

# 2019

## AGREVIVAL RESEARCH



# Nate Firle

FOUNDER & CHIEF AGRONOMIST



## We test so you don't have to guess.

Innovation is critical in agriculture. It's why the United States leads the world in agricultural productivity. But when it comes to identifying the best new products and practices for your farm, innovation can be costly—in time and money.

We're here to help. Over the past 9 years, AgRevival has conducted research in corn, soybeans, and sugar beets. Our 2019 AgRevival Research publication contains findings from over 155 acres of replicated trials. It's your guide to the products, practices, and management programs that will bring you the best ROI for your farm.

# 2019 AgRevival Research



# Your guide to better farming.

## More studies. Greater accuracy.

The 2019 AgRevival Research book contains data from AgRevival's 6 replicated research locations. To be published in this book, all studies must contain multiple data points. We are committed to delivering accurate data as this book is intended to be the starting point in your agronomic decision-making process.



● Blomkest  
Fairfax ● Gibbon

★ AgRevival Headquarters

## Your Minnesota cooperator for Beck's Practical Farm Research.

We are excited to be working again as a cooperator for Beck's Practical Farm Research (PFR) program. As a cooperator, we fill needs on certain soils, geographies, diverse acres, etc. In 2019, we performed 24 PFR studies on 55 acres. The protocol for these studies was designed by Beck's PFR team and executed by AgRevival. You will find 1 PFR study included in this book. The others can be viewed at [www.beckshybrids.com/pfresearch](http://www.beckshybrids.com/pfresearch).

Thank you to our project partners.



# Calculating Return-on-Investment (ROI)

**Return-on-Investment = Bushels Per Acre x Price Per Bushel – Treatment Cost**

The crop prices used to calculate ROI in the 2019 AgRevival Research book are determined based on the average Friday Chicago Board of Trade (CBT) closing futures prices from September 1, 2018 through August 31, 2019 minus \$0.20.

We believe these prices to be a fair and accurate market value that you can use to view ROI in our 2019 studies at a glance. However, if you expect to receive a price that differs significantly from the listed commodity prices, we recommend recalculating the ROI to better fit your operation.

*Test weight and bu./ac. are adjusted to 15% moisture for corn and 13% for soybeans.*

<b>Corn</b> \$3.72/bushel	
<b>Soybeans</b> \$9.04/bushel	

## Research Plots Soil Descriptions

### AgRevival Headquarters

After our second year on this site, we are learning that the variability of the soils, fertility, and drainage of this location accurately represent the majority of Minnesota's acres. Learning this farm, knowing exactly where we place what study is the key to providing great data. Along with Beck's Hybrids Practical Farm Research agronomists, we are dialing this in to be a farm to learn from as it represents Minnesota's agriculture very well.

### Gibbon 1

Gibbon 1 has been with us since the beginning, and with that, it has become our go-to location for new studies and research and development. Soil fertility, pH, organic matter, and soil types on this farm are very consistent across the acres, allowing us to decrease the amount of replications needed to achieve accurate data with initial topic explorations.

### Gibbon 2

Gibbon 2 is the smallest of our locations, but contains our longest running study, the Starter Study. Initially, the pH of this location averaged in the upper 7's. After the use of CarbonWorks RSTC 17® for several years, the average soil pH has decreased to 7.1. Soil organic matter, P, and K levels are well maintained as we have dairy manure applied to this location every other year. The soil type of this farm contains some lighter pockets, allowing us to measure performances of products and practices on soils that are similar 30 percent of Upper Midwest soils.

### Fairfax 1

Fairfax 1's soil well represents the majority of corn and soybean acres in Minnesota. The soil has very high yield potential and average fertility levels. Soil types in this location contain a good balance between clay and loam. This farm has been used to test nitrogen stabilizers and application studies.

### Fairfax 2

Located 2 miles from Fairfax 1, this plot was acquired to meet the increasing acreage demand for our studies. Similar to Fairfax 1 in soil type, this location had slightly better nutritional management before we acquired it. It was also 0.5% higher in organic matter. This location has some pockets of high pH soil which allows us to research iron additives, pH "fixers", and other technologies that focus on increasing soybean yields.

### Blomkest

Blomkest is our high pH and high calcium research location. The studies placed here help us understand how we can better manage farms with challenging soils. In 2019, we expanded this research plot from 18 to 38 acres. With this expansion, we gained acres with high yield potential enabling us to test "whole farm" approaches vs. targeted approaches.

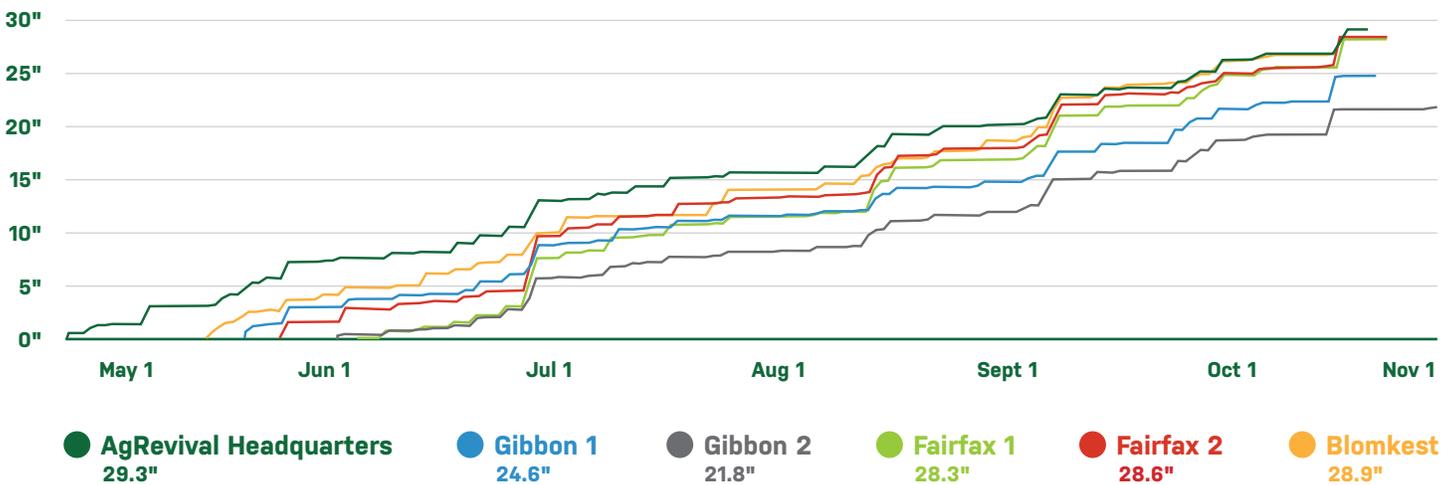
# Weather Summary

For many growers across the Midwest, the 2019 growing season felt like a repeat of 2018. Although we received the GDU's and rainfall needed for our crops, the variability and timing of these GDU's was not ideal. April offered us a few planting days towards the end of the month with cool soil temps but favorable planting conditions. The first weeks of May turned cool and wet, keeping planters out of the fields until mid May. The latter part of May was cool and wet, offering growers short planting windows. Early June offered longer windows to finish planting and temperatures quickly changed for the better, making up for May's lag. Capitalizing on early planting windows helped us achieve the highest yields.

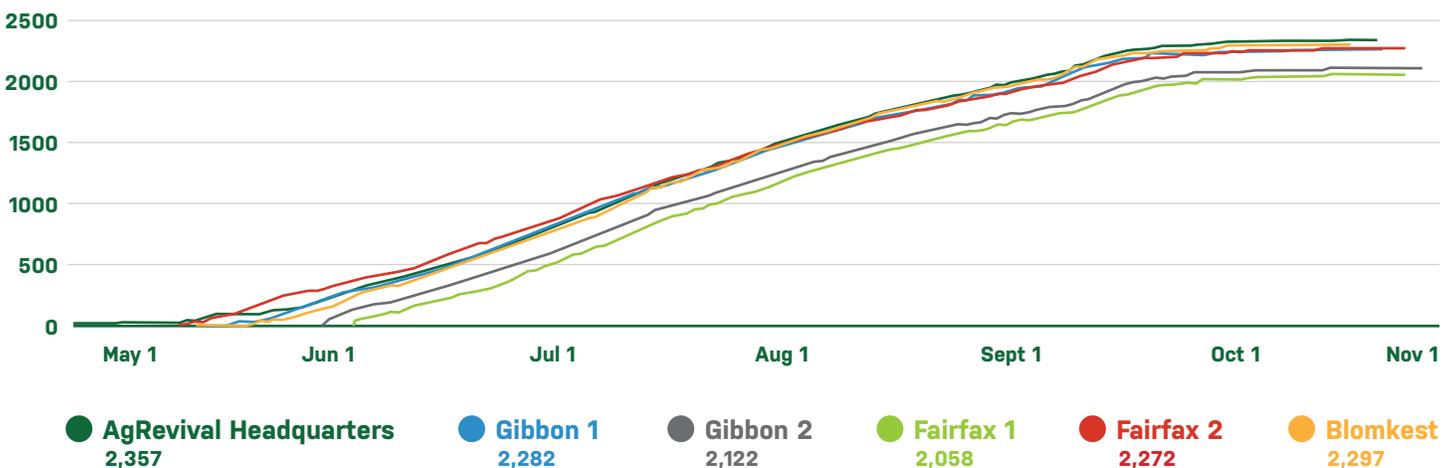
The latter part of June was back to the "2019 ways" giving growers short herbicide application windows which caused some deadlines to be missed. The sidedress application windows were also short making it easy to miss some crucial V4 growth stage applications. Saturated soil conditions affected nitrogen uptake due to excessive leaching or poor conversion into plant available forms. A wet and modest July provided only three days above 90°F which held GDU accumulation back by approximately one week compared to average. Eleven days of sunlight were observed in August, coupled with cool and humid conditions, creating less than ideal conditions for grain development. September's weather improved the soil conditions and helped GDU's catch up to assist the final stages of crop maturing.

