

STAR ANNUAL REPORT

CROP YEAR 2020

Improving Conservation One Field At A Time



A letter from the STAR Steering Committee Chairman

2020—what’s there to say? As a full-time farmer, the routine of planting and raising the 2020 crop offered welcome moments of normality. With so much seeming out of our own control this past year, I became more aware and grateful of things within my own sphere of control.

Management practices, how a farmer raises their crops, are one of the few things a farmer can control. As farmers and ranchers seek to balance production goals with each of our state’s resource concerns, Saving Tomorrow’s Agriculture Resources (STAR) provides a clear roadmap for suggested practice changes. As I work to increase the STAR Ratings on my farm, I am confident we’re on the right track.

Despite all the unknowns and curveballs thrown our way, the STAR initiative continued to grow in 2020. Beyond increased adoption across Illinois, STAR leadership fielded multiple inquiries from conservation leaders across the US, from the Eastern seaboard to the Rockies, wanting to see how STAR could be utilized for their own resource concerns. STAR’s framework focuses on finding the alignment between local resource concerns, trusted science, and practical farming methods. It’s clear the need for local solutions to nationwide conservation issues resonates with many others.

On behalf of the STAR steering committee, we’re excited to bring you the annual report for STAR’s 2020 Crop Year (beginning after harvest in 2019 and running through harvest of 2020). Join us as we look back on the initiative’s growth and impact over the past year.

It’s a great time to be in conservation!



Steve Stierwalt,
STAR Steering Committee
Chairman
Sadorus, Illinois



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Year in Review

2020 was a year of historic challenges. While the world slowed to a crawl, fields still needed to be tended, seeds sown, and crops harvested. The agricultural community adapted to these trying times and so did STAR. STAR continued to accelerate its growth increasing both its internal capabilities and farmer participation, doubling the number of acres, fields, and participants in the 2020 Crop Year.

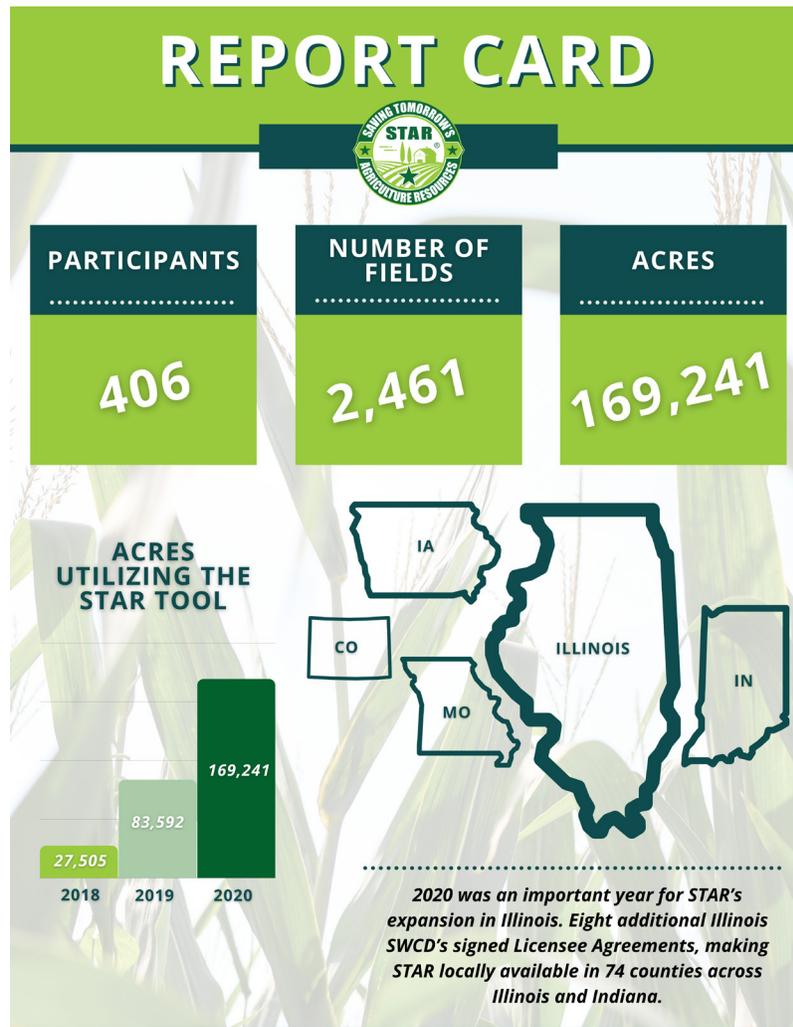
With a generous grant from the Walton Family Foundation, STAR partnered with the Association of Illinois Soil and Water Conservation Districts to hire their first full-time STAR Coordinator. Coming over from Iowa with a conservation-ag background, Nick Longbucco started remotely last fall. Now fully relocated, Nick is engaging with partners and licensees to further establish STAR throughout Illinois.



Nick Longbucco
STAR Coordinator

Also this past year, STAR partnered with American Farmland Trust to launch its first Pilot Incentive Program, which offered participants an incentive payment for increasing their STAR Rating from year to year. Nearly 40 participants signed up and over \$66,000 were allocated to assist farmers in continuing their conservation journey through STAR.

Lastly, STAR completed its first full verification process, working with a dedicated group of volunteers to document practices of randomly selected fields. By establishing a reliable verification process, STAR establishes itself as a credible, farmer-led initiative that can evaluate the stewardship of fields at scale.



Program Overview

In 2016, the Soil and Water Conservation District (SWCD) in Champaign County began to explore ways to encourage farmers in Champaign County, IL to adopt conservation practices identified in research to reduce nutrient losses into waterways in support of the Illinois Nutrient Loss Reduction Strategy (NLRs).

This led to the development of STAR, an initiative that educates and encourages farmers, ranchers, and landowners to employ conservation management practices that improve water quality and soil health. STAR evaluates an individual field for a given crop year that includes practices such as cover crops, nutrient management, and tillage.

The expertise of the Science Advisory Committee, including university researchers and other experts, ensures that STAR accurately captures nutrient loss reductions and impacts on agriculture resources. Fields are then ranked on the 5-STAR scale, and participants can receive a sign for their fields to identify their STAR designation. Roughly 10% of fields undergo a verification process to validate their field evaluation.

The initiative has been recognized nationally and adopted by SWCDs in Illinois, Iowa, Colorado, Missouri, and Indiana. STAR is organized into committees of governmental, nongovernmental, and nonprofit partner organizations and farmers to implement and expand the initiative. These conservation-minded partners make up the following committees to ensure STAR is efficient and effective in its goals to improve water quality in the state:

- Steering Committee
- Science Advisory Committee
- Outcomes and Alignment Subcommittee of the Science Advisory Committee
- Communications Committee
- Market Development Committee
- Training and Education Committee
- Evaluation and Verification Committee

