Dr. Reid Christianson**
*Assistant Professor, Department of Crop Sciences, University of Illinois*

## LaSalle County Farm Bureau

The LaSalle County Farm Bureau (CFB) is a 501(c)(5) non-profit organization based in Ottawa, Illinois, serving 6,257 members. The mission of the LaSalle CFB is "representing agriculture and our member families through information and legislation to improve financial stability and quality of life."

Through a Nutrient Stewardship Grant from Illinois Farm Bureau (IFB), LaSalle CFB has sponsored education and outreach opportunities for local elected officials and community members in 2019 and 2020. Thanks to the work of several collaborators, the LaSalle CFB hosted a field day in 2019 geared at elected officials to discuss the Illinois Nutrient Loss Reduction Strategy (NLRS) and farming practices that mitigate agricultural runoff, as well as the impacts of flooding. In 2020, LaSalle CFB continued to share similar information to its target audience, as well as incorporating video "vignettes" from local farmers that shared their individual experiences with conservation practices on their farms.

## Illinois Farm Bureau

Since 2015, IFB has contributed to an impressive statewide effort, the NLRS. Through leadership and participation from our farmer members across the state, IFB has been able to make meaningful contributions toward water quality improvements in Illinois. From 2016 to present, IFB has committed approximately $1.5 million of its own funding to build and maintain its sustainability programs.

The NLRS is a science-based framework for using research, technology and industry experience to assess and reduce nutrient loss to Illinois waters and to the Gulf of Mexico. The NLRS sets forth a plan to leverage existing programs to optimize nutrient loss reduction while promoting collaboration, research, and innovation among the private sector, academia, non-profits, wastewater treatment agencies, the agricultural sector, and state and local government. The primary goals include reducing nitrate-nitrogen losses by 15% and reducing total phosphorus losses by 25% by the year 2025 from established baseline conditions. The NLRS was released in July of 2015 after multiple years of stakeholder discussions in which IFB actively participated. Since 2015, IFB has continued its participation in NLRS meetings and work groups in order to strategically guide the effort. In addition, IFB created new programs in 2015 to support farmer implementation of best management practices (BMPs) to help Illinois meet the goals of the NLRS.

For the past several years, IFB has made it an organizational priority to lead on environmental issues, most notably, the NLRS. IFB's NLRS efforts focus in four priority areas: 1) education and outreach to farmers, landowners and the general public; 2) supporting research of best management practices to reduce nutrient loss from agricultural fields; 3) supporting farmer implementation efforts across the state; and 4) demonstrating progress toward the long-term goals of the NLRS. The IFB Board of Directors committed significant financial resources and support from staff to accomplish some ambitious goals, allowing IFB to tackle environmental challenges head-on. IFB will continue to prove that voluntary, incentive-based conservation, based on science, will move the needle on water quality improvements in our state.

The IFB Nutrient Stewardship Grant Program is one example of the many ways IFB is creating lasting impacts in implementing the NLRS across Illinois. This program funds CFB projects throughout the state focused on improving soil health and water quality. Since 2015, IFB has dedicated over $550,000 to CFBs to complete a wide range of unique projects, including planting test plots of cover crops, watershed planning, water testing, hosting education and outreach activities. For more information on IFB's environmental efforts, see www.ilfb.org/take-action/current-priorities/protecting-our-environment.

## Illinois Nutrient Research and Education Council Support

The Illinois Nutrient Research & Education Council (NREC) is a collaborative effort by Illinois farmers, the fertilizer industry and the Illinois Department of Agriculture to address issues related to fertilizer use in Illinois.

Created by state statute in 2012, NREC is funded by a 75-cent assessment on each ton of bulk fertilizer sold in Illinois. These funds are invested in research projects and educational programs designed to optimize nutrient use and protect the environment.

A 13-member NREC council annually solicits, reviews and funds projects that fulfill the organization's mission. Environmental organizations provide input to the council.