Weather can have a significant impact on yields. Performing research in these challenging conditions helps us identify agronomic strategies that can deliver the return-on-investment you need to continue growing.

## Cumulative Rainfall (in.) from Planting through Harvest



## Growing Degree Days (°F) from Planting through Harvest



# Important Crop Development Stages



## VE – V4

Root and plant establishment takes place.

## V5 – V8

Yield potential is established.

## V9 – VT

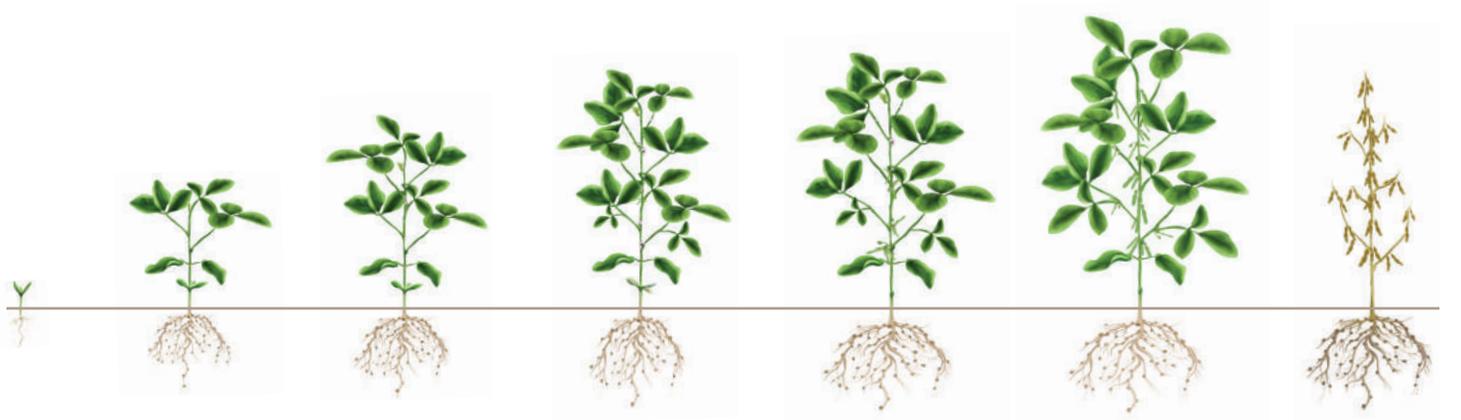
Vegetative growth takes place. The focus is on fulfilling the yield potential that was set earlier.

## R1 – R3

Grain establishment takes place.

## R4 – R6

Grain fill takes place.



## VE – V3

Root and plant establishment takes place.

## V3 – R1

Nodule development increases.

## R2 – R3

Pod determination takes place. (Number of pods per node that can be filled.)

## R4 – R5

Grain establishment takes place. (Number of beans per pod that can be filled.)

## R6 – R8

Grain fill takes place.

### Note:

Soybeans can have several functions occurring simultaneously during reproductive stages. This diagram is a generalization of the average function taking place.

# 2019 AgRevival Research

## Corn Studies

Stream Bar Strategies.....	7
Talc Study.....	8
Furrow Max Study.....	9
2x2x2 Strategies.....	10
Sulfur Study.....	11
In-Furrow Starter Study.....	12
In-Furrow Bio-Stimulant Study.....	13
In-Furrow Biological Study.....	14
Zinc Study.....	15
High Calcium Strategies Study.....	16
In-Season Nitrogen Placement Study.....	17
Nitrogen Stabilizer Study (Drop Hoses).....	18
Nitrogen Stabilizer Study: (Top-dress).....	19
Water Conditioner Study.....	20
Foliar Study.....	21

## Soybean Studies

Land Roller Study.....	22
Talc Study.....	23
Furrow Max Study.....	24
2x2x2 Study.....	25
In-Furrow Starter Study.....	26
In-Furrow Bio-Stimulant Study.....	27
In-Furrow Biological Study.....	28
High Calcium Strategies.....	29
Stream Bar Study.....	30
Sidedress Study.....	31
Water Conditioning Study.....	32
Sugar Foliar Study.....	33
Foliar Study.....	34
Fungicide vs. Sugar Study.....	35
Fungicide Additive Study.....	36

## AgRevival Agronomics

Understanding the Difference Between Biologicals & Bio-Stimulants.....	37
How the Nitrogen Conversion Process Impacts Your Yields.....	39
Exploring Stream Bar Strategies.....	41

## Ask AgRevival

Have questions about the studies, products, or farming practices included in this book?

Get answers at [www.agrevival.com/ask-agrevival](http://www.agrevival.com/ask-agrevival)



### Introduction:

Notice that we said introduction? While common in small grain production, stream bars are new to corn production. Our decision to test them in 2019 was motivated by a necessity to "keep the planter rolling". Waiting for a custom applicator to apply your base nitrogen can delay planting, which almost always equates to lost yield. The purpose of these studies is to see if stream bar nozzles can be used to apply nitrogen directly over the plant zone following the planter pass, thereby giving growers greater flexibility for applying their base nitrogen.

Treatment	Percent Moisture	bu./ac.	bu./ac. Difference	ROI
60 lbs. N - UREA - Broadcast - Pre-Plant	22.9	172.5	N/A	N/A
60 lbs. N - UAN 28% - 2x2x2 Planter Applied	22.0	180.9	+ 8.4	+ \$28.05
60 lbs. N - UAN 28% - Stream Bar - Pre-Emerge	21.4	185.9	+ 13.4	+ \$45.83
90 lbs. N - UAN 28% - Stream Bar - Pre-Emerge	22.9	176.4	N/A	NA
90 lbs. N - UAN 28% - Stream Bar - VE	23.7	178.1	+ 1.7	+ \$6.32
90 lbs. N - UAN 28% - Stream Bar - V2	23.1	177.0	+ 0.6	+ \$2.23
90 lbs. N - UAN 28% - Stream Bar - V4	22.1	163.1	- 13.3	- \$49.48

(Individual results may vary.)



**Chafer Stream Bar**

### Observation:

Observation on pages 41 – 42.

**Purpose:**

To evaluate talc replacement products available on the market compared to a standard 80% talc and 20% graphite blend.

Seed Treatment	Percent Moisture	bu./ac.	bu./ac. Difference	ROI
Control: 3 oz. Standard Talc	24.2	192.5	N/A	N/A
4 oz. Dust	24.9	195.4	+ 2.9	+ \$10.07
4 oz. Gro Pak	23.9	198.9	+ 6.4	+ \$21.56
3 oz. PMZ Dry	23.6	196.0	+ 3.5	+ \$10.32

(Individual results may vary.)



**Observation:**

New talc replacement products are entering the market with added benefits such as micro-nutrient packages and safer handling than standard talc and graphite. This year we decided to look at several talc replacement products to see how each compared to a standard planter lubrication talc/graphite blend. Our first year of testing showed substantial yield advantages over standard talc and graphite. We intend to look further into the cause of these yield increases in the coming years. Initially, we believe it may be the result of better singulation and seed flow and the added micro-nutrient benefits.

**Price Information:**

<b>Corn</b>	<b>\$3.72 /bu.</b>
Dust	\$2.86 /lb.
Gro Pak	\$9.00 /lb.
PMZ Dry	\$14.40 /lb.

**Purpose:**

To evaluate the yield and mechanical effectiveness of the Furrow Max units from Kimberley Ag Sales and Service.

**Project Partners:**



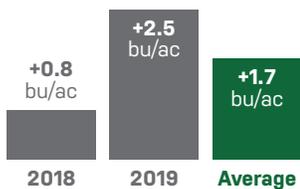
Combination	Percent Moisture	bu./ac.	bu./ac. Difference
Solid Rubber	23.3	222.3	N/A
Solid Rubber + Furrow Max	23.3	229.6	+ 7.3
Yetter Twister™ 6200	23.2	224.9	+ 2.6
Yetter Twister™ 6200 + Furrow Max	23.0	229.5	+ 7.2
Copperhead AG Furrow Cruisers®	23.1	230.1	+ 7.8
Copperhead AG Furrow Cruisers® + Furrow Max	23.9	225.8	+ 3.5
RFM Coil	23.2	229.7	+ 7.4
RFM Coil + Furrow Max	22.9	232.2	+ 9.9

No Furrow Max	23.2	226.8	N/A
Furrow Max	23.3	229.3	+ 2.5

(Individual results may vary.)

**2-Year Average Yield Increase with Furrow Max Closing System**



**Furrow Max**



**Solid Rubber**



**Furrow Cruiser®**



**Yetter Twister™ 6200**



**RFM Coil**

**Observation:**

Furrow Max is designed to deliver 2 benefits: (1) alleviate sidewall compaction and (2) apply 2x2x2 nutrients. The 2019 Furrow Max study was designed to quantify the yield differences achieved by the mechanical aspect of the Furrow Max closing system. In this study we observed a yield increase with all 4 closing wheels styles when the Furrow Max system is used.

**Purpose:**

To evaluate best management practices and use rates when applying nitrogen 2x2x2 with Furrow Max.

2x2x2 Treatment	Percent Moisture	bu./ac.	bu./ac. Difference	ROI
Control: Dribble 45-0-0	26.7	181.3	N/A	N/A
Furrow Max: 2x2x2 45-0-0	26.3	183.9	+ 2.6	+ \$9.67
Control: No Additional N	26.4	182.4	N/A	N/A
8 gal. UAN 28% 2x2x2	26.6	197.3	+ 14.9	+ \$17.08
16 gal. UAN 28% 2x2x2	26.9	201.7	+ 19.3	+ \$37.55
24 gal. UAN 28% 2x2x2	26.7	201.2	+ 18.8	+ \$18.58
Control: 16 gal. UAN 28% 2x2x2	27.2	201.0	N/A	N/A
6 oz. NZONE MAX™	27.2	206.8	+ 5.8	+ \$16.24
6 oz. CarbonWorks Cetain®	26.9	208.2	+ 7.2	+ \$22.28

(Individual results may vary.)

