



WARREN-HENDERSON FARM BUREAU

2020 NUTRIENT STEWARDSHIP
VIRTUAL FIELD DAY



Project Partners

Warren-Henderson Farm Bureau

The Warren-Henderson Farm Bureau is a non-profit membership organization based in Monmouth, Illinois. In 2018 and 2019, the Warren-Henderson Farm Bureau received an Illinois Farm Bureau (IFB) Nutrient Stewardship Grant to develop a field trial and research partnership that aims to examine nitrogen efficiency. Since then, they have worked hard to maintain the field site and generate data to analyze for farmer use.

Illinois Farm Bureau

Founded in 1916, IFB is a non-profit, membership organization directed by farmers who join through their County Farm Bureau (CFB). IFB has a voting membership of more than 78,000. IFB represents three out of four Illinois farmers. The mission of IFB is to "improve the economic well-being of agriculture and enrich the quality of farm family life."

University of Illinois Extension

The University of Illinois (U of I) Extension is the flagship outreach effort of the U of I at Urbana-Champaign. The U of I Commercial Agriculture team has stepped in to present research-based information that supplements the work done for the Warren-Henderson Farm Bureau Nutrient Stewardship Grant. Furthermore, educators are assisting with data analyses and statistics-based presentations of the data generated from this project.

University of Illinois – Soils Lab

Dr. Andrew Margenot is an assistant professor of soil fertility at U of I Urbana-Champaign. Dr. Margenot joined the Department of Crop Sciences in 2017, where his team researches agronomically profitable and environmentally sound management of soil fertility for Illinois production agriculture.



I ILLINOIS
College of Agricultural, Consumer
& Environmental Sciences



NLRS Background and Illinois Farm Bureau Nutrient Stewardship

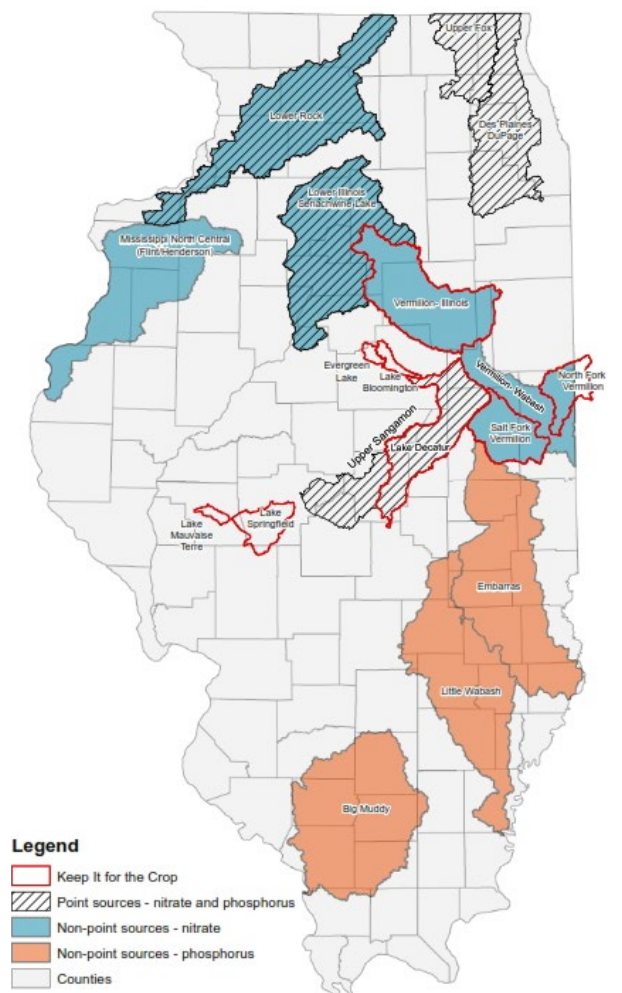
Since 2015, IFB has contributed to an impressive statewide effort called the Illinois Nutrient Loss Reduction Strategy (NLRs). Through leadership and participation from our farmer members across the state, IFB has been able to make meaningful contributions toward water quality improvements in Illinois. 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 BMPs 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 LOSS REDUCTION STRATEGY PRIORITY WATERSHEDS