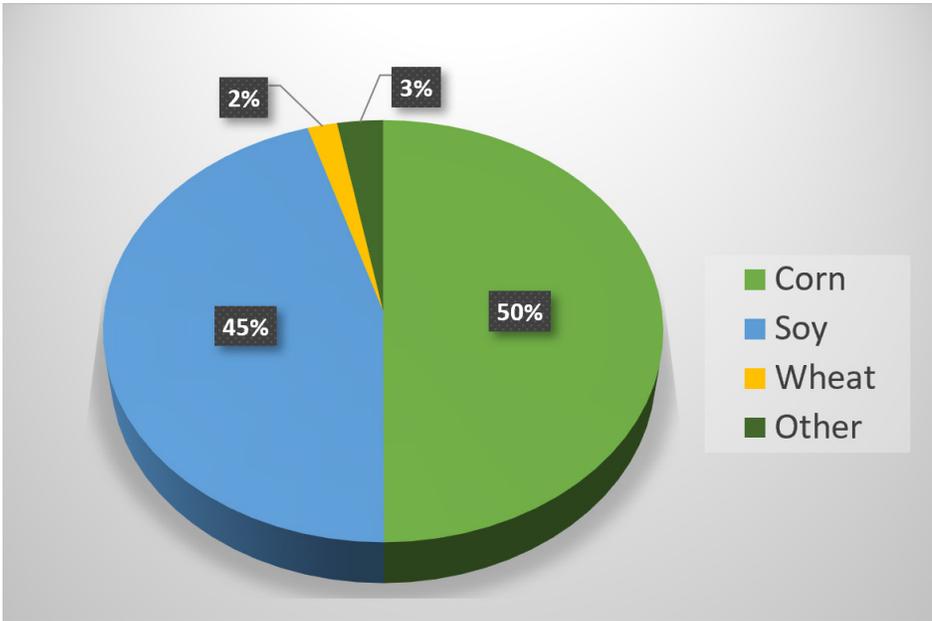
We'd like to thank the following partners who serve on committees for their support and work developing, promoting, and implementing STAR:

- American Farmland Trust
- Archer Daniels Midland Company
- Association of Illinois SWCDs
- Certified Crop Advisors
- Champaign Co. SWCD
- Centrec Consulting Group
- Champaign Co. Farmers
- CHS, Inc
- Coles Co. SWCD
- Crawford Co. Farmer
- Crawford Co. SWCD Director
- DC Analysis, LLC
- DIGS Associates
- Illinois Corn Growers Association
- Illinois Department of Agriculture
- Illinois Fertilizer and Chemical Association
- Illinois Nutrient Research and Education Council
- Illinois Soybean Association
- Kankakee Co. SWCD Director
- McHenry Co. SWCD
- Natural Resources Conservation Service Illinois
- Piatt Co. SWCD Director
- Precision Conservation Management
- The Nature Conservancy
- The Strategic Collaboration Group, Inc.
- University of Illinois
- University of Illinois Extension
- Wabash Valley FS

2020 IL Program Totals

For the 2020 Crop Year, 385 participants utilized the STAR tool on 155,605 acres over 2,276 Fields. Acres enrolled in IL STAR more than doubled between CY 2019 and CY 2020, signifying a substantial increase in utilization of the STAR tool.

2020 STAR Fields by Row Crop



What Does a Top-Rated Field Look Like?