**Control**



**CarbonWorks Cetain®**

**Observation:**

Planter applied nitrogen is gaining popularity as a method of applying the base nitrogen needs of our corn plants. The purpose of these studies are threefold: (1) To gain an understanding of which application methods perform best, (2) To identify the optimal quantity of nitrogen to apply, and (3) To identify additives that will maximize the ROI from this pass.

First, we see that incorporating nitrogen with Furrow Max provided a gain of \$9.67 per acre. Second, there is an economic threshold at 16 gallons of nitrogen per acre. More was not better in this study. Lastly, both nitrogen stabilizers used in this study showed a positive ROI. The image above shows that the planter applied nutrients were still available late in the season with CarbonWorks Cetain®, which helped deliver the \$22.28 ROI.

**Price Information:**

<b>Corn</b>	<b>\$3.72 /bu.</b>
UAN 28%	\$2.14 /gal.
NZONE MAX™	\$114.00 /gal.
CarbonWorks Cetain®	\$96.00 /gal.

**Purpose:**

To evaluate the yield impact of using ammonium thiosulfate applied 2x2x2 and at sidedress on soils with a sulfur level of 3 ppm.

2x2x2 Treatment	Percent Moisture	bu./ac.	bu./ac. Difference	ROI
12 gal. UAN 28% - 2x2x2	27.6	188.4	N/A	N/A
10 gal. UAN 28% + 2 gal. ATS - 2x2x2	27.0	201.7	+ 13.3	+ \$38.12

**Sidedress V4**

16 gal. UAN 28% - Sidedress V4	26.4	197.0	N/A	N/A
14 gal. UAN 28% + 2 gal. ATS - Sidedress V4	26.2	206.9	+ 9.9	+ \$25.47

(Individual results may vary.)


**Observation:**

For several years, we included ammonium thiosulfate (ATS) in our stabilizer studies, seeing tremendous results. This year we removed it from our nitrogen stabilizer study in order to better understand how this product works. Are the benefits of ATS from the nitrogen stabilizer characteristics or from the sulfur nutrient? In this study, we applied ATS as a 2x2x2 and sidedress V4 additive on soils with very low sulfur levels. The results were very positive leading us to believe the sulfur nutrient is driving the results.

**Price Information:**

<b>Corn</b>	<b>\$3.72 /bu.</b>
Ammonium Thiosulfate	\$5.68 /gal.

**Purpose:**

To evaluate common products applied in-furrow with the planter, and how they affect yield, moisture, and return on investment.

In-Furrow Treatment	Percent Moisture	bu./ac.	bu./ac. Difference	ROI
Control: No In-Furrow	25.6	191.5	N/A	N/A
24 oz. CarbonWorks RSTC 17®	25.0	197.6	+ 6.1	+ \$4.70
5 gal. 10-34-0	24.9	198.4	+ 6.9	+ \$10.77
5 gal. 6-24-6	24.9	192.7	+ 1.2	- \$15.04

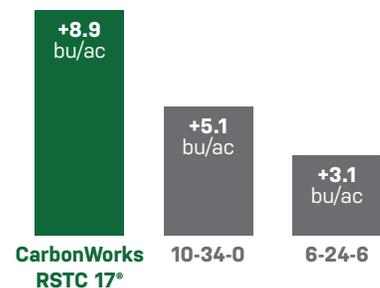
(Individual results may vary.)

**Control**

**CarbonWorks RSTC 17®**



**5-Year Average Yield Increase from Corn Starters**



**Observation:**

This is our longest running study. The purpose of a starter or "pop-up" is to speed germination and emergence. In our research, starters generally provide a more uniform stand. However, some products contain too high of a salt load to provide consistent performance year after year. In wet springs, the negative salt index in high-salt starters is diluted enough to deliver good results. In moderate to dry springs, the salts are not diluted enough, and they may deliver little or even negative results. On the flip side, low-salt starters can lose their holding capacity and dilute completely from the furrow in wet years and show little gain as a result. CarbonWorks RSTC 17® is a salt-free starter that does not rely on salts to deliver the hydrogen and oxygen molecules to the seed, thereby providing more consistent performance between wet and dry years.

**Price Information:**

Corn	Price
CarbonWorks RSTC 17®	\$3.72 /bu.
10-34-0	\$96.00 /gal.
6-24-6	\$2.98 /gal.
	\$3.90 /gal.

**Purpose:**

To evaluate performance of various bio-stimulant products applied in-furrow at planting time.

In-Furrow Treatment	Percent Moisture	bu./ac.	bu./ac. Difference	ROI
Control: 5 gal 10-34-0	20.8	191.4	N/A	N/A
5 gal 10-34-0 + 6 oz. CarbonWorks RSTC 17®	21.6	195.1	+ 3.7	+ \$9.26
5 gal 10-34-0 + 32 oz. Soil Revitalizer	21.6	195.4	+ 4.0	+ \$6.00
5 gal 10-34-0 + 8 oz. eXceed™ Nano Brown Sugar	20.9	191.8	+ 0.4	- \$0.39
5 gal 10-34-0 + 16 oz. NanoZyme 2.0	21.2	197.0	+ 5.6	+ \$17.08
Control: 24 oz. CarbonWorks RSTC 17®	23.8	195.5	N/A	N/A
24 oz. CarbonWorks RSTC 17® + 32 oz. Soil Revitalizer	24.9	193.4	- 2.1	- \$16.69
24 oz. CarbonWorks RSTC 17® + 8 oz. eXceed™ Nano Brown Sugar	24.7	196.2	+ 0.7	+ \$0.72
24 oz. CarbonWorks RSTC 17® + 16 oz. NanoZyme 2.0	24.5	195.0	- 0.5	- \$5.61

(Individual results may vary.)

**Control**



**CarbonWorks RSTC 17®**



**Observation:**

Bio-stimulant products are designed to feed the microorganisms already living in the soil. Unlike biological products, bio-stimulants contain NO live strains of biology.

**Price Information:**

<b>Corn</b>	<b>\$3.72 /bu.</b>
10-34-0	\$2.98 /gal.
CarbonWorks RSTC 17®	\$96.00 /gal.
Soil Revitalizer	\$35.50 /gal.
eXceed™ Nano Brown Sugar	\$30.00 /gal.
NanoZyme 2.0	\$30.00 /gal.



**Purpose:**

To evaluate performance of various biological products applied in-furrow at planting time.

In-Furrow Treatment	Percent Moisture	bu./ac.	bu./ac. Difference	ROI
Control: 5 gal. 10-34-0	23.8	195.5	N/A	N/A
5 gal. 10-34-0 + 8.4 oz. XiteBio® Yield+	24.7	198.8	+ 3.3	+ \$3.28
5 gal. 10-34-0 + 3.2 oz. Envita™	24.5	197.9	+ 2.4	- \$0.82
Control: 24 oz. CarbonWorks RSTC 17®	20.8	191.4	N/A	N/A
24 oz. CarbonWorks RSTC 17® + 8.4 oz. XiteBio® Yield+	21.2	198.2	+ 6.8	+ \$16.30
24 oz. CarbonWorks RSTC 17® + 3.2 oz. Envita™	21.4	198.3	+ 6.9	+ \$15.92
Control: No In-Furrow	24.1	189.2	N/A	N/A
8.4 oz. XiteBio® Yield+	24.3	190.7	+ 1.5	- \$3.42
3.2 oz. Envita™	25.1	195.0	+ 5.8	+ \$11.83

(Individual results may vary.)

**Observation:**

Biological products contain live strains of biology. These products are designed to increase the number of biology living in the soil, and most are designed to serve a specific function.

**Price Information:**

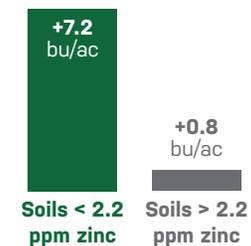
<b>Corn</b>	<b>\$3.72 /bu.</b>
CarbonWorks RSTC 17®	\$96.00 /gal.
10-34-0	\$2.98 /gal.
XciteBio® Yield+	\$9.00 /ac.
Envita™	\$390.00 /gal.

**Purpose:**

To evaluate the performance of Nano Zinc 9%, on soils that average a zinc level of 0.8 ppm.

In-Furrow Treatment	Percent Moisture	bu./ac.	bu./ac. Difference	ROI
Control : 5 gal. 6-24-6	25.3	198.7	N/A	N/A
5 gal. 6-24-6 + 1 pt. Nano Zinc 9%	25.0	204.1	+ 5.4	+ \$16.71
Control : 24 oz. CarbonWorks RSTC 17®	25.9	196.5	N/A	N/A
24 oz. CarbonWorks RSTC 17® + 1 pt. Nano Zinc 9%	26.0	199.8	+ 3.3	+ \$8.90

(Individual results may vary.)


**3-Year Average Yield Increase using 16 oz. Nano Zinc**

**Observation:**

To achieve the highest potential ROI from a zinc application, a soil test is almost always necessary for determining the optimal application rate. According to our research, applying zinc on soils with up to 2.2 ppm will deliver a positive response and provide you with the best opportunity for a positive ROI.

**Price Information:**

<b>Corn</b>	<b>\$3.72 /bu.</b>
Nano Zinc 9%	\$27.00 /gal.

**Purpose:**

To evaluate products designed to fix soil calcium levels on a location with a pH of 8.4 and soil calcium level of 19,575 ppm.