### The NREC Mission

NREC is committed to helping farmers and other users of fertilizer products get the best performance possible from their nutrient applications. To accomplish this, NREC sponsors research and educational programs that have three purposes:

- Ensure adoption and implementation of best practices that optimize nutrient efficiency.
- Ensure soil fertility.
- Address environmental concerns related to fertilizer use.

Since its inception in 2012, Illinois NREC has invested over $23 million into nutrient-related research efforts. Through the research that is being funded through NREC, Illinois agriculture is working together to meet the requirements of the NLRS. Without this funding, the industry would be without critical research into maximizing the efficiency of agricultural nutrients while minimizing any possible negative impacts to the environment.

### Research Priorities

NREC focuses on three main goals when considering research projects:

- Maximize Efficiency
- Minimize Losses
- Mitigate Negative Environmental Impacts

These goals are pursued by sponsoring projects that examine the effectiveness and economic viability of farming practices that will reduce losses of nitrogen and phosphorus to water without being detrimental to yield.

Learn more by visiting www.illinoisnrec.org where you can see a full listing of current projects, review the annual report, and see other priority areas being studied.

# Struvite: A Potential Slow-Release P Fertilizer for Illinois Agriculture

*Content provided by Dr. Andrew Margenot, Assistant Professor, University of Illinois College of Agricultural and Consumer Sciences*

Dr. Andrew Margenot and his team at the University of Illinois are evaluating slow release phosphorus (P) fertilizers to increase crop production and environmental quality. Struvite ($MgNH_4PO_4$) is a mineral form of P that offers a means for point sources such as wastewater treatment plants to remove dissolved phosphate from wastewater. Being relatively insoluble in water (< 3%) **(Figure 1)**. The appreciable P content of struvite (5-28-0) means that it can be re-used as a fertilizer. Moreover, the dissolution of struvite in the presence of plant roots offers potentially greater synchronization of P release with crop P demand. Thus, struvite could offer a way to transfer P from point sources to non-point sources as a P fertilizer, thus 'double dipping' to P loss reductions.

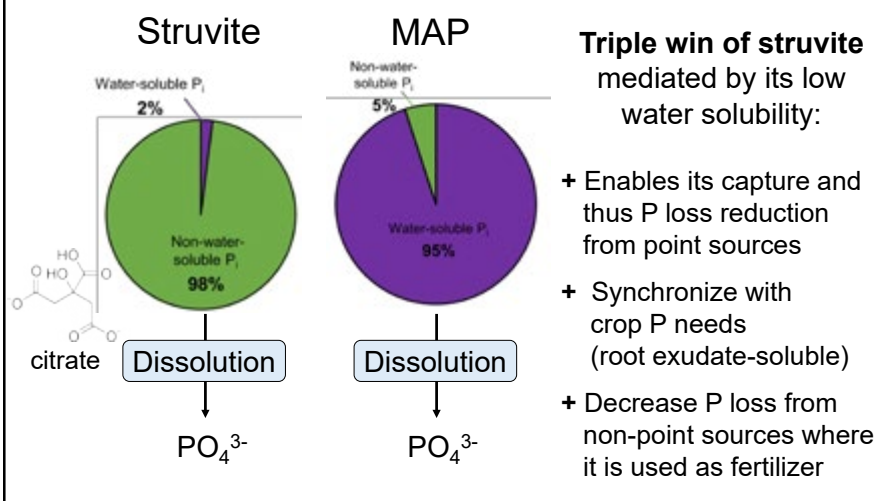


**Figure 1.** *Comparison of struvite with monoammonium phosphate (MAP) and the benefits of struvite for meeting crop production and P loss mitigation goals.*

However, struvite has not been sufficiently evaluated in the peer-reviewed scientific literature to enable its use by producers. With the support of NREC funding, and in collaboration with producers via on-farm trials facilitated by IFB, this four-year project (2018-2021) is comprehensively determining the dual agronomic and environmental outcomes of struvite.