Most Common 5 STAR Practices



91%

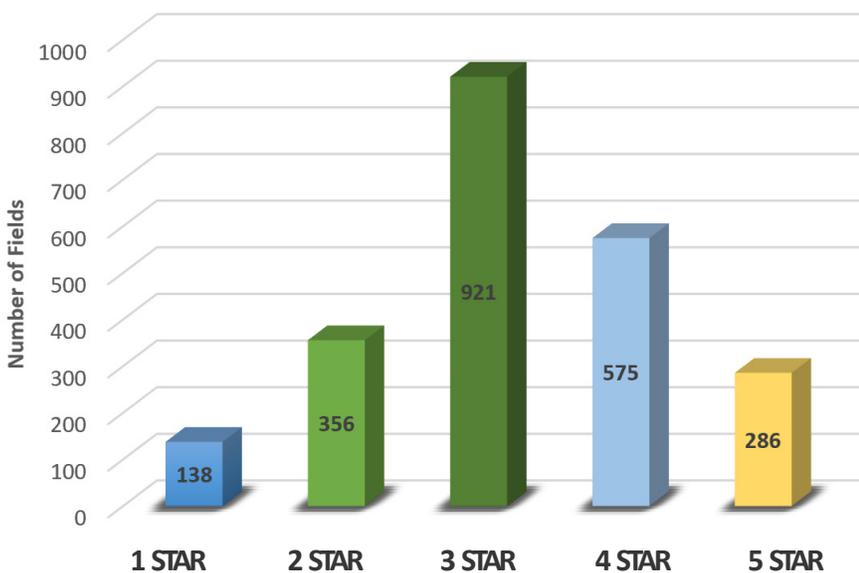
Applied P at or below removal rates



81%

Planted a winter hardy cover crop

Distribution of 2020 STAR Ratings



62%

Under no-till or strip-till management



44%

Corn fields did not apply fall N

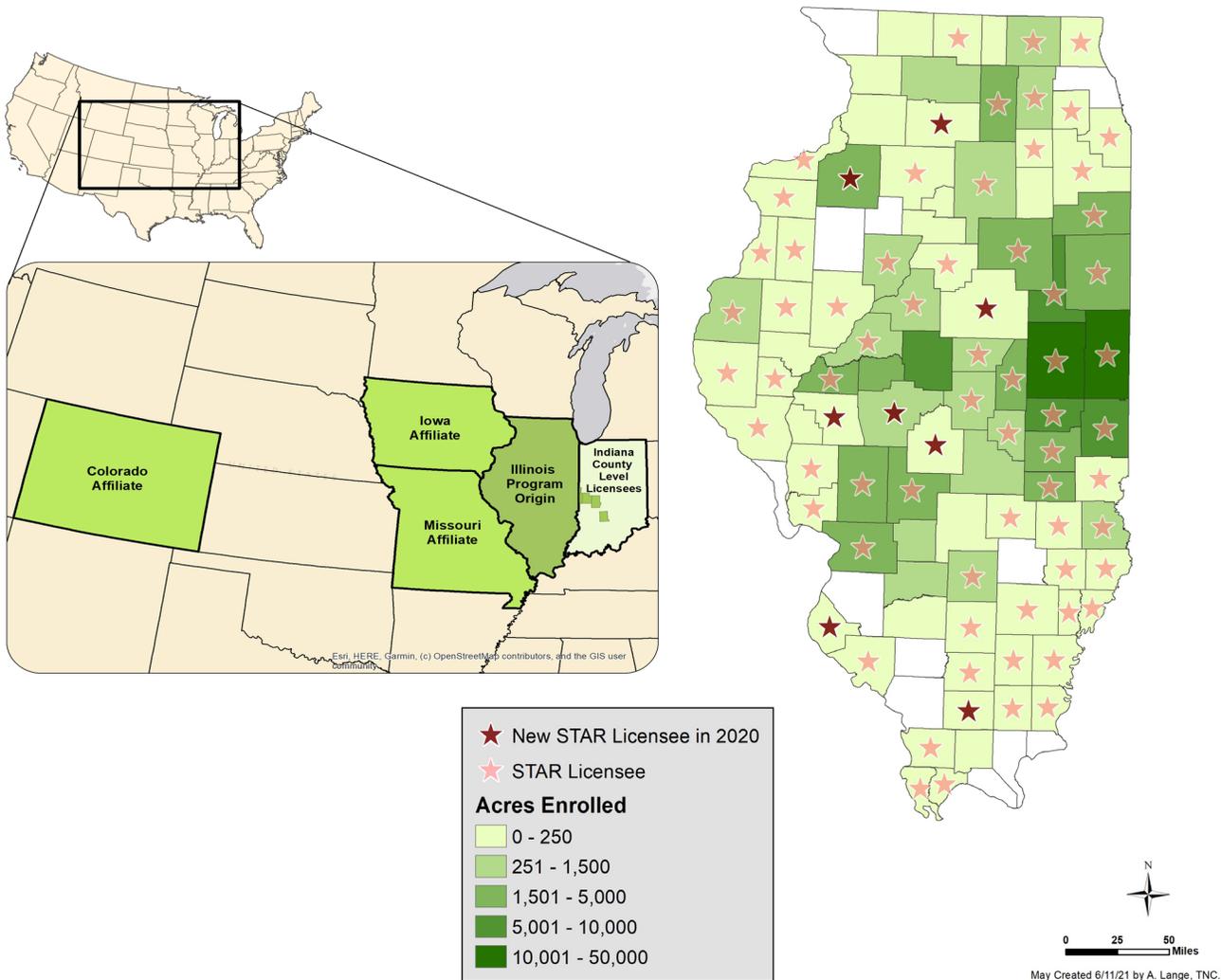
Program Overview

Program Expansion

2020 was an important year for STAR's expansion, both inside and outside of Illinois. Iowa STAR finalized its field evaluation form with support of its Science Committee, and is currently available on the Conservation Districts of Iowa website. In January 2020, the Colorado Department of Agriculture executed an memorandum of understanding to bring STAR west, complementing their Soil Health Program that will launch in summer 2021. STAR's journey expanding to other states has been nothing but exciting, and shows an adaptability, simplicity, and benefit it brings to conservation organizations, farmers, and ranchers across the nation.

Expansion continued within Illinois as well. Although farmers can utilize the program anywhere in a state, entities within a particular county can sign up to be a STAR Licensee to administer the program locally and provide technical assistance to the growers in their county. For the 2020 Crop Year, 8 additional SWCDs signed Licensee Agreements, making STAR locally available in 74 counties across Illinois and Indiana.

The Illinois Department of Agriculture also saw the value of STAR as a means to better track the practices and outcomes of their Partners for Conservation (PFC) program, requiring 2020 PFC cost-share contract holders to fill out a STAR Field Form. Participants filled out 124 STAR Field Forms through the PFC program.



Program Overview

Activities

Education and outreach is a vital component of the STAR. This year's outreach looked vastly different than last year due to COVID-19. Nonetheless, outreach was conducted for farmers, conservation staff, larger community working on water quality, and agriculture supply chain partners. Even more important than education around STAR itself, many of our presentations focused on soil health management systems. Education on the practices known to provide the highest nutrient loss reductions for the state, while adding resilience for farmers, is requisite to the long-term benefit of STAR.

Date	STAR Presentation	Location	Attendees
3/2/2020	STAR to Kaskaskia Watershed Partners	Illinois	25
3/3/2020	STAR at CCSWCD's Conservation Series	Illinois	25
3/10/2020	STAR at CCSWCD's Conservation Series BBQ	Illinois	56
4/1/2020	IL Environment Council's Lunch and Learn Series	Webinar	25
7/29/2020	Soil & Water Conservation Society's Conference	Webinar	30
8/12/2020	STAR Licensee Training	Webinar	40
8/26/2020	STAR to Colorado Conservation Board	Webinar	27
9/10/2020	STAR to Colorado Collaborative for Healthy Soils	Webinar	35
11/12/2020	STAR to Colorado Association of Conservation Districts	Webinar	100
12/17/2020	STAR Holiday Webinar	Webinar	53
1/6/2021	STAR Incentive Programs (STAR Brunch and Learn Series)	Webinar	63
1/20/2021	STAR at Conservation Cropping Seminars	Webinar	240
Total Reach			719

2020 STAR Awards

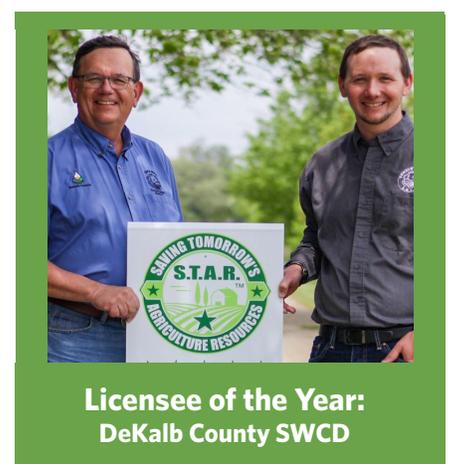
Numerous players in the agriculture community assist growers daily with their conservation goals. The STAR Steering Committee was happy to recognize three stakeholders that went above and beyond to promote STAR in 2020 to their peers, customers, and larger community.



Sarah works specifically in the Upper Macoupin Watershed to drive adoption of conservation practices. Sarah utilized the STAR Initiative to complement her own messaging, sending out postcard mailings, and even putting up STAR billboards across the countryside.



Pictured left to right: Derek, Jeff, and Doug Martin. Since 2018, the Martin family have utilized the STAR field signs to promote STAR and demonstrate their commitment to stewardship in their local community. One of their neighbors used STAR for the first time in 2020 because of that promotion!



Pictured left to right: Dean Johnson and Jeff Woodyatt. STAR Licensee DeKalb County SWCD had the largest increase in STAR. SWCD staff Dean and Jeff went above and beyond to promote STAR, guide producers through the process, and deliver field signs for those wanting to promote the initiative.

Program Overview

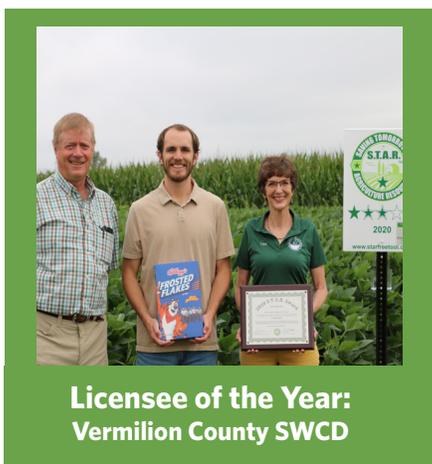
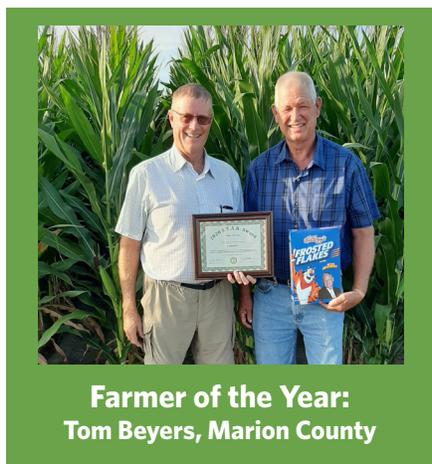
2020 STAR WARZ Winner

Illinois STAR rolled out a new competition late in Crop Year 2020 for licensees. This served as a great motivation for a final push in STAR enrollment right before the end of the crop year in early 2021. The county licensee with the most sign-ups received a gift basket from STAR supporters across the state. Donations from Riggs Brewing, Whiskey Acres, Practical Farmers of Iowa, and STAR itself were included.