In-Furrow Treatment	Percent Moisture	bu./ac.	bu./ac. Difference	ROI
Control: No In-Furrow	26.7	180.6	N/A	N/A
24 oz. CarbonWorks RSTC 17®	25.6	189.5	+ 8.9	+ \$15.11
32 oz. Soil Revitalizer	26.4	191.3	+ 10.7	+ \$30.93
24 oz. CarbonWorks RSTC 17® + 32 oz. Soil Revitalizer	26.6	190.0	+ 9.4	+ \$8.10
1 lb. Marathon	26.1	189.0	+ 8.4	+ \$5.25
2 lbs. Triathlon	26.1	190.3	+ 9.7	+ \$17.09
24 oz. CarbonWorks RSTC 17® + 32 oz. Soil Revitalizer + 1.5 lbs. Triathlon	26.0	193.3	+ 12.7	+ \$6.12

(Individual results may vary.)



**Observation:**

The above treatment programs have worked well when put in-furrow with soybeans on high calcium ground. This year, we applied the same treatment programs to corn on the same high calcium ground and on the exact same GPS lines as last year. The results showed that adding any of these products to the soil—regardless of whether its iron, oxygen or carbon—provides what is needed to increase the nutrient efficacy and ultimately, increase corn yields.

**Price Information:**

<b>Corn</b>	<b>\$3.72 /bu.</b>
CarbonWorks RSTC 17®	\$96.00 /gal.
Soil Revitalizer	\$35.50 /gal.
Marathon	\$26.00 /ac.
Triathlon	\$19.00 /ac.

**Purpose:**

To evaluate the application method of early in-season nitrogen applications and its impact on moisture, yield and return-on-investment.

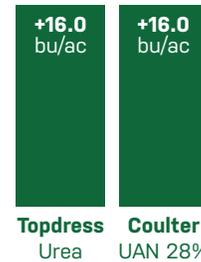
V4 Treatment	Percent Moisture	bu./ac.	bu./ac. Difference	ROI
Control: No Additional Nitrogen	25.5	193.2	N/A	N/A
110 lbs. Urea - Spinner Applied	25.5	205.7	+ 12.5	+ \$20.41
16 gal. UAN 28% - Coulter Applied	25.5	204.1	+ 10.9	+ \$7.37
16 gal. UAN 28% - Drop Hoses Applied	25.5	206.0	+ 12.8	+ \$12.44
16 gal. UAN 28% - Stream Bar Applied	24.8	210.6	+ 17.4	+ \$35.55

(Individual results may vary.)



**4-Year Average Yield Increase from a 50 lb. In-Season Nitrogen Application on a Full Nitrogen Base**

(185 lbs. of Nitrogen Base)



**Observation:**

While this study continues to change with each year, there is one thing remains constant: the optimal timing and placement of nitrogen always depends on the weather. In wet years, top-dressing urea has performed well since there is ample moisture to take the urea into the soil and surround the plant's roots. During a wet year, corn roots don't spread out as far which makes a coulter application not perform as well. New to our study this year is the stream bar, which places four streams of 28% over the plants' root zone. In the 2019 research trial, the stream bar delivered the highest ROI. We believe the four streams of nitrogen provide more opportunities for the plants' roots to intercept the nitrogen compared to the one stream from drop hoses.

**Price Information:**

Corn	\$3.72 /bu.
Urea	\$0.36 /unit N
UAN 28%	\$0.48 /unit N
Application Dry	\$8.00 /ac.
Application Coulter	\$10.00 /ac.
Application Drop Hoses	\$12.00 /ac.
Application Stream Bar	\$6.00 /ac.

**Purpose:**

To evaluate the effect of nitrogen stabilizers in UAN 28% on the nitrogen's performance and the ROI. This application was made at V5 using the drop hoses on the Unverferth NutriMax Dual Delivery System.

V5 Treatment	Percent Moisture	bu./ac.	bu./ac. Difference	ROI
Control: 16 gal. UAN 28%	26.4	195.6	N/A	N/A
16 gal. UAN 28% + 6 oz. Agrotain®	26.8	195.4	- 0.2	- \$2.72
16 gal. UAN 28% + 32 oz. Instinct® II	27.0	195.6	± 0.0	- \$18.00
16 gal. UAN 28% + 6 oz. NZONE MAX™	26.9	197.5	+ 1.9	+ \$1.54
16 gal. UAN 28% + 64 oz. CarbonWorks Growules® Liquid	27.4	196.8	+ 1.2	+ \$1.21
16 gal. UAN 28% + 6 oz. CarbonWorks Cetain®	27.0	198.6	+ 3.0	+ \$5.91
16 gal. UAN 28% + 16 oz. Humika™	26.9	198.7	+ 3.1	+ \$4.41
16 gal. UAN 28% + 64 oz. NACHURS Humi-Flex®	26.7	197.9	+ 2.3	+ \$0.06



(Individual results may vary.)



**Observation:**

We attribute the small returns from nitrogen stabilizers and drop hose nitrogen applications to the highly saturated soils and sluggish soil biology. As a result, the NBPT/bactericide stabilizers showed little to no response because there was very little nitrogen being converted by the soil biology anyway, so slowing the nitrogen conversion process even more did not help. The carbon based stabilizers on the other hand held onto the nitrogen until the soil biology could convert it to the plant available form leading to a positive yield response.

**Price Information:**

<b>Corn</b>	<b>\$3.72 /bu.</b>
UAN	\$0.48 /unit N
Agrotain®	\$58.00 /gal.
Instinct® II	\$72.00 /gal.
NZONE MAX™	\$118.00 /gal.
Growules® Liquid	\$6.50 /gal.
CarbonWorks Cetain®	\$112.00 /gal.
Humika™	\$57.00 /gal.
NACHURS Humi-Flex®	\$17.00 /gal.

**Purpose:**

To evaluate how using nitrogen stabilizers when top-dressing urea on V5 corn will affect the performance of the nitrogen and its return-on-investment.

V5 Treatment	Percent Moisture	bu./ac.	bu./ac. Difference	ROI
Control: 110 lbs. Urea	26.8	186.7	N/A	N/A
110 lbs. Urea + 5.3 oz. Agrotain®	26.4	196.0	+ 9.3	+ \$32.20
110 lbs. Urea + 5.3 oz. Contain™	26.4	197.1	+ 10.4	+ \$34.76
110 lbs. Urea + 24 oz. Instinct® II	26.2	196.6	+ 9.9	+ \$23.33
110 lbs. Urea + 5 lbs. CarbonWorks Growules® Dry	26.1	199.7	+ 13.0	+ \$30.86
110 lbs. Urea + 6 oz. CarbonWorks Growules® Liquid	26.4	196.0	+ 9.3	+ \$34.29
110 lbs. Urea + 4 oz. CarbonWorks CetaiN™	25.7	206.2	+ 19.5	+ \$69.04
110 lbs. Urea + ESN Agrium (50/50 mix)	25.9	199.2	+ 12.5	+ \$32.89
110 lbs. Urea + ESN Agrium (25/75 mix)	26.3	200.4	+ 13.7	+ \$30.55

(Individual results may vary.)



**Observation:**

2019's results from top-dressing urea are very similar to 2018. Rains following the urea application allowed the nitrogen to be taken into the soil and then converted. We continue to see carbon stabilizers provide some of the highest ROI due to the holding capacity of carbon molecule.

**Price Information:**

<b>Corn</b>	<b>\$3.72 /bu.</b>
Agrotain®	\$58.00 /gal.
Contain™	\$95.00 /gal.
Instinct® II	\$72.00 /gal.
Growules® Dry	\$3.50 /lb.
Growules® Liquid	\$6.50 /gal.
CarbonWorks CetaiN®	\$112.00 /gal.
ESN Agrium	\$495.00 /ton

**Purpose:**

To evaluate water conditioners' impact on moisture, yield, and return-on-investment when used with a foliar application at the V5 growth stage.

V5 Treatment	Percent Moisture	bu./ac.	bu./ac. Difference	ROI
Control: 16 oz. eXceed™ Nano Brown Sugar	25.8	191.4	N/A	N/A
16 oz. eXceed™ Nano Brown Sugar + 2.4 oz. Regulator 3.0™	25.6	191.4	± 0.0	- \$2.10
16 oz. eXceed™ Nano Brown Sugar + 6.4 oz. pH Max	25.4	192.4	+ 1.0	+ \$2.17

(Individual results may vary.)



**Observation:**

Using water conditioners with foliar applications have proven to deliver a positive ROI. When using water conditioners, it is important to consider your water source as that will dictate the amount of product needed to achieve the optimal pH for the plant to absorb the foliar product. The timing of the spray application and the pH of your solution will impact your yields which is why foliar products and water conditioners can be a hit or miss.

**Price Information:**

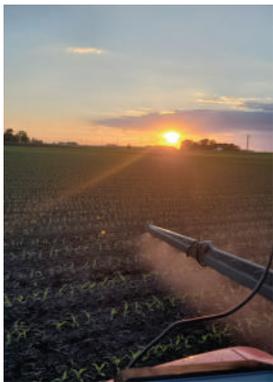
<b>Corn</b>	<b>\$3.72 /bu.</b>
eXceed™ Nano Brown Sugar	\$30.00 /gal.
Regulator 3.0™	\$112.00 /gal.
pH Max	\$31.00 /gal.

**Purpose:**

To evaluate foliar applied products at the V5 growth stage, and their effect's on moisture, yield, and ROI.

V5 Treatment	Percent Moisture	bu./ac.	bu./ac. Difference	ROI
Control: No Foliar	26.8	189.1	N/A	N/A
32 oz. MicroBoost™	25.6	185.9	- 3.2	- \$18.90
16 oz. NanoZyme 2.0	26.0	186.9	- 2.2	- \$11.93
24 oz. Nutrimax AC™	25.4	188.6	- 0.5	- \$18.17
8 oz. Humika™	26.1	190.7	+ 1.6	+ \$2.39
16 oz. Green Boost	24.6	191.6	+ 2.5	+ \$2.68
16 oz. eXceed™ Nano Brown Sugar	25.8	194.2	+ 5.1	+ \$15.22
32 oz. Awake™	24.1	193.1	+ 4.0	+ \$7.88

(Individual results may vary.)


**Observation:**

With better application timing windows this year we saw more of the foliar products give a positive response. eXceed™ Nano Brown Sugar continues to show positive yield response year after year and is a cost effective way to pick up some extra profits for your farm next growing season.