While Dr. Margenot's research on struvite was the focus of this project, he provided additional information on phosphorus (P) fertility recommendations and his lab's work on updating the Illinois Agronomy Handbook P recommendations.

Key findings to-date (second field season underway in 2020) include:

- Meta-analysis identified that the overwhelming majority of struvite evaluations are greenhouse-based studies with no measurement of yield at the field-scale for corn and soybean. Our NREC-funded work builds on these identified shortcomings in previous evaluations in order to deliver an accurate evaluation of struvite as a P source for Illinois cropping systems
- In soils with deficient soil test P (STP), **50-50% struvite-MAP blends appear optimum** for maximizing corn and soybean growth while **minimizing residual STP by up to -18%.** This indicates lower dissolved reactive P (DRP) loss risk from surface soils via runoff without compromised crop growth.
- In on-farm trials with soils with adequate to high STP, **corn yields are unaffected by up to 75% struvite substitution** and yields of **double-cropped wheat and soybean** are unaffected by up to 100% struvite substitution for MAP. Though this likely reflects 'banked' P from previous applications, these conditions are representative of the 'maintenance' STP levels recommended for production of these crops in Illinois.
- Timing (fall vs. spring) and placement (broadcast vs banding) did not influence corn or wheat yields
- With no yield penalty from swapping MAP with struvite *on adequate STP soils,* struvite adoption mitigates the P loss risk from non-point sources. Given that struvite enables point sources to increase P loss reductions, non-point sources can take a leading role in helping point sources make use of this otherwise waste material. This represents a collaborative effort of point sources and non-point sources working together to reduce state P losses

## Updating Phosphorus (P) Fertility Recommendations for Illinois

Led by Dr. Andrew Margenot, a team of graduate students and postdoctoral researchers at the University of Illinois are working to update the Illinois Agronomy Handbook phosphorus (P) fertility recommendations. Additionally, the team is working to fine-tune management recommendations that enhance the profitability of P fertilizers, and testing under-evaluated approaches to mitigate off-field P losses.

Key updates and activities include:

- Updating soil test P (STP) guidelines so that producers can better interpret build-and-maintain values that reflect changes in STP methods offered by commercial testing labs. Currently, the Handbook expresses STP values based on the Bray test, but Mehlich-3 test (colorimetric and ICP) is an increasingly popular STP option in our North-Central US region.
- Ground-truthing at county-level the concept of soil P supplying power that is the current basis of interpreting STP values in the Handbook.
- Add updates from other scientists, including from NREC-supported research, on the 4Rs of P. This includes recent research on timing and placement of P fertilizers, and updated grain nutrient removal rates.
- Analogous to crediting N release from soil organic matter, gauging the potential contribution of P mineralization to crop P needs. Additionally, evaluating soil moisture and temperature conditions under which P mineralization can occur will offer insight to whether there is a potential asynchrony of P mineralization and crop P needs that could contribute to non-point P losses that are not due to P fertilization.

*Contact Dr. Andrew Margenot at margenot@illinois.edu*

## Soil Health Partnership

*Content provided by Abigail Peterson, Field Manager, Southern Illinois and Missouri, and Jim Isermann, Field Manager, Northern Illinois and Wisconsin*

Jim Isermann joined us to share information on soil health, specifically on the Isermann farm.

Founded in 2014, the Soil Health Partnership (SHP) was developed by a diverse group of organizations that had a shared vision of developing a farmer-led research network to measure the impacts of implementing soil health practices on working farms. The Nature Conservancy (TNC), Bayer, and the Environmental Defense Fund (EDF) – alongside the National Corn Growers Association (NCGA) – came together to see this vision through. The SHP network spans across 16 states and includes partner organizations at the federal, state and county levels. SHP has grown from 17 research sites in 2014 to a network of 200+ research sites and represents over 7,000 acres. SHP currently has a team of eleven regional field managers that work alongside farmers to design and implement experiments in fields across North America.