2019 STAR Awards

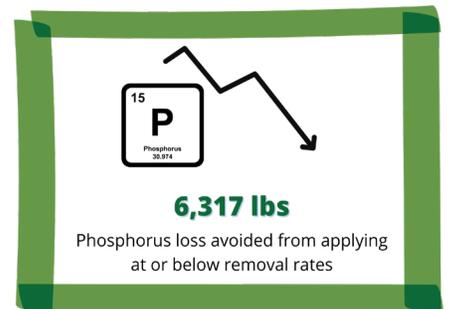
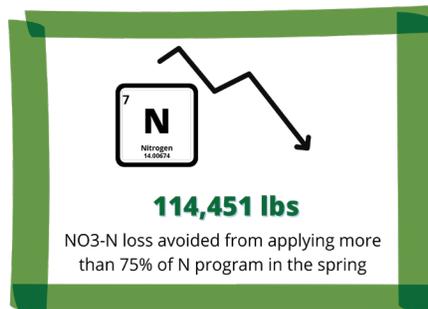
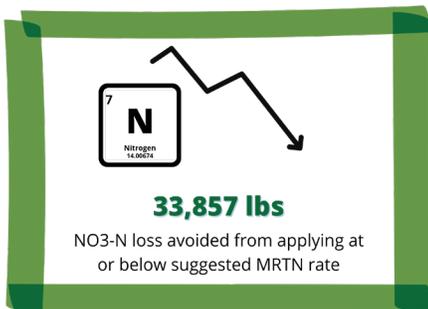
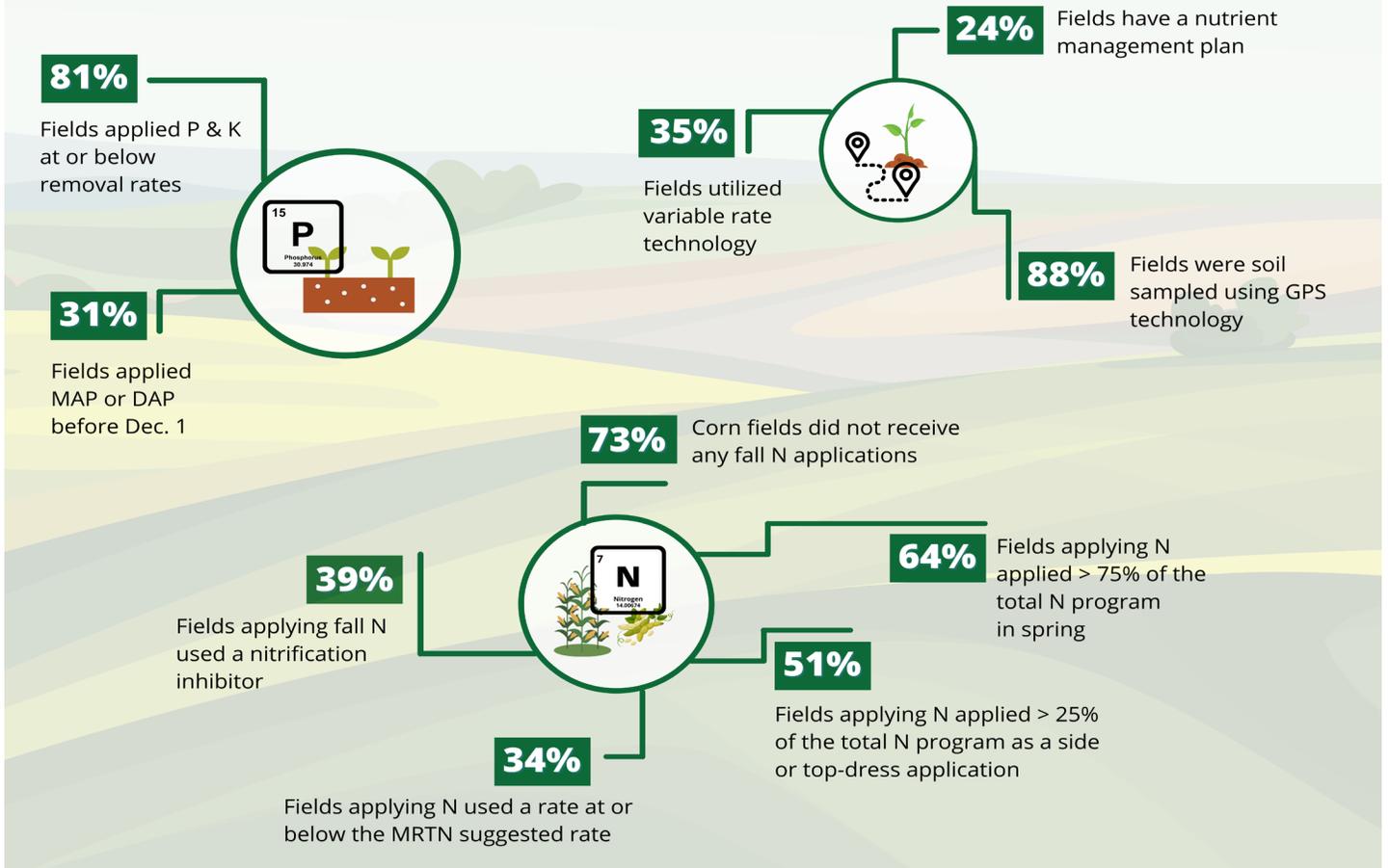
During 2020, we also recognized 2019's STAR Award winners. STAR Chairman Steve Stierwalt met the awardees safely outside to deliver the unique awards, donated by the Kellogg Company, a longtime supporter of STAR.



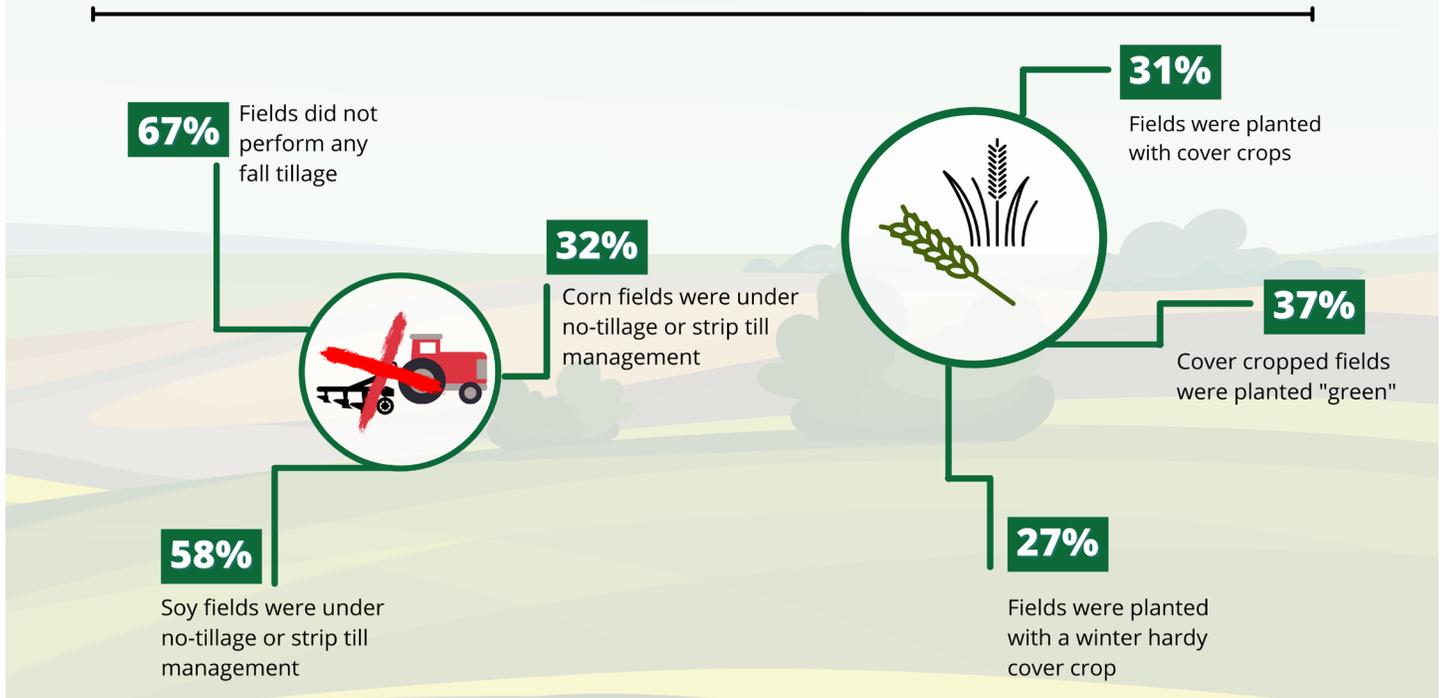
Practices

The following statistics provide a breakdown of a majority of the 2020 Crop Year practices included in the Field Form. Reported metrics have been calculated on a per practice basis and are meant to provide an estimate of practice level performance. Values presented are not additive. All methods employed to quantify environmental outcomes, including equations and Illinois data sources, can be found in the appendix.