**Price Information:**

<b>Corn</b>	<b>\$3.72 /bu.</b>
MicroBoost™	\$28.00 /gal.
NanoZyme 2.0	\$30.00 /gal.
Nutrimax AC™	\$87.00 /gal.
Humika™	\$57.00 /gal.
Green Boost	\$53.00 /gal.
eXceed™ Nano Brown Sugar	\$30.00 /gal.
Awake™	\$28.00 /gal.



**Purpose:**

To evaluate the use of a land roller on soybeans at different growth stages and how it affects plant stand, node count and yield.

Research in collaboration with:



Treatment	V3 Stand Count	Population Difference	bu./ac.	bu./ac. Difference
Control: No Land Roller	129,000	N/A	61.1	N/A
Mechanical Roll Pre-Emerge	124,000	-5,000	62.6	+ 1.5
Mechanical Roll at V1 at 8 a.m.	116,000	-13,000	61.9	+ 0.8
Mechanical Roll at V1 at 3 p.m.	123,000	-6000	63.3	+ 2.2

(Individual results may vary.)

**Control    Pre-Emerge    V1 at 8 a.m.    V1 at 3 p.m.**



**Observation:**

In this Beck's Practical Farm Research study, we looked at whether or not rolling soybeans after emergence produced more branching which leads to higher yields. The plants rolled at V1 definitely had more branches but suffered from a reduced stand. This year, some of the yield increase came at harvest time. The rolled soybeans allowed the header to be run closer to the ground which helped gather more pods. This was especially helpful since the soybean plants were short with pods close to the ground.

**Purpose:**

To evaluate talc replacement products available on the market compared to a standard 80% talc and 20% graphite blend.

Seed Treatment	Percent Moisture	bu./ac.	bu./ac. Difference	ROI
Control: 3 oz. Standard Talc	15.4	63.9	N/A	N/A
4 oz. Dust	15.3	65.7	+ 1.8	+ \$15.56
4 oz. Gro Pak SB	15.2	64.9	+ 1.0	+ \$5.04
3 oz. Moly Dry	15.2	65.8	+ 1.9	+ \$14.18

(Individual results may vary.)


**Observation:**

This was a new study for us in 2019. The study involved looking at different talc products applied to the seed that aid planter functions, improve singulation and seed flow, and deliver added nutrient packages. Although we can't measure how well each product helps lubricate the planter's parts, we can study how each one holds to the seed and how the seed flows before and after applying the talc. Better seed flow-ability means more uniform stands which leads to higher yields. There is still a lot to learn about the new multi-purpose talc products, and we look forward to expanding our research in this area in the coming years.

**Price Information:**

Soybeans	\$9.04 /bu.
Standard Talc	\$3.12 /lb.
Dust	\$2.86 /lb.
Gro Pak SB	\$16.00 /lb.
Moly Dry	\$16.00 /lb.



**Purpose:**

To evaluate how Kimberly Ag's Furrow Max closing system affects moisture and yield.

**Project Partners:**



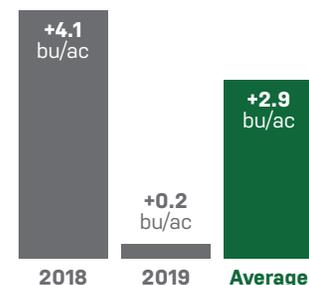
Combination	Percent Moisture	bu./ac.	bu./ac. Difference
Control: Solid Rubber	15.4	65.4	N/A
Solid Rubber + Furrow Max	15.8	66.8	+ 1.4
Yetter Twisters™	15.9	65.3	- 0.1
Yetter Twisters™ + Furrow Max	15.8	65.7	+ 0.3
Copperhead AG Furrow Cruisers®	15.7	65.7	+ 0.3
Copperhead AG Furrow Cruisers® + Furrow Max	15.7	64.9	- 0.5
RFM Coil	15.7	65.7	+ 0.3
RFM Coil + Furrow Max	15.7	65.4	± 0.0
No Furrow Max	15.7	65.5	N/A
Furrow Max	15.7	65.7	+ 0.2

(Individual results may vary.)

**Observation:**

Updates to the Furrow Max closing system have made assembling the unit easier and more resilient to challenging field conditions. After another year of testing, we are seeing yield results similar to last year. The spring tensioned discs provide a means to apply products 2x2x2 in a covered band while crushing sidewall compaction. However, when we shallowed up the planting depth for soybeans, the smaller disks were not able to penetrate as deeply into the soil as in corn. We believe this was the cause for little to no yield increase between closing combinations this year.

**2-Year Average Yield Increase with Furrow Max Closing System**



**Purpose:**

To evaluate the use of planter applied products with nitrogen, phosphorus, and potassium and how they affect return-on-investment.

<b>2x2x2 Treatment</b>	<b>Percent Moisture</b>	<b>bu./ac.</b>	<b>bu./ac. Difference</b>	<b>ROI</b>
Control: No 2x2x2	13.6	56.2	N/A	N/A
4 lbs. Spring	13.7	60.3	+ 4.1	+ \$32.82
6 gal. 6-24-6	13.7	57.6	+ 1.4	- \$10.44
3 gal. L-CBF Boost™	13.8	60.6	+ 4.4	+ \$26.73

(Individual results may vary.)


**Observation:**

Applying liquid nutrients to corn is becoming a common practice with the 2x2x2 system. Here we are testing products that deliver N, P, and K to the soybean root zone with the same 2x2x2 system. In years past, we saw that applying N, P, and K to soybeans delivers a positive ROI. The 2x2x2 placement is showing promise as the ideal application method.

**Price Information:**

<b>Soybeans</b>	<b>\$9.04 /bu.</b>
Spring	\$1.06 /lb.
6-24-6	\$3.85 /gal.
L-CBF Boost™	\$4.35 /gal.



### Purpose:

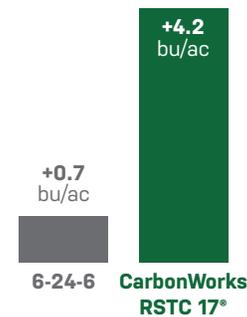
To evaluate products applied in-furrow with the planter, and how they affect yield, moisture, and return-on-investment.

In-Furrow Treatment	Percent Moisture	bu./ac.	bu./ac. Difference	ROI
Control: No In-Furrow	13.4	55.3	N/A	N/A
24 oz. CarbonWorks RSTC 17®	13.6	57.7	+ 2.4	+ \$3.70
3 gal. 6-24-6	13.6	54.2	- 1.0	- \$21.49
3 gal. L-CBF Boost™	13.5	56.6	+ 1.3	- \$1.30

(Individual results may vary.)



### 5-Year Average Yield Increase from Soybean Starters



### Observation:

In-furrow starters are designed to increase germination rates, speed emergence and boost plant vigor. Soybean seedlings are very sensitive to the salt contained in traditional starter fertilizers. CarbonWorks RSTC 17® does not contain salts. Instead, it delivers energy and oxygen with carbon which is safe to apply directly on the seed. L-CBF Boost™ is a molasses-based carbon additive product that contains 30% sugar which helps reduce seedling burn from the other salts present in the product.

### Price Information:

Soybeans	\$9.04 /bu.
CarbonWorks RSTC 17®	\$96.00 /gal.
6-24-6	\$3.85 /gal.
L-CBF Boost™	\$4.35 /gal.

**Purpose:**

To evaluate performance of various bio-stimulant products applied in-furrow at planting time.

In-Furrow Treatment	Percent Moisture	bu./ac.	bu./ac. Difference	ROI
Control: 24 oz. CarbonWorks RSTC 17®	13.5	53.6	N/A	N/A
24 oz. CarbonWorks RSTC 17® + 8 oz. eXceed™ Nano Brown Sugar	13.2	59.4	+ 5.8	+ \$50.56
24 oz. CarbonWorks RSTC 17® + 16 oz. NanoZyme 2.0	13.5	55.6	+ 2.0	+ \$14.33
24 oz. CarbonWorks RSTC 17®+ 32 oz. Soil Revitalizer	13.5	58.4	+ 4.8	+ \$34.52
24 oz. CarbonWorks RSTC 17® + 24 oz. NutriMax AC™	13.4	56.9	+ 3.3	+ \$13.52

(Individual results may vary.)



**Observation:**

Bio-stimulant products promote an increase in microorganism populations by enhancing the environment in which they live and/or by providing food for them to consume. Bio-stimulants do not contain living microorganisms. Year after year, we find that feeding the biology in the soil and/or improving the soil environment delivers a positive yield response in addition to improving soil health.

**Price Information:**

Soybeans	\$9.04 /bu.
CarbonWorks RSTC 17®	\$96.00 /gal.
eXceed™ Nano Brown Sugar	\$30.00 /gal.
NanoZyme 2.0	\$30.00 /gal.
Soil Revitalizer	\$35.50 /gal.
NutriMax AC™	\$87.00 /gal.



**Purpose:**

To evaluate the performance of various biological products applied in-furrow at planting time.

In-Furrow Treatment	Percent Moisture	bu./ac.	bu./ac. Difference	ROI
Control: 24 oz. CarbonWorks RSTC 17®	13.5	53.6	N/A	N/A
24 oz. CarbonWorks RSTC 17® + 3.2 oz. Envita™	13.5	57.0	+ 3.4	+ \$20.99

(Individual results may vary.)



**Observation:**

Biologicals tend to deliver yield responses that vary from field to field. This variability is caused by the biology strains present in the soil and the environment in which the biology is placed. Putting the biology with a energy source such as CarbonWorks RSTC 17® delivered a positive yield response even with planting into cold, wet soils. We will continue to look into the world of biological products and find ways to provide more consistent results from field to field.

**Price Information:**

**Soybeans** **\$9.04 /bu.**  
 Envita™ \$390.00 /gal.

**Purpose:**

To evaluate products designed to fix soil calcium levels in combination with delivering and/or making iron available for plant uptake.