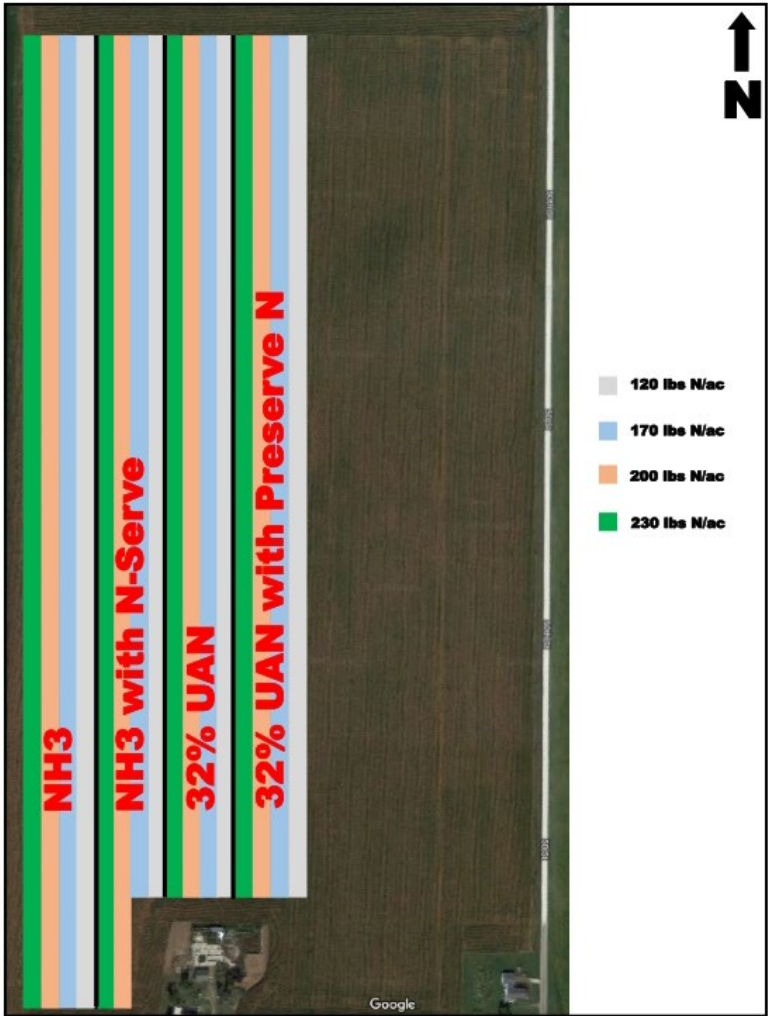
Methods and Background

Study Design

The objective of this study was to compare two of the 4Rs of nutrient management, including the source and rate of nitrogen application for corn. Additionally, a simple economic comparison among sources and rates was used to help identify the sustainable choice (i.e. best for profits while placing the right source and amount of N for plant uptake).

Field History

The plots were in the same field located in Tompkins township of Warren county. This area is in the Flint-Henderson Watershed. Soil types of the field are characterized as 0-2% slopes with 82.6% Sable silty clay loam and 17.4% Muscatune silt loam. 2019 marked the third year the field has had corn and the first year of the study. Over the 2019 season, significant rain prevented planting until an unusually late date.



Agronomic Timeline and Treatments

- April 15th – Vertical tillage (Great Plains Turbo-Max; Gangs at 4°)
- April 20th – Root zone banding P and K on all plots
- April 20th – NH_3 and NH_3 + N-Serve knifed in the root zone at rates of 120, 170, 200, 230 lbs/ac on respective plots (Case IH 5310 Bar; Case IH Air Cart)
- June 14th – After a long period of rain delay planted corn plots on top of the root zone banding strips, at a population of 36,000 population (Stine R9633E-21 VT3, 107 day)
- June 18th – UAN and UAN + Preserve N side dressed at rates of 120, 170, 200, 230 lbs/ac on respective plots (FAST 8100 15 knife on 30-inch rows)
- June 18th – Sulfur 20 lbs/ac side dressed on all plots (FAST 8100 15 knife on 30-inch rows)
- Plant growth regulator applied at post spray
- Thrive 8-21-6 with micros applied at post spray
- Fungicide applied at tassel
- The control was a soybean field in which no N was applied

Soil Tests

- Collected in two rows across the north and south end of the plots, eight times during 2019
- Samples were collected to a depth of 12 inches