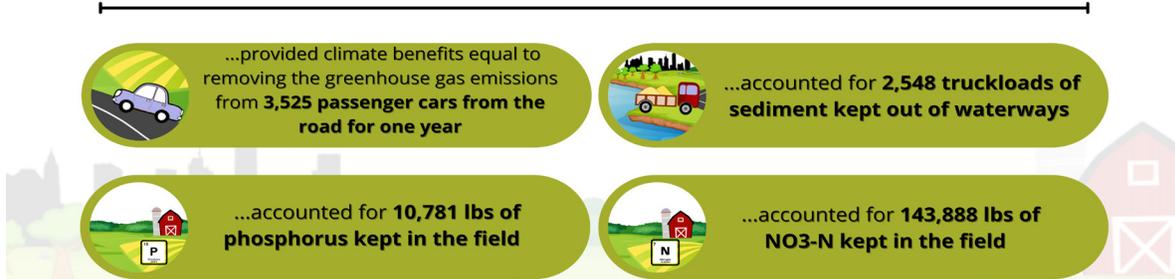
SOIL SAMPLING AND NUTRIENT MANAGEMENT



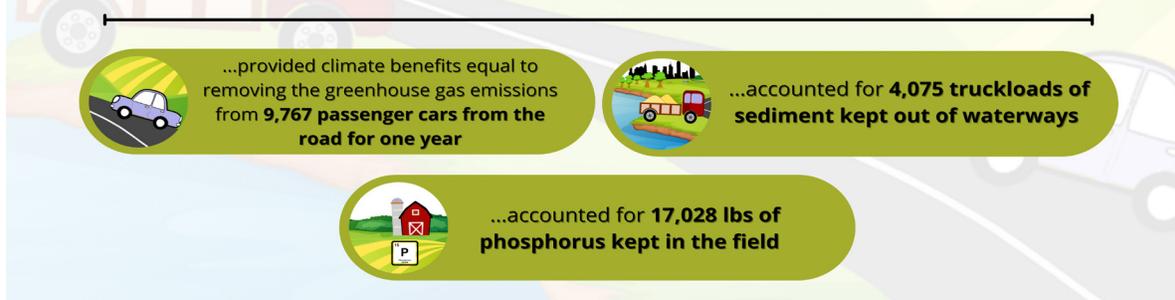
COVER CROPS & NO-TILL



THE USE OF COVER CROPS BY STAR FARMERS...



THE USE OF NO-TILL & STRIP TILL BY STAR FARMERS...



Looking to the Future

Aside from keeping valuable topsoil in its place, avoided nutrient, sediment and carbon losses translate to on-farm benefits by way of increased productivity. We look forward to working with more farmers to improve their soil health and overall profitability in 2021. Visit www.starfreetool.com to get STARted today!

2020 Crop Year Field Form

IL S.T.A.R. – 2020 Field Form

For office use:

Points: _____

STARS: _____



"If you can't measure it, you can't improve it." - Peter Drucker

Farmer/Owner Information:

1. Name: _____ Email: _____
 Phone: (____) _____ - _____ Street/City/Zip: _____
 2. Field name: _____ 3. 2020 Crop: _____ 4. Acres: _____
 5. County: _____ 6. Sec/Township/Range: _____
 7. Owner: _____ 8. Is this field tile-drained? Yes No

I understand this field may be randomly selected for verification. To the best of my knowledge, this information is correct.

Signature: _____ Date: _____

IMPORTANT - Before proceeding, please review these instructions. Accurate responses will help ensure your field is awarded the correct point total and S.T.A.R. rating.

- This form documents field activities beginning immediately after harvest in 2019 and concluding with 2020 harvest.
- Read every item under each category. More than one selection is possible, but sometimes no items will be selected.
Example of multiple selections from the Cover Crops section- You planted a cover crop mix of cereal rye and tillage radish. You would select "Winter hardy- single species" and "Winter kill- single species."
- Completely read each statement. Several have more than one qualifier that needs to be met.
Example from the Spring Tillage section- "Any full width operation, limited to a single pass, where no fall tillage was performed."

First, tell us a little bit about the field you have selected.

9. Conservation and Management Practices- (check all that apply on this individual field):

- | | |
|---|--|
| <input type="checkbox"/> Saturated Buffers | <input type="checkbox"/> Conservation Plan that reduces sheet/rill erosion to "T" |
| <input type="checkbox"/> Bioreactor | <input type="checkbox"/> Nitrogen rate study conducted |
| <input type="checkbox"/> Constructed Wetland | <input type="checkbox"/> You attended a soil health or nutrient management meeting or field day within the last year |
| <input type="checkbox"/> Terraces/Contours/WASCOBs | <input type="checkbox"/> Nutrient management plan and/or field is under CCA advisement |
| <input type="checkbox"/> Grass Filter Strip/Riparian Buffer | <input type="checkbox"/> Enrolled in Federal/State/Local Conservation Program |
| <input type="checkbox"/> Grass Waterway | <input type="checkbox"/> Completed S.T.A.R. Form in 2019 for this field |
| <input type="checkbox"/> Pollinator Planting (a ½ acre minimum) | |
| <input type="checkbox"/> Windbreak | |

Now let's establish a crop history for this field.

10. Crop Rotation- use an "X" to indicate the 5-year crop history on this field.

Crop	2020	2019	2018	2017	2016
Corn	<input type="checkbox"/>				
Soybean	<input type="checkbox"/>				
Small Grain: _____	<input type="checkbox"/>				
Forage: _____	<input type="checkbox"/>				
Pasture: _____	<input type="checkbox"/>				
Other: _____	<input type="checkbox"/>				

Example: A field has been in corn/soybean rotation for over a decade. In 2020 it was planted to corn. Place an "X" adjacent to corn for the years 2020, 2018, 2016. Soybean would have an "X" for 2019, 2017. If your crop is not listed, i.e. Milo, write your crop on the line and mark "X" in the year(s) planted.

11. Cover Crops (Summer 2019-Spring 2020)- Established with NRCS guidelines (must have some growth):

- Winter hardy- single species
- Winter hardy- 2 or more species
- Winter kill- single species
- Winter kill- 2 or more species
- Cover crop was terminated AFTER spring 2020 cash crop planting

Discussion: Time period varies slightly here. Any cover crops established in 2019 either prior to harvest or after a summer crop was harvested count. Examples: aerial application into standing corn or drilling after wheat harvest.

Continue to Page 2

2020 Crop Year Field Form Cont.

12. Soil Sampling- Use the previous 5-year field history:

- Not sampled
- Sampled every 4 years or less
- Spring or Summer sampled
- Fall sampled
- GPS sampled (by grid or zone)

Discussion: Here is a great example of why you should read every item in each category. If a respondent simply marked "Sampled every 4 years or less" they may have missed points if they didn't indicate when the field was sampled or if GPS was used.

Almost done. The next category is tillage practices broken down into Fall 2019 and Spring 2020 categories.