In-Furrow Treatment	Percent Moisture	bu./ac.	bu./ac. Difference	ROI
Control: No In-Furrow	15.0	49.0	N/A	N/A
24 oz. CarbonWorks RSTC 17®	15.0	53.6	+ 4.6	+ \$23.58
32 oz. Soil Revitalizer	14.9	53.0	+ 4.0	+ \$27.49
24 oz. CarbonWorks RSTC 17® + 32 oz. Soil Revitalizer	14.9	54.4	+ 5.4	+ \$21.94
1.5 lbs. Marathon	14.7	55.7	+ 6.7	+ \$34.57
2 lbs. Triathlon	14.6	57.8	+ 8.8	+ \$60.55
24 oz. CarbonWorks RSTC 17® + 32 oz. Soil Revitalizer + 1.5 lbs. Triathlon	14.6	59.7	+ 10.7	+ \$55.60

(Individual results may vary.)



**Observation:**

This location has a history of severe iron deficiency chlorosis (IDC) with a soil pH of 8.4 and a calcium (Ca) level of 19,575 ppm. This study has been repeated on this site for 3 consecutive years. Each year, the products have been applied to the same GPS line. The purpose of this study is to see if we can fix the soil with products such as Soil Revitalizer and CarbonWorks RSTC 17® instead of taking a "band-aid" type of approach such as applying iron. After reviewing the results, we are seeing the calcium and pH readings drop, and the overall yields on this location increase. We recommend a combination of actives when approaching these candid soils that provide us with "yellow" soybeans.

**Price Information:**

<b>Soybeans</b>	<b>\$9.04 /bu.</b>
CarbonWorks RSTC 17®	\$96.00 /gal.
Soil Revitalizer	\$35.50 /gal.
Marathon	\$26.00 /ac.
Triathlon	\$19.00 /ac.



**Purpose:**

To evaluate the use of stream bars to foliar apply different products to soybeans.

V4 Treatment	Percent Moisture	bu./ac.	bu./ac. Difference	ROI
Control	14.7	41.6	N/A	N/A
4 lbs. Spring + 14 gal. water	14.6	46.7	+ 5.1	+ \$41.86
6 gal. 6-24-6	14.7	42.5	+ 0.9	- \$14.96

(Individual results may vary.)



**Observation:**

This was another new study for 2019. We wanted to see if a stream bar is an effective way for growers to apply fertilizer to soybeans after planting. Spring is a dry product with an analysis of 12-40-12 and a few other micronutrients. It is 100% water soluble and can be applied foliar or to the soil. In this study, Spring was applied over the row with stream bar nozzles.

**Price Information:**

<b>Soybeans</b>	<b>\$9.04 /bu.</b>
Spring	\$1.06 /lb.
6-24-6	\$3.85 /gal.

**Purpose:**

To evaluate the use of products applied to soybeans using a coultter and how it effects yield and return-on-investment.

R1 Treatment	Percent Moisture	bu./ac.	bu./ac. Difference	ROI
Control: No Sidedress	13.6	57.0	N/A	N/A
32 oz. CarbonWorks RSTC 17®	13.4	59.8	+ 2.8	+ \$1.31
16 oz. eXceed™ Nano Brown Sugar	13.5	60.4	+ 3.4	+ \$26.99
32 oz. Soil Revitalizer	13.4	60.2	+ 3.2	+ \$20.05

(Individual results may vary.)


**Observation:**

During a challenging economic period for farmers, buying a new piece of equipment commonly used for only one crop can be hard to justify. But could it be profitable to use a coultter applicator for sidedress applications on soybeans, too? The data says yes. We believe sidedressing soybeans has benefits beyond just applying plant nutrients. 2019 was another year of wet and cold soils which prevented soybeans plants from using the soil to its maximum. Opening the soil and providing soil biology with oxygen and carbon or sugar proved to be beneficial.

**Price Information:**

<b>Soybeans</b>	<b>\$9.04 /bu.</b>
CarbonWorks RSTC 17®	\$96.00 /gal.
eXceed™ Nano Brown Sugar	\$30.00 /gal.
Soil Revitalizer	\$35.50 /gal.



**Purpose:**

To evaluate the use of water conditioners when applying sugar to soybeans at R3, and how it effects yield and return-on-investment.

R3 Treatment	Percent Moisture	bu./ac.	bu./ac. Difference	ROI
Control: No Foliar Application	14.8	51.8	N/A	N/A
16 oz. eXceed™ Nano Brown Sugar	15.0	53.3	+ 1.5	+ \$9.81
16 oz. eXceed™ Nano Brown Sugar + 6.4 oz. pH Max	14.9	54.1	+ 2.3	+ \$15.49
16 oz. eXceed™ Nano Brown Sugar + 2.4 oz. Regulator 3.0	15.0	55.3	+ 3.5	+ \$25.79

(Individual results may vary.)



**Observation:**

This was our second year testing water conditioners added to foliar applied plant food. The plant food applied this year was eXceed™ Nano Brown Sugar. The results were similar to last year with the addition of a water conditioner helping to lower the solutions pH, assisting the plants ability to intake the food, and increasing the consistency of the product's performance.



**Price Information:**

<b>Soybeans</b>	<b>\$9.04 /bu.</b>
eXceed™ Nano Brown Sugar	\$30.00 /gal.
Regulator 3.0	\$112.00 /gal.
pH Max	\$31.00 /gal.



### Purpose:

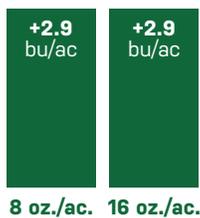
To identify optimal rate and sugar product to maximize your return-on-investment. We used a carrier rate of 15 gal. per acre of water and applied at the R3 growth stage.

R3 Treatment	Percent Moisture	bu./ac.	bu./ac. Difference	ROI
Control: No Sugar Applied	13.5	45.5	N/A	N/A
8 oz. eXceed™ Nano Brown Sugar	13.5	48.9	+ 3.4	+ \$28.86
16 oz. eXceed™ Nano Brown Sugar	13.4	50.4	+ 4.9	+ \$40.55
4 lbs. Feed Grade Dextrose	13.5	48.5	+ 3.0	+ \$24.96

(Individual results may vary.)

### 3-Year Average Yield Increase with eXceed™ Nano Brown Sugar

(Application between R1 - R3)



### Observation:

We recommend using sugar as a foliar product with herbicide and fungicide applications. Over the last three years we have tested the rate of eXceed™ Nano Brown Sugar and have narrowed it to 8-16 oz. acre. This year we tested feed grade dextrose as a competitive control. Feed Grade Dextrose is a dry product, requiring proper mixing and agitation when spraying to achieve positive performance. In this study, the added time and equipment needed for mixing and agitation was NOT factored into the ROI as the costs will vary. eXceed™ Nano Brown Sugar is a liquid product that is easy to use and has shown consistent results year-to-year.

### Price Information:

Soybeans	\$9.04 /bu.
eXceed™ Nano Brown Sugar	\$30.00 /gal.
Feed Grade Dextrose	\$0.54 /lb.



### Purpose:

To evaluate products applied foliar to soybeans at R3 growth stage and their affect on yield and return-on-investment.

R3 Treatment	Percent Moisture	bu./ac.	bu/ac. Difference	ROI
Control: No Foliar	14.4	51.5	N/A	N/A
8 oz. eXceed™ Nano Brown Sugar	14.7	53.0	+ 1.5	+ \$11.69
2 lbs. Spring + 8 oz. eXceed™ Nano Brown Sugar	14.5	53.4	+ 1.9	+ \$13.18
2 lbs. Spring	14.8	53.8	+ 2.3	+ \$18.67
32 oz. Awake™	14.6	54.1	+ 2.6	+ \$16.50
32oz. Awake™ + 8 oz. eXceed™ Nano Brown Sugar	14.7	53.2	+ 1.7	+ \$6.49

(Individual results may vary.)



### Observation:

The 2019 foliar study involved three products that all have different purposes. Sugar is applied to provide the microbiology with a food source thereby leaving more plant-made sugars available for grain fill. Spring is a water soluble dry product that provides the plant with extra NPK and a few micronutrients. Awake™ is a liquid product that also provides the plant with NPK using small molecular carriers. As seen above, all products whether alone or mixed together provided a positive ROI. Our goal in this study is to narrow down what foliar product or product combination will achieve the highest return-on-investment.

### Price Information:

<b>Soybeans</b>	<b>\$9.04 /bu.</b>
Awake™	\$28.00 /gal.
Spring	\$1.06 /lb.
eXceed™ Nano Brown Sugar	\$30.00 /gal.

**Purpose:**

To evaluate the use of Trivapro vs. eXceed Nano Brown Sugar applied to R3 soybeans and its affect on yield and return-on-investment.

R3 Treatment	Percent Moisture	bu./ac.	bu./ac. Difference	ROI
Control: No Foliar	13.8	56.2	N/A	N/A
13.7 oz. Trivapro®	13.8	60.8	+ 4.6	+ \$24.88
8 oz. eXceed™ Nano Brown Sugar	13.7	59.0	+ 2.8	+ \$23.44

(Individual results may vary.)



**Observation:**

In this study we addressed the common question of, "Should I use sugar or fungicide?" According to our data both products provide a yield benefit, but in different ways. A sugar product gives us a yield benefit from feeding the microbes within the plant which allows the natural plant made sugars to contribute to pod fill and bean size. A fungicide suppresses microbes that take away the plant made sugars. Plants sprayed with fungicide tend to stay green longer which leads to higher moisture but bigger beans. This is an example of 2 different approaches solving the same issue.

**Price Information:**

<b>Soybeans</b>	<b>\$9.04 /bu.</b>
Trivapro®	\$156.00 /gal.
eXceed™ Nano Brown Sugar	\$30.00 /gal.



### Purpose:

To evaluate the use of additive products to enhance a fungicide's performance and how that contributes to yield and return-on-investment.