Corn Tissue Tests

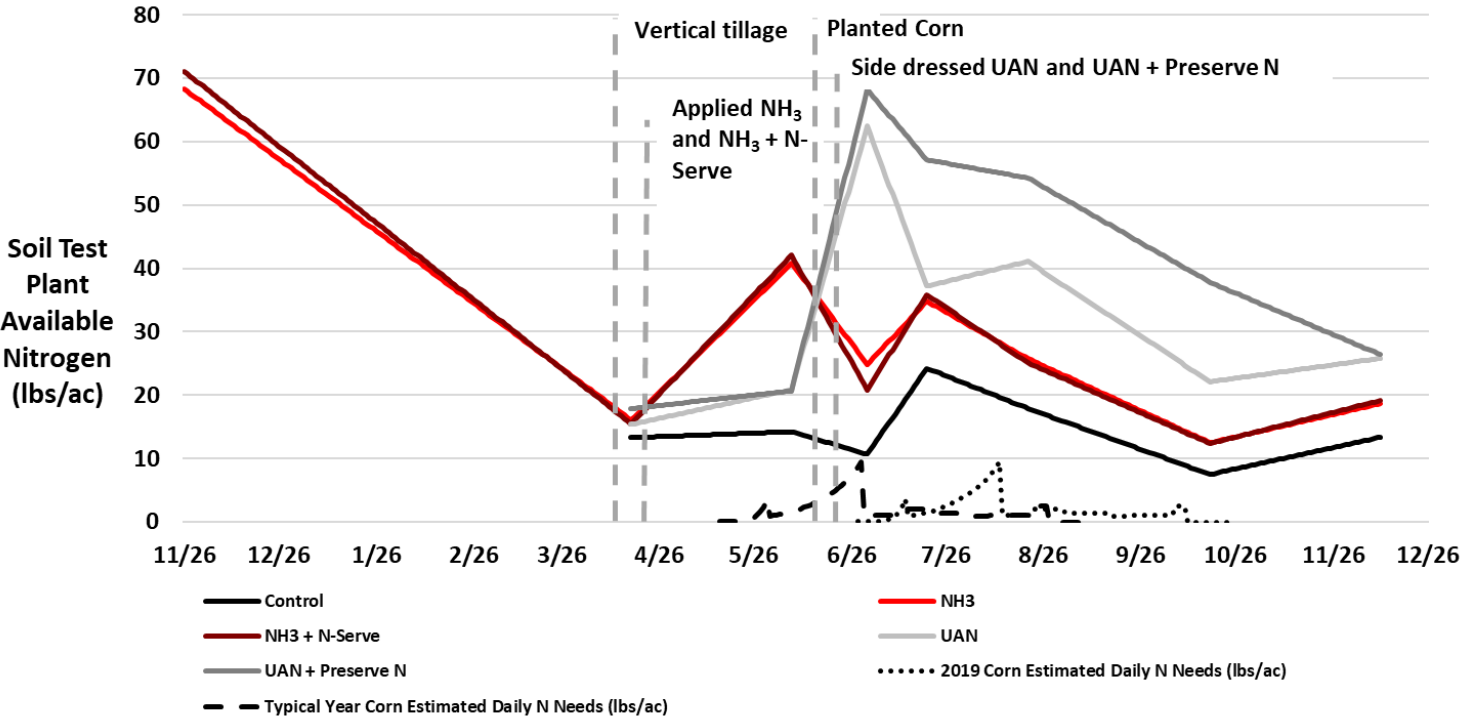
- Tissue samples were collected in the NH_3 + N-Serve plots and UAN + Preserve N plots
- Samples were collected on July 24th at V7 from the leaves directly below the whorl and two sets of samples were collected on August 15th at R2 from the ear leaves
- Tissue samples were sent to Waypoint Analytical in Champaign, IL for analysis of N, P, K and micronutrients

Yield Measurements and Profit Calculations

- Recorded yield for each strip by separate harvest and transport to be weighed by Cameron Grain
- Net profits were calculated based on the U of I Department of Agricultural and Consumer Economics Crop Budgets, Illinois, 2019. The budgets used were for the Northern Region of Illinois corn after corn, which had \$5 more expenses in pesticides than corn after soybean budget. The overall non-land production costs without fertilizer costs were \$485/ac. This “non-land” cost does not include cash rent, taxes on owned land, or any tenant pay split scenarios. Local fertilizer prices were used for the respective rates and products. The prices used for NH_3 was \$610/ton, N-Serve \$14/ac, UAN \$315/ton, and Preserve N \$12/ac. The price of corn used was \$3.85 per bushel, which represented the local market and was applied to the respective yields of each treatment. The fertilizer price, rate, and product, as well as the yields, were the only things that differed in the net profit budget calculations.