13. Fall Tillage- Starting after harvest of the 2019 crop:

- No tillage or low disturbance fertilizer toolbar
- Strip tillage on field classified as non-HEL
- Shank type fertilizer bar and no other tillage performed
- Any full width operation not exceeding a 3" depth
- Any full width operation exceeding a 3" depth
- Any full width operation on soybean stubble

Discussion: With numerous possibilities for soil preparation, we elected to keep the options fairly simple. No tillage and strip tillage are easily definable. Full-width tillage can be tricky. In the fall, focus on the depth of machine operation and also note if soybean residue was tilled. In the spring, how many passes were made and was fall tillage performed?

14. Spring Tillage- 2020 field operations:

- No tillage or low disturbance fertilizer toolbar
- Strip tillage or Strip freshener on non-HEL field, or shank type fertilizer bar, and no other Spring tillage
- Any full width operation, limited to a single pass, where no fall tillage was performed
- Any full width operation, two or more passes, where no fall tillage was performed
- Any full width operation, one or more passes, where fall tillage was performed

Finally, your nutrient management strategies are a large component of your overall score. Like tillage, we've broken these into two sections defined by specific time periods. A third section reviews activities that may have occurred at any time during the crop year being reviewed.

15. Nutrient Management (Fall 2019 – February 2020):

- No Nitrogen was applied in this time frame other than MAP or DAP
- Wheat topdress
- MAP or DAP was applied before December 1st
- NH₃ was applied when the soil temperature was below 50 degrees, and amounted to no more than 50% of the total Nitrogen program, and included an inhibitor
- Manure/Biosolid injected or applied and incorporated when soil temperature was below 50 degrees.
- Manure applied, not incorporated

16. Nutrient Management (March 1st – Summer 2020):

- No Nitrogen was applied in this time frame AND no prior Fall 2019-February 2020 Nitrogen other than MAP or DAP
- Spring/Summer nitrogen application(s) amounted to 50% - 74% of the total N Program (from all sources)
- Spring/Summer nitrogen application(s) amounted to at least 75% of the total N Program (from all sources)
- In-season N application (top or sidedress) was at least 25% of the total N Program (from all sources)
- Manure/Biosolid injected or applied and incorporated
- Manure applied, not incorporated

17. Additional Nutrient Activities:

- Total Nitrogen applied on corn that followed a different crop was 181 to 200 lbs./acre, OR corn-on-corn was 201 to 220 lbs./acre
- Total Nitrogen applied on corn that followed a different crop was 180 lbs. or LESS/acre, OR corn-on-corn was 200 lbs. or LESS/acre
- Phosphorus and/or Potassium application based on removal rates and/or soil samples (may mean zero applied)
- At least 50% of total applied phosphorus was banded subsurface
- Used Triple Super Phosphate (0-45-0)
- Used Variable Rate Technology application
- Any fertilizer source containing Nitrogen or Phosphorous was broadcast on **frozen** or **snow-covered** ground

2020 Crop Year FAQ



Illinois S.T.A.R. FAQ

Instructions, definitions, and frequently asked questions: 2020 Crop Year

1. Should I mark something on each section of the Field Form? Yes, it is very important to mark all applicable activities in each section. Separate forms should be completed for each field you would like rated.
2. Why is my contact information needed? Once your field is rated, we will contact you with your results and offer a field sign to display your rating.
3. Why am I asked to sign and date the Field Form? Your signature acknowledges that you have completed the form as accurately as possible and that you understand your field may be randomly selected for verification.
4. What is the definition of a "Crop Year?" The 2020 Crop Year began the day after the 2019 fall harvest and ends the day of 2020 harvest. If cover crop was planted before 2019 fall harvest in late summer, that is included in this time frame.
5. How will my answers be verified? The S.T.A.R. Coordinator will use random sampling to identify up to 10% of the fields in regions of Illinois. Each county will have a person serve as the "Verifier" to contact the participant(s) to confirm the use of the practices identified on their Field Form.
6. Who will know my S.T.A.R. rating(s)? While we strongly encourage participants to post field signs to display their S.T.A.R. ratings, your ratings are confidential and will not be shared with anyone but you. Your Field Form may be placed in your NRCS folder (which is not subject to Freedom of Information Act requests). While we strongly encourage participants to post field signs to display their S.T.A.R. ratings, individual ratings, practices, and personal information is kept strictly confidential. Field-level practice data will be aggregated for use in tracking S.T.A.R. participation and program outcomes on a state/country basis once personal identifiable and specific location data has been removed.
7. Is a post provided with the S.T.A.R. sign? No.
8. The verification process will occur in Feb-March 2021. Potential items and information that may be requested from participants whose field or fields are randomly selected for verification are as follows:
 - Dated copies of soil test results and maps
 - Dated pictures or drone imagery for fall and spring cover crop growth
 - Dated fertilizer spread maps as applied or application logs
 - Invoices/receipts of fertilizer, seed, and/or application
 - Copy of MRTN plan
 - Manure application rate and sample test results
 - Planter or harvest log/map
 - FSA 578 or crop insurance APH summary
 - Enrollment verification in PCM, EQIP, CSP, or other government conservation programs
 - Cost share program documentation
 - Plans and results from trials
 - HEL compliance confirmation
 - Residue check fall and/or spring
9. **Section 9 – Conservation and Management Practices:** This section includes several recommended practices to reduce nutrient and soil loss in addition to the in-field management practices that S.T.A.R. prioritizes. Items should be checked only if applicable to the individual field being evaluated. The first eight items on the list should only be checked if they are still functioning as intended.
 - Having a "Conservation Plan" is good, but checking this item assumes it is working well enough to reduce sheet and rill erosion to the point that the field has reached the "T" goal. The soil loss tolerance rate (T) is the maximum rate of annual soil loss that will permit crop productivity to be sustained economically and indefinitely on a given soil. Erosion is considered greater than T if either the water (sheet and rill) erosion or the wind erosion rate exceeds the T rate.