R3 Treatment	Percent Moisture	bu./ac.	bu/ac. Difference	ROI
Control: No Fungicide	15.7	51.6	N/A	N/A
13.7 oz Trivapro®	15.8	54.1	+ 2.5	+ \$5.90
13.7 oz. Trivapro® + 2.4 oz. Regulator 3.0	15.9	56.9	+ 5.3	+ \$29.12
13.7 oz. Trivapro® + 2.4 oz. Regulator 3.0 + 8 oz. eXceed™ Nano Brown Sugar	16.0	58.2	+ 6.6	+ \$38.99

(Individual results may vary.)



### Observation:

In this study, we looked at possible products to enhance a fungicide such as Trivapro®. We know that having a plant stay healthier and green longer leads to better pod fill and bean size. Higher moisture because of the longer growing period tends to be a drawback. However, even with the higher moisture levels, we saw substantial yield increases by adding a water conditioner and a sugar product to help the plant better receive the fungicide. Regulator 3.0 is a water conditioner and eXceed™ Nano Brown Sugar provides sugar for microbes.

### Price Information:

<b>Soybeans</b>	<b>\$9.04 /bu.</b>
eXceed™ Nano Brown Sugar	\$30.00 /gal.
Trivapro®	\$156.00 /gal.
Regulator 3.0	\$112.00 /gal.

# AgRevival Agronomics

## Understanding the Difference Between Biologicals & Bio-Stimulants

The purpose of biological products (or biologicals) and bio-stimulants are often confused. This article will help you understand what they are, how they perform differently, and provide you with the basic knowledge to implement them more effectively in your agronomy program.

### What is a biological?

A biological is a product that contains cultures of living microorganisms. Biologicals are sometimes known as 'bugs in a jug.'

### What is a bio-stimulant?

A bio-stimulant is a product that promotes the increase of microorganism populations by enhancing the environment in which they live and/or by providing food for them to consume. Bio-stimulants do *not* contain living microorganisms.

### How effective are biologicals and bio-stimulants?

Over the past 9 years of testing at AgRevival, bio-stimulants have shown consistently positive return-on-investments (ROI). Various biological products have also shown a positive ROI. However, the results from biologicals vary more from field to field. The reason for this variability can be attributed to a number of causes:

#### 1) The type of microorganism(s) in the product may not be the right one(s) for your soil or crop.

The complexity of your soil's ecosystem surpasses any one person's understanding. Knowing which microorganism is lacking, or how introducing a population of microorganisms will impact the balance of this ecosystem is, at best, an educated shot in the dark. If a biological product isn't working in a particular field, it simply may not be the one you need.

#### 2) There isn't enough food to sustain the additional microbial population.

Why is sugar added to make bread? To feed the yeast cultures. Without sugar, yeast cultures have no food to consume which restricts their growth and results in a flat, dense loaf.

Similarly, adding biologicals to the soil without ensuring an ample food source will yield little to no results.

#### 3) The environment is not conducive to support the microbial population.

To continue with our yeast example, there is another reason your bread may not rise—your yeast died. This can happen if the water is too hot. In other words, something in the environment is killing off or limiting the microorganisms' growth.

In farming, this can be caused by cool soil temperatures, a lack of oxygen in the soil, residual chemicals, heavy metals, high salt levels, or other factors.

### Avoid mixing biological products with high-salt fertilizers.

The high salt content in fertilizers such as 10-34-0 is detrimental to soil biology. Adding a biological to a product such as this will nullify any benefits you might have gained.

### Enhance the performance of biologicals by adding a bio-stimulant.

Adding a bio-stimulant to the mix can help boost the performance and reduce the variability of a biological product. Bio-stimulants can provide additional food and oxygen and reduce the negative impact from salts or heavy metals.

### Bio-stimulants can be a great 'stand-alone' product.

Alternatively, bio-stimulants can help boost the population of beneficial microorganisms that are already present in the soil. In other words, you may not need to add additional microorganisms to the ecosystem to reap the benefits of a healthy biological population. Throughout our years of research, bio-stimulants have delivered a more consistent return-on-investment than biologicals.

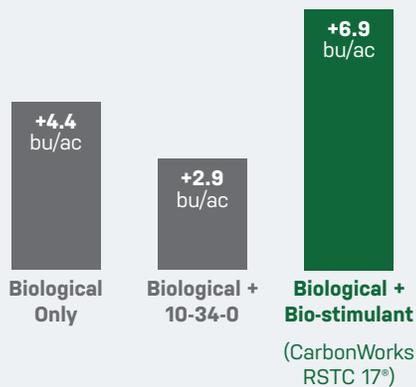
### Find a solution for your farm.

Not all biologicals and bio-stimulants perform equally. Over the years of testing these products, we have seen certain products consistently stand out. Contact us to learn more about our research and how you can implement the products and practices we've tested to yield a positive ROI on your farm.



*Bio-stimulants can be used to speed the breakdown of plant residue. The photo on the right shows the increased breakdown of weed carcasses after spraying with a bio-stimulant. The photo on the left received no bio-stimulant.*

**Average Yield Increase from Biologicals**  
(Applied In-Furrow at Planting)



**The environment in which you place a biological will impact its performance.**

High salt levels are detrimental to soil biology. As we can see from the data, the salt in 10-34-0 inhibited the performance of the biological products. With a bio-stimulant the effectiveness of the total mix increased over the biological only application.



# AgRevival Agronomics

## How the Nitrogen Conversion Process Impacts Your Yields

When talking with growers, we find many do not have a solid understanding of how the nitrogen conversion process impacts their corn yields. The "I put it on so my plants will take it up" mindset overlooks a necessary process that must take place between applying nitrogen and the corn plant utilizing it. That all-important step is called the nitrogen conversion process.

### When applying nitrogen fertilizers, you are not simply applying "N".

The chemical makeup of your nitrogen fertilizers is not simply N. Urea, for example, has a chemical makeup of  $\text{NH}_2\text{CONH}_2$ . Anhydrous ammonia is  $\text{NH}_3$ . UAN 28% is a combination of urea,  $\text{NH}_4$ , and  $\text{NO}_3$ . Furthermore, nitrogen does not remain in the same form as it starts out. It can readily change to  $\text{NH}_3$ ,  $\text{NO}_2$  and  $\text{N}_2$  gas.

If your brain is starting to reel, don't worry. We are going to simplify this down to what you need to know for planning a successful nitrogen program.

### Understand the nitrogen conversion process.

The diagram below shows a somewhat simplified view of the nitrogen conversion process. The majority of nitrogen fertilizers begin as  $\text{NH}_4$  ammonium (or they become  $\text{NH}_4$  shortly after they are applied). While the corn plant can take up some ammonium, the majority is taken up as  $\text{NO}_3$

nitrate. In order to go from  $\text{NH}_4$  to  $\text{NO}_3$ , a conversion process must take place. This conversion process is dependent on soil biology—specifically, nitrosomonas and nitrobacter.

Like all microbes, these require favorable conditions to perform their all-important task of making nitrogen available to your corn plants. However, changing weather patterns—cool, wet springs and summers—inhibit this conversion process.

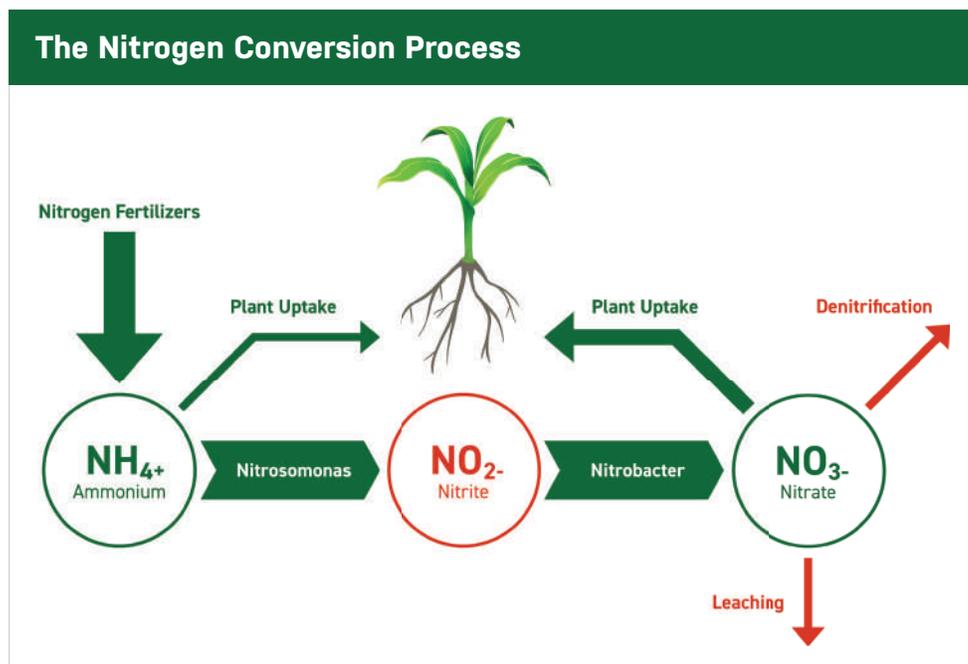
In 2019, we saw nitrogen become available late. A relatively cool and wet spring and summer slowed the nitrogen conversion process, and it wasn't until September that the soil moisture became favorable for the biology to do their job. Soil samples from our research plots showed higher than normal nitrate levels left over in October after the crop was harvested.

What does this mean for growers? If these weather patterns continue, growers will need to ensure their nitrogen is made available to the corn plants early in the growing season. Choosing the right nitrogen source can help.

### The amount of nitrogen that must go through the conversion process varies between nitrogen fertilizer types.

The 3 major sources of nitrogen—anhydrous ammonia, urea, and UAN 28% (or 32%)—each have a unique nitrogen makeup.