RESULTS



Plant Available Nitrogen:

The chart above shows the plant available nitrogen (Ammonium [NH_3] and Nitrate [NO_3]) from soil tests taken in each strip (i.e. plot). The way this graph is set up is to look at the average across rates for each source (i.e. NH_3 , $\text{NH}_3 + \text{N-Serve}$, UAN, UAN + Preserve N, Control) which are represented by the colors over the timeframe of soil sampling.

Dashed and dotted lines on the graph show the estimated corn N needs basing on a yield goal of 200 bu/ac and an application of 204 lbs/ac N. The dashed line is the “typical” year (plating late April to early May) daily N needs in lbs/ac. The dotted line is the 2019 estimated daily N needs (planted in June). It should be noted and shown by the lines on the graph that the 2019 planting season was delayed over a month compared to a “regular” corn planting season.

4Rs

Right Place

- This study looked to compare the systems of 4Rs, not single out application methods. However, spring application and side dressing of N are two of the best practices for applying N to mitigate losses.

Right Time

- You can see that the plots which had ammonia applied in the fall and sampled in late November had significantly higher N than the same plots in the spring, which may be indicative of loss over the winter months.
- Another expected observation you can see is the pre-plant NH_3 (red and maroon lines) applied in April provided more N early on in the season than UAN (grey and dark lines). However, after UAN was side dressed in July more N was available in those plots. This difference is mostly due to the delayed planting season in 2019.

Right Rate

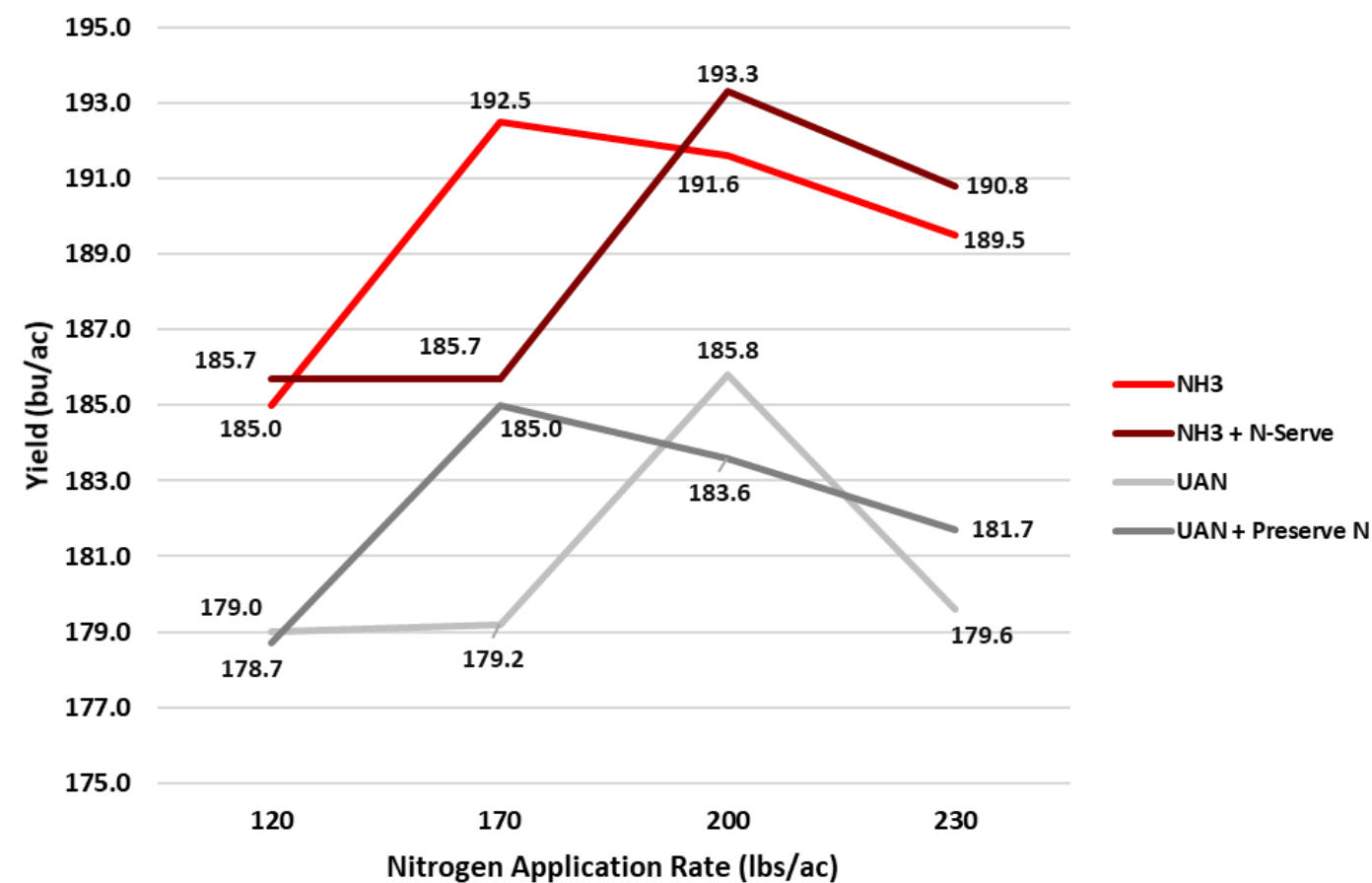
- The higher rate did not always result in the largest amount of available nitrogen. Note: this could be a result of sampling a “hot spot” in the field in the smaller rate strips.
- However, generally across the sampling dates, the larger rates had greater N available for corn during the growing season. The 200 and 230 rates were not significantly different, with the 170 and 200 rates also not different.
- All rates appeared to provide enough N in the soil for the corn requirements on the days they were sampled.
- Tissue test of tissue percent N in corn plants did not differ across plots with different N rates (i.e. 120, 170, 200, 230) for each of the sources sampled at V7 and R2 stages.