In Illinois, SHP has over 20 research sites that are designed to show the economic and environmental impacts of best management practices. The leading field trial of no-till cover crop implementation has been conducted on some fields for over 5 years. Specifically, field managers Jim Isermann and Abigail Peterson are comparing the weather, soil type, soil health, agronomic, and economic influences of what it takes to make a successful adaption of a cover crop system across Illinois fields. Within the program, farmers range in experience from advanced to just beginning. The wealth of regional agronomic decision making information that has been recorded on these sites is what makes the Soil Health Partnership an exciting program for all farmers wanting to learn more about cover crop adoption.

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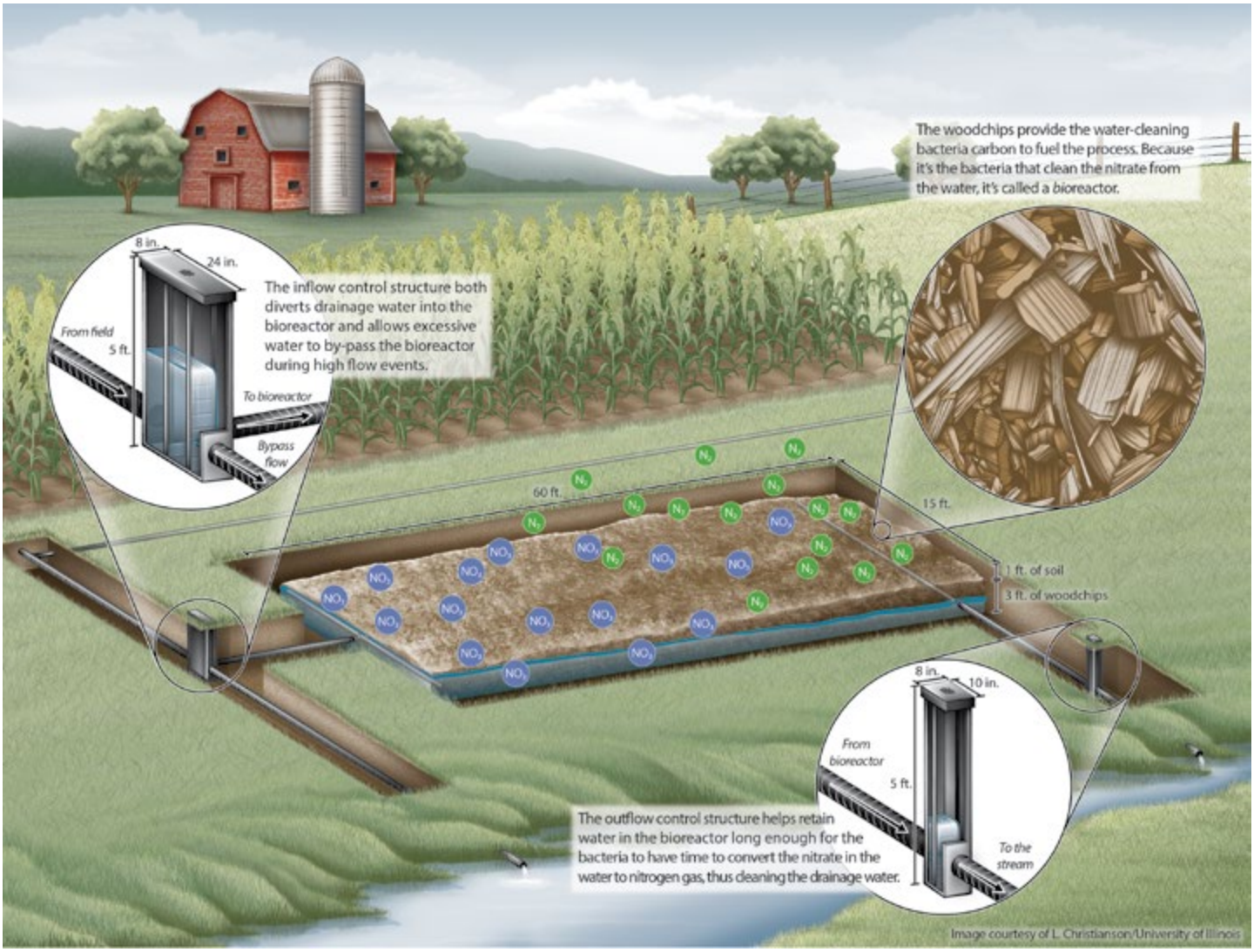
# Woodchip Bioreactor Research