2020 Crop Year FAQ Cont.

- “Attended soil or nutrient management meeting/field day” may have been any meeting that includes some discussion or recommendations related to soil, nutrient use, or cover crops, including field days, no matter the length of time. It should have been within the past year at the time of completing the form and counts for every field evaluated.
 - “A written nutrient management plan” is often completed with the help of a retailer or private consultant and does not have to be an NRCS 590 plan. S.T.A.R. recognizes it is best if the person helping with any advice is a Certified Crop Advisor.
 - “Enrolled in a Federal, State, or Local Conservation Program” includes CSP, EQIP, PCM or others.
 - “Completed S.T.A.R. Form in 2019” is to be checked only if it was done for this specific field.
10. **Section 10 – Crop Rotation:** Rotating crops helps to improve above-ground and below-ground diversity. Ideally, a field would never have more than two continuous years of a crop (one exception would be continuous forage). Incorporation of a winter hardy or perennial crop into a corn/soy rotation offers several benefits including, but not limited to, improved soil structure, increased organic matter, greater diversity of soil biology, and reduced nutrient loss. A perennial forage crop also is considered a cover crop. The “Other” crop could be milo, sunflowers, canola, etc.
11. **Section 11 – Cover Crops:** A cover crop credited for the 2020 Crop Year must have been planted in the late summer or fall of 2019 and established, which means it must have had some growth before spring planting. According to NRCS Practice Standard Code 340, “established” means the cover crop was planted “in a timely matter and when there is adequate moisture to establish a good stand.” Planting dates for the likelihood of “adequate establishment” will vary by the species and geographic location. It is best to use winter hardy species, including annual ryegrass, cereal rye, winter wheat, etc., as these species provide more soil protection and nutrient capture over the winter months and into early spring than winter kill species. Cover Crop Resources: www.mccc.msu.edu/statesprovince/illinois
12. **Section 11 – Cover Crops:** How do I record my cover crop species? Check the category that applies to your cover crops. If you planted cereal rye, mark “Winter hardy single species.” If you planted cereal rye and radish, mark “Winter hardy – 2 or more species.” If you planted cereal rye and radish, mark “Winter hardy – single species” AND “winter kill single species.” It should be noted that planting more than one species will encourage additional above and below ground biodiversity that may offer distinct soil health benefits when compared to single species.
13. **Section 11 – Cover Crops:** The longer a winter hardy species is actively growing, the more environmental benefits it provides, so we encourage termination of a winter hardy cover crop AFTER spring planting (thus the participant “planted green”). It is important to note that termination timing is a very important aspect of successful cover crop management and we recommend utilizing the previously mentioned cover crop resources and/or reaching out to your local SWCD or NRCS office for technical assistance in deciding cover crop mixes and termination strategies appropriate for your operation.
14. **Section 12 – Soil Sampling:** Soil samples should be collected for each field every four years or less. To reduce the uncertainty associated with in-field soil variability and to inform accurate nutrient management decisions, samples should always be taken from the same locations identified via GPS. We encourage spring or summer sampling to provide ample time to incorporate soil analyses into nutrient recommendations for the upcoming crop year. How do I know if my sampling was done with GPS? If your sampling is done by a soil testing or related service firm, it is VERY likely done using GPS. The grid or zone sizes should be based on the University of IL Agronomy Handbook: extension.cropsciences.illinois.edu/handbook/
15. **Section 13 & 14 – Fall and Spring Tillage:** Minimal soil disturbance is recommended. Ideally, everyone would implement conservation tillage or no-till systems to keep soils covered and minimize soil loss due to wind and water erosion. We acknowledge that fertilizer tool bars are likely to be low disturbance (unless it is a shank-type) and we consider these applications (with the shank-type exception) equivalent to no tillage. Strip-till systems are acceptable as they limit soil disturbance compared to full-width tillage systems, but should NEVER

2020 Crop Year FAQ Cont.

be used on Highly Erodible Land, as the strips become a pathway for gullies to form. Any full width tillage on soybean stubble should be avoided! If a cover crop is planted or manure is applied in the fall, a shallow tillage operation to incorporate has some benefit, but is still considered one tillage pass. Use of a strip freshener in the spring is considered the same as strip tillage, again with the assumption it is NOT Highly Erodible Land. Tillage done in small areas of a field, such as rut repair, is not considered part of a routine tillage system and is outside the scope of S.T.A.R.

16. **Section 15 – Fall/Winter Nutrient Management:** We discourage fall and winter application of nitrogen fertilizers due to an increased risk of nitrate loss from rainfall on fields without an active crop. If applying MAP (11-52-0) or DAP (18-46-0) in the fall, it should be applied before December 1st. In wheat rotations, a top-dress nitrogen fertilizer in February with an active crop growing reduces the risk of nitrate loading to local waterways.
17. **Section 15 – Fall/Winter Nutrient Management:** If NH₃ (anhydrous ammonia = 82-0-0) is used during the fall through February time period, it should be applied with an inhibitor and when the 4-inch soil temperature is below 50 degrees. Though NOT recommended, if a fall through February NH₃ application is made, it should represent no more than 50% of the total Nitrogen Program.
18. **Section 15 – Fall/Winter Nutrient Management:** Manure/Biosolids are best applied in the spring when there is less likelihood of leaching or runoff. If Manure/Biosolids are to be applied in the fall through February time period, it should be injected or broadcast when the soil temperature is below 50 degrees Fahrenheit and if broadcast, it should be incorporated. Management of such applications should include soil tests to determine exact amounts of nutrients being added by the manure. Research on stabilizers used in conjunction with manure applications is inconclusive and the S.T.A.R. Science Advisory Committee does not feel that the use of manure stabilizers is warranted at this time.
19. **Section 16 – Spring/Summer Nutrient Management:** From an environmental perspective, it would be best if NO nitrogen fertilizer was applied to any crop because of potential negative consequences to water quality. However, most crops require additional nitrogen inputs. Therefore, nitrogen is best applied in the spring and/or summer, as close as possible to the time the crop will use it, minimizing or eliminating nutrient losses from the field.
20. **Section 16 – Spring/Summer Nutrient Management:** Manure/Biosolids applied during the spring or summer should be incorporated if broadcast.
21. **Section 17 – Additional Nutrient Activities:** The “total nitrogen program” for a crop should incorporate residual soil nitrogen as well as nitrogen made available from organic matter mineralization. The maximum levels identified for this section are based on the maintenance needs for optimal yield goals in Illinois and should limit losses due to leaching and denitrification. The continuous corn rotation allows higher nitrogen rates due to the maintenance needs of corn following corn versus corn following soybeans. Optimally, producers would follow the guidelines of the “Corn N-Rate Calculator” that is a part of the NRCS 590 Nutrient Management standards and specifications, found at this link: <http://cnrc.agron.iastate.edu>. The Corn N-Rate Calculator uses current corn and nitrogen prices to calculate the MRTN (Maximum Return to Nitrogen) but is NOT required for S.T.A.R. Participants should also consider using the 4R Principles (Right Source, Right Rate, Right Time, and Right Place) when making nutrient decisions. More details can be found here: www.nutrientstewardship.com/4rs/4r-principles/
22. **Section 17 – Additional Nutrient Activities:** Adding NO phosphorus to fields would help meet the water quality goals of the Illinois Nutrient Loss Reduction Strategy. However, if phosphorus is applied, either in the fall or spring, it is best to follow soil test recommendations and to be banded subsurface. Triple Super Phosphate is much better than MAP or DAP as it does not add the complexity of additional nitrogen. As stated earlier, it is also best to apply phosphorus and potassium based on soil testing, but it is reasonable to replace those nutrients using estimated removal rates.
23. **Section 17 – Additional Nutrient Activities:** If any fertilizer containing nitrogen or phosphorus, including manure, is broadcast on either frozen ground OR on snow covered ground, that would be VERY BAD both from an economic and environmental perspective. Applying fertilizers to frozen or snow-covered ground should be avoided because that practice DRASTICALLY increases the likelihood of loss, particularly via surface run-off.

Methodology

Methodology for Calculating Environmental Outcomes of the S.T.A.R. Initiative in Illinois

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Background: A rough approximation of nutrient, greenhouse gas (GHG) and sediment load reductions from acres enrolled in the Saving Tomorrow's Agriculture Resources (S.T.A.R.) Initiative were estimated utilizing the data sources, tools and equations listed below. All reported metrics have been calculated on a per practice basis and are meant to provide an estimate of practice level performance, as such equations are not additive.