Right Source

- It is hard to discern which source provided the most plant available nitrogen when corn needed it due to the delayed planting and UAN side dressing. When looking at the average over the 2019 season, there was no significant difference among N for the four sources, but all sources were significantly greater than the control.
- If you look at the NH_3 application compared to the dashed line (“typical” planting year) and UAN samples compared to the dotted line (2019), you can see both sources provide large amounts of N before peak daily corn N requirements.
- Except for NH_3 at 230 lbs, the majority of N-Serve plots showed more N available during the increasing N requirement of the corn plant. UAN and Preserve N tracked more similarly to each other than the NH_3 and N-Serve sources.
- Tissue test of tissue percent N in corn plants did not differ between N-Serve and Preserve N sources while staying close to 3% at V7 and 2.5% at R2.

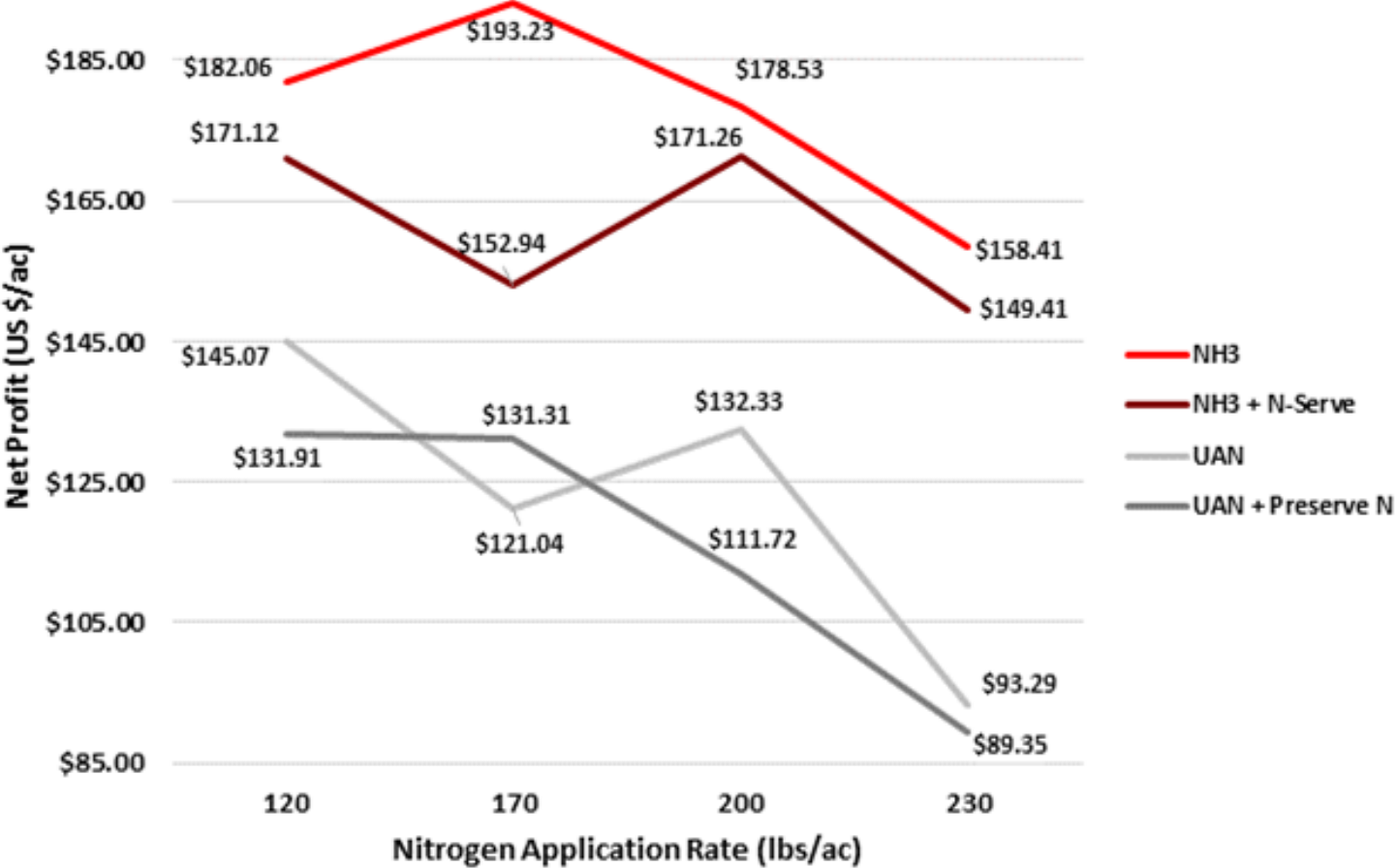
No matter the soil N, the right place, time, rate, and source are the 4Rs that allow the farm to be profitable. Looking at the yield and economic results are a critical consideration when selecting 4Rs.

Yields



- The additional N-Serve and Preserve N products showed to have mixed results across rates with the N-serve, providing a yield boost at higher application rates and Preserve N having diminishing yields beyond the 170 lbs/ac rate.
- A larger amount of available N does not always result in larger yields. This has been shown by the U of I MRTN tool. Based on the yield data, it appears the best rate for the field the plots were located in was between 170-200 lbs/ac for all products.
- Greater yields do not always mean greater profits, right source and rate are usually what is the most profitable depending on the price of the source.

Profits



- The NH₃ sources that are cheaper are the most profitable even though the yields of N-Serve at the higher rates (200 and 230 lbs/ac) were greater than NH₃.