*Content provided by Dr. Laura Christianson, Assistant Professor, University of Illinois College of Agricultural, Consumer & Environmental Sciences*




Agricultural productivity in the US Midwest is underlain by a foundation of more than 48 million acres of tile drainage networks, with approximately 10 million tile-drained acres in Illinois alone. After more than 150 years of improving land drainage in this way, this practice is fully integrated into the economy and culture of our crop production. However, in changing how water leaves our fields by installing tile pipes, we have also changed how nutrients can leave our fields. Nitrate is a particularly tricky nutrient because it does not "stick" to soil and is thus highly susceptible to leaching. Edge-of-field practices like woodchip bioreactors allow us to keep our tile drainage systems functioning for good crop production while also cleaning nitrate out of drainage water before it moves downstream.

Dr. Laura Christianson shared information about the design and research behind woodchip bioreactors.

A woodchip bioreactor is a woodchip-filled trench that cleans nitrate from tile drainage water. Bioreactors clean nitrate from water using the process of denitrification, which is a natural part of the nitrogen cycle where nitrate in the soil or in water is converted into benign nitrogen gas. This process of denitrification has been happening for millions of years on its own, and in a bioreactor, ideal conditions are created to enhance this nitrate conversion. One of the important aspects of denitrification is that

the process is performed by bacteria. These denitrifying bacteria are the work horses of converting the nitrate in the water to harmless nitrogen gas. In other words, inside a bioreactor, the nitrate doesn't stick to the woodchips or get physically filtered out of the water. It is biologically converted into nitrogen gas by these bacteria. It is this biological conversion of nitrate that lends the name "bio"-reactor.

From a research perspective, there are two main pieces of information needed to estimate how much nitrate a woodchip bioreactor has removed. Firstly, researchers collect water samples at the inflow control structure and at the outflow control structure. The water samples are brought to a laboratory and are analyzed to determine their nitrate concentrations. There should be a lower nitrate concentration in the water leaving the bioreactor compared to the water flowing in. That means the bioreactor is working. Oftentimes automated samplers are used to do the water sampling, so research staff doesn't have to be physically at the bioreactor to collect the samples over long periods of time.

However, simply collecting water samples does not provide the full picture for how well a bioreactor is working. The amount of water being treated in the bioreactor also needs to be quantified. The second component of bioreactor research is monitoring the water flow. Small hot-dog shaped pressure transducers are placed in the control structures to continuously record how much water is pushing down on them as the water flows through the structure. That water depth is logged and later related to a flow rate using an equation in the laboratory. A lot of water pushing down on the pressure transducer is related to a high flow rate, whereas relatively shallower depths of water pushing down on the pressure transducer are related to relatively slower water flow rates.

One of the most commonly asked questions about bioreactors is: "How long do the woodchips last?" Practical observation and research across the US Midwest have shown woodchips in a bioreactor last approximately 7-12 years before the woodchips need to be replaced (or, "recharged"). Another common question involves if the type of woodchip matters. The short answer is the tree species used to make the woodchips generally does not matter. All woods contain roughly the same amount of carbon which is the fuel for the process of denitrification inside a bioreactor. Rather than the type of tree, it's the physical size and shape of the woodchips that are more important. Locally-available woodchips will be most cost-effective, but they must be clean from leaves or dirt. Ideally, the woodchips should have a square/ rectangular "chip shape" and be around 1" or more in size. There is a restriction on the use of oak woodchips due to concerns about leaching of tannins although this is an area of active research.