Data Sources:

- Acres enrolled in S.T.A.R. in IL
 - Champaign County Soil and Water Conservation District (CCSWCD)
- GHG reductions in Carbon Dioxide Equivalents (CO₂e) from adding a non-legume cover crop to non-irrigated cropland (CPS 340) and switching from intensive till to no-till or strip-till on non-irrigated cropland (CPS 329) as estimated via USDA and Colorado State University's COMET-Planner Tool
 - <http://comet-planner.com/>
- Nutrient Removal Efficiencies of selected practices – IL Nutrient Loss Reduction Strategy (NLRs)
 - <https://www2.illinois.gov/epa/Documents/iepa/water-quality/watershed-management/nlrs/nlrs-final-revised-083115.pdf>
- HUC 8 NPS Nutrient Loading - IL NLRs 2019 Science Assessment Update
 - https://www2.illinois.gov/epa/topics/water-quality/watershed-management/excess-nutrients/Documents/NLRs_SCIENCE_ASSESSMENT_UPDATE_2019%20v7_FINAL%20VERSION_web.pdf
- HUC 8 and Illinois County Boundaries – Geospatial Data Gateway
 - <https://datagateway.nrcs.usda.gov/>
- Non-irrigated cropland acres per county (calculated as total cropland acres remaining after subtracting irrigated cropland acres reported per county) - 2017 Census of Agriculture
 - https://www.nass.usda.gov/Quick_Stats/CDQT/chapter/2/table/1/state/IL/year/2017
- Average annual sediment load per county - 2018 IL Department of Agriculture Tillage Transect
 - <https://www2.illinois.gov/sites/agr/Resources/LandWater/Pages/Illinois-Soil-Conservation-Transect-Survey-Reports.aspx>

Methodology

Nutrients

Non-point Source (NPS) Nitrate-N (NO₃-N) and Total Phosphorus (TP) Load Reductions

County level Agricultural NPS NO₃-N and TP Loads were estimated using total non-irrigated cropland acres calculated from acres reported by the 2017 Census of Agriculture and the HUC 8 NPS Loads estimated by the 2019 IL Nutrient Loss Reduction Strategy Science Assessment Update averaged for water years 2012 – 2017. Briefly, a weighted average of county area contained within each HUC 8 was used to allocate estimated NPS HUC 8 loads (NO₃-N and TP) to the county scale using the following equations:

Methodology Cont.

Non-irrigated Cropland Acres in each HUC8 per County = Percentage of Area in each HUC 8 draining the county * 2017 non-irrigated cropland acres for that county [EQ 1]

Annual Load from Non-Irrigated Cropland Acres in each HUC8 per County (lbs/yr) = Non-irrigated Cropland Acres in each HUC8 per county * Estimated NPS NO₃-N and TP yield (lbs/ac-yr) associated with each HUC8^a [EQ 2]

Annual County NPS Load (lbs/yr) = Sum of Annual Load from Non-Irrigated Cropland Acres in each HUC8 per County (lbs.) by county [EQ 3]

Average County NPS Loading (lbs/ac-yr) = Annual County NPS Load (lbs/yr) / Non-irrigated Cropland Acres in each County [EQ 4]

Annual County NPS Load Reduction (lbs/yr) from Cover Crops = (Average County NPS Loading (lbs/ac-yr) * Acres of Cover Crops enrolled in S.T.A.R. per County) * NLRs Nutrient Removal Efficiency of Cover Crops^b [EQ 5]

Annual County NPS P Load Reduction (lbs/yr) from No-till/Strip-till = (Average County NPS Loading (lbs/ac-yr) * Acres Under No-till/Strip-till Management enrolled in S.T.A.R. per County) * NLRs Nutrient Removal Efficiency of changing conventional tillage to conservation tillage or no-till [EQ 6]

Annual County NPS P Load Reduction (lbs/yr) from acres applying P at or below Removal Rates = (Average County NPS P Loading (lbs/ac-yr) * Acres Applying P at or Below P Removal Rates enrolled in S.T.A.R. per County) * NLRs Nutrient Removal Efficiency of P application rate reduction [EQ 7]

Annual County NPS N Load Reduction (lbs/yr) from acres applying N at or below Maximum Return to Nitrogen Rates (MRTN) = (Average County NPS Loading (lbs/ac-yr) * Acres applying N at or below MRTN enrolled in S.T.A.R. per County) * NLRs Nutrient Removal Efficiency of reducing N application rate [EQ 8]

Annual County NPS N Load Reduction (lbs/yr) from acres applying in-season N = (Average County NPS Loading (lbs/ac-yr) * Acres applying > 25% in-season N enrolled in S.T.A.R. per County) * NLRs Nutrient Removal Efficiency of split N application [EQ 9]

Assumptions:

^a Negative values for NPS NO₃N were not reported in the NLRs and were assumed to be based on mismatches between HUC areas and monitored drainage areas and/or load estimation errors. For the 2019 Update, negative values were reported to facilitate future identification and correction of inappropriate assumptions or errors in calculating point and non-point yields. For the S.T.A.R. methodology, where negative NPS NO₃N and TP values were reported in the 2019 Science Update for the 2012 – 2017 period, zeros were substituted. This could lead to a slight overestimate of NPS load from agriculture, but given the magnitude of NPS nutrient loading, any potential overestimate would be considered negligible. HUCs reporting negative values for NPS NO₃N and TP include Lower Illinois - Senachwine Lake, Upper Fox, Upper Rock, and Chicago. HUCs reporting negative values for NPS TP only include Lower Illinois - Lake Chautauqua & Lower Illinois.

^b An estimate of 30% was used for both NPS NO₃N and TP removal efficiencies.

Methodology Cont.

Sediment

Non-point Source (NPS) Sediment Load Reductions

Annual Sediment Load Reductions from Cover Crops (tons/yr) = (Average sediment load per acre (tons/ac-yr, averaged across corn and soy estimates provided by the 2018 IDOA tillage transect) * Acres of Cover Crops enrolled in S.T.A.R. per County) * Sediment Removal Efficiency of Cover Crops provided by literature^c
[EQ 10]

Annual Sediment Load Reductions from No-till/Strip-till (tons/yr) = (Average sediment load per acre (ton/ac-yr, averaged across corn and soy estimates provided by the 2018 IDOA tillage transect) * Acres under No-till/Strip-till Management enrolled in S.T.A.R. per County) * NLRs Nutrient Removal Efficiency of changing conventional tillage to conservation tillage or no-till^d
[EQ 11]

Assumptions:

While average sediment loads per acre vary depending on if the field is planted to corn or soy, in any given year it is assumed that roughly half a county's commodity acres will be in corn or soy, so averaging these estimated erosion rates was considered reasonable for the purpose of calculations.

Truckloads of sediment reported in annual report used an average number of 14 tons per dump truck.

^cPrevious studies have reported sediment removal rates by cover crops ranging from 11 to over 90% for Midwest soils. A bibliography compiled by the Sustainable Agriculture Research and Education Program (SARE) and the University of Missouri reported a range of soil loss reduction of 31 to 100% by non-legume cover crops, including rye species. Given these ranges, a Sediment Removal Efficiency estimate of 40% was used in EQ 10.

^d50% reduction for P assumed to be primarily due to phosphorus attached to soil particles, thus reduction efficiency for P extended to sediment in EQ 11

Carbon Sequestration and Greenhouse Gas Emissions

Tonnes of Carbon Dioxide Equivalents (CO₂e) Reduced per Year

Calculated using USDA and Colorado State University's online COMET-Planner Tool by selecting IL and the county of interest in Step 1, Cropland Management in Step 2, Cover Crop (CPS 340) and Add Non-Legume Seasonal Cover Crop to Non-Irrigated Cropland or Residue and Tillage Management OR No-Till (CPS 329) and Intensive Till to No Till or Strip Till on Non-Irrigated Cropland in Step 3, and the number of acres utilizing cover crops or no-till/strip-till management enrolled in S.T.A.R. per county in Step 4. The COMET-Planner Tool provides approximate carbon sequestration and GHG emission reductions in tonnes of CO₂ equivalents (CO₂e) per year. CO₂e estimates were converted to number of passenger vehicles driven for one year using the equations provided by the Environmental Protection Agency's Greenhouse Gas Equivalencies Calculator available here: <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>

STAR Structure