- For yield results that do not consider the price of the N source, the optimal rate for all sources appeared to be between 170 and 200 lbs/ac; when looking at a profit for all sources, this seems to be similar.



Updating Phosphorous (P) Fertility Recommendations for Illinois

Led by Dr. Andrew Margenot, a team of graduate students and postdoctoral researchers at the U of I are working to update the Illinois Agronomy Handbook (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 Nutrient Research and Education Council (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.

Next Steps:

Warren-Henderson Farm Bureau is continuing the nitrogen strip trial in 2020 and hopes to follow suit in subsequent years. By conducting the strip trial over multiple years, the data collected will provide a better representation of which management practices show a year in and year out return on investment (ROI). Tracking nutrient loss and plant health through soil and tissue tests will enable farmers to see which combination of practices have been the most beneficial over a period of time at this particular site.

The 2020 nitrogen strip trial will be slightly altered from 2019. The nitrogen sources planned will be anhydrous ammonia, anhydrous ammonia with N-Serve, and liquid nitrogen with Preserve N applied at pre-plant in the spring. The last strip will be liquid nitrogen with Preserve N applied at side dress.

In 2019, the liquid nitrogen yielded less than the anhydrous ammonia. This lower yield was likely due to the lack of rainfall during the time between the liquid nitrogen side-dress application and black layer. Comparing liquid nitrogen pre-plant to side-dress going forward will help determine if a lack of rain was the probable cause of lower yields.





Contact the Warren-Henderson Farm Bureau at

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(309) 734-9401

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