*Contact Dr. Laura Christianson at lechris@illinois.edu*


*Picture of an open woodchip bioreactor, captured in Henry County, 2017*

# Reducing Phosphorus Loss by Controlling Erosion

*Content provided by Dr. Reid Christianson, Assistant Professor, U of I College of Agricultural, Consumer & Environmental Sciences*

Dr. Reid Christianson shared some background on erosion control and phosphorus loss, including sharing the Augmented Reality Sand Table.

Phosphorus has impaired nearly 500 waterbodies in Illinois. In freshwater systems, phosphorus is usually the limiting nutrient for algae growth, meaning reducing phosphorus loss can directly reduce harmful algal blooms. The NLRS recommends the practices of no-till/conservation tillage and cover cropping as some of the most effective phosphorus loss reduction practices. A primary mechanism for these practices is the reduction of soil erosion, and since phosphorus is often bound to the soil, erosion control methods work well to reduce phosphorus loss. Other practices important for erosion control include contour farming, terraces, reducing land slope, and implementation of water and sediment control basins.

While many of these types of practices are effective at reducing surface runoff phosphorus losses, their promotion solely from a water quality improvement perspective "for the public good" can be a hard sell. However, many of these practices also provide on-farm benefits, like improving soil health, which can lead to a more resilient farming operation. Improvements in soil health qualities such as infiltration rate and water holding capacity are useful metrics to measure over time.

Many of the land management practices impacting topography, like contour farming or terraces, can be quickly and easily visualized using the NREC funded Augmented Reality Sand Table. The Augmented Reality Sand Table, also called the erosion table, is a highly interactive display to visualize erosion by seeing how water moves across our landscape. The Augmented Reality Sand Table shows how changes in land elevation (topography) can impact the potential for loss of our precious soil resource. This display helps us learn about management techniques used to reduce the risk of erosion by water.

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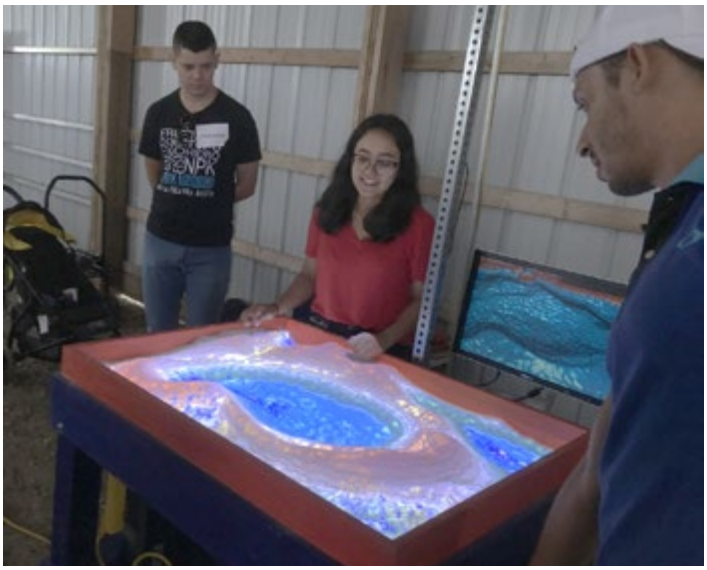

*Above image by Laura Christianson featuring Illinois Drainage Education and Outreach lab members, from left to right, Fernando Zucher, Ariana Muñoz, and Ronnie Chacón at the 2019 Crop Sciences Agronomy Day.*

*Above image from Illinois NREC on Twitter (@IllinoisNrec) featuring Dr. Laura Christianson talking with a guest at the 2019 Farm Progress Show.*

## Contact Information

You can contact the LaSalle CFB at:

www.lcfb.org

815-433-0371

For more information about our Virtual Field Day, visit: https://www.lcfb.org/virtual-field-day

To learn more about all other IFB Nutrient Stewardship Virtual Field Days, visit: www.ilfb.org/FieldDays

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