- 1. Anhydrous ammonia** is initially comprised of the highly volatile  $\text{NH}_3$  compound, but it quickly becomes  $\text{NH}_4$  when it contacts the soil. A small portion of the  $\text{NH}_4$  will be taken up by the corn plant but the rest must go through the nitrogen conversion process to become plant available.
- 2. Urea** begins as  $\text{NH}_2\text{CONH}_2$  but quickly becomes the highly volatile  $\text{NH}_3$  and follows the same process of anhydrous ammonia to become plant available.
- 3. UAN 28%** is comprised of the urea, ammonium, and



nitrate forms of nitrogen. In UAN 28%, half is urea, 25% is ammonium, and 25% is already in the nitrate form which can be taken up by the corn plant.

When we consider a wet, cool year in which the nitrogen conversion process is slowed, applying UAN 28% gives you a 25% "head start" over urea and anhydrous ammonia.

For growers who have depended solely on anhydrous ammonia or urea, we recommend applying a minimum of 25% of your called for nitrogen as UAN 28% or a similar liquid nitrogen source. The best time to apply this is in-season between the V2 and V4 growth stages.

**Nitrogen stabilizers impact when your nitrogen is made available.**

In talking about the nitrogen conversion process and fertility programs, the importance of nitrogen stabilizers should not be ignored.

While NO<sub>3</sub> is the ideal form of nitrogen for plant uptake, it is easily lost by leaching (often caused by excess rain) and denitrification (the breakdown of NO<sub>3</sub> to N<sub>2</sub> gas).

Traditionally, the problem of losing nitrogen has been addressed by preventing the conversion of NH<sub>4</sub> to NO<sub>3</sub> by sterilizing the soil of the nitrosomonas and nitrobacter. But with the unfavorable weather patterns of the past 2

years, we need *more* of these bacteria in our soils to make nitrogen available! Fortunately, we are convinced that the solution to this problem already exists.

**CarbonWorks Cetain® is topping our research plots.**

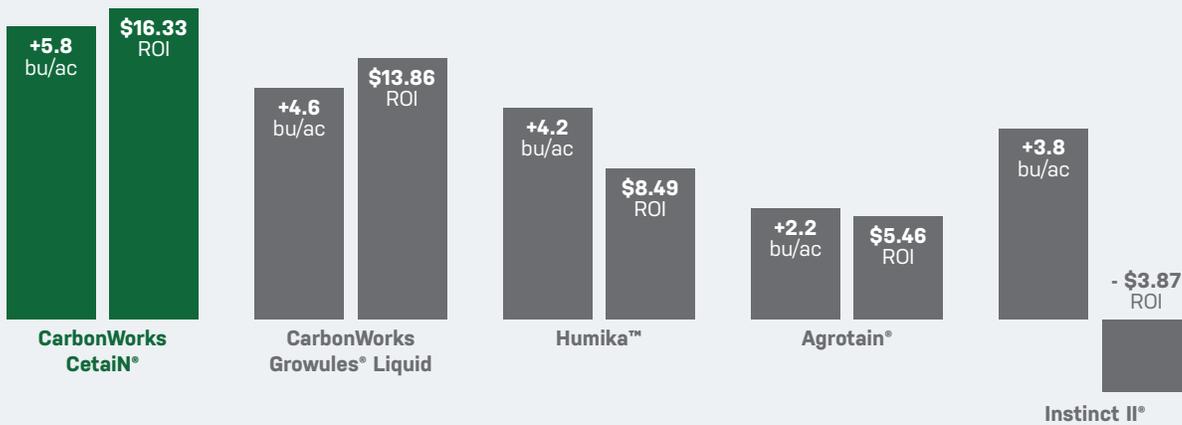
Released to the market 2 years ago—and now tested in our research plots for 3 years—is a nitrogen enhancement additive that can be used with urea or UAN 28%. Its multifunction approach holds all forms of nitrogen to the soil with a carbon element, delivers oxygen to the nitrosomonas and nitrobacter to boost their activity, and provides hydrogen for the urea compound.

**A quick note regarding urea:** Urea requires fast contact with a hydrogen ion when applied, otherwise it will quickly escape into the air as NH<sub>3</sub> gas and be lost. The hydrogen in CarbonWorks Cetain® helps prevent this volatilization.

**Solutions exist. We can help you find the right one for your operation**

The depth of the nitrogen conversation seems to get more expansive every year. AgRevival's research and knowledge is available to help you gain understanding and find solutions for your farm. We encourage you to reach out to us for guidance in planning an effective nitrogen strategy.

**3-Year Average Nitrogen Stabilizer Performance with Drop Hoses**  
(Ranking Based on Average ROI)



**Data Analysis**

**Carbon products are top performers for stabilizing nitrogen.**

CarbonWorks Cetain®, CarbonWorks Growules® Liquid, and Humika™ are all carbon-based nitrogen stabilizers. Agrotain® prevents ammonia volatilization. Instinct II® prevents the conversion of nitrogen from NH<sub>4</sub> to NO<sub>3</sub>, which during wet, cool years can work against you.

# AgRevival Agronomics

## Exploring Stream Bar Strategies

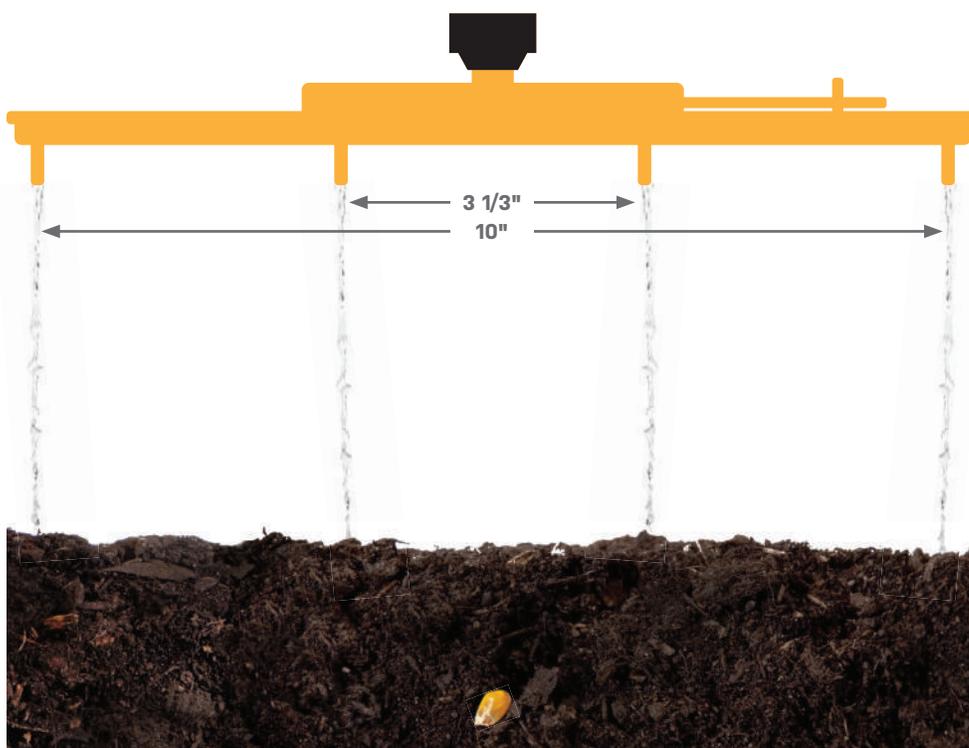
Growers know that missing the optimal planting date can significantly reduce corn yields. Unfortunately, the optimal planting window was small again in 2019, and as a result, many growers had to decide between waiting for the custom applicator to apply their nitrogen prior to planting, or go ahead and plant without any nitrogen down and try to figure out how to get it applied afterwards.

Here is where the saying, "necessity is the mother of invention" proves itself to be true. In 2019, we decided to incorporate stream bar technology into corn production—a technology used in small grain production. We wanted to test whether or not stream bars could be an effective means of applying nitrogen after planting prior to emergence and as an in-season nitrogen placement option.

### What is a Stream Bar?

A stream bar is a type of sprayer nozzle attachment that focuses multiple low-pressure streams of liquid downward at an even spacing. The stream bar we tested in 2019 generated 4 streams with 3 1/3 inches between each stream. The total width of 1 stream bar is 10 inches.

Compared to a traditional broadcast application, we expected the stream bar to be a more efficient placement for nitrogen.



### The Principle Behind the Stream Bar

Using a stream bar in corn production serves two purposes:

1. To improve nitrogen efficiency, and
2. To give growers greater flexibility with nitrogen application timing, rather than depending on pre-plant broadcast applications or fall applied nitrogen.

When we talk about the efficient use of nitrogen, we mean that nitrogen is available:

1. In the right place (the plant's root zone)
2. At the right time (when the plant needs it)
3. In the right amount

We believe that the stream bar may be able to improve nitrogen efficiency through better placement and timing when compared to other application methods.

### The Stream Bar as a Pre-Emerge Nitrogen Application Method

In our 2019 research trials, a pre-emerge application of 60 lbs/acre of nitrogen as UAN 28% with the stream bar yielded 13.4 bu/acre more than a broadcast pre-plant application of 60 lbs/acre of nitrogen in the urea form.

We also tested a 2x2x2 planter applied placement of 60 lbs/acre of nitrogen as UAN 28%, and the stream bar out-yielded this method by 5 bu/acre.

*(View the study on page 7.)*

### The Stream Bar as an In-Season Nitrogen Application Method

Growers have been trending towards applying nitrogen in-season which means they must decide which application method will work best for their operation. We've tested various in-season nitrogen application methods over the past several years and new to this year was the stream bar.

In order to avoid applying the nitrogen directly onto the corn plants' leaves—which would burn

the plant—we offset the stream bar by 4" and turned it to a 45° angle.

Between top-dress applications of urea, cultor applications, drop hose applications, and stream bar applications of UAN 28% (all at V4) the stream bar application method topped the charts in 2019 with a 17.4 bu/acre yield increase over no additional nitrogen. The drop hoses came in second with a 12.8 bu/acre yield increase followed closely by top-dressed urea with a 12.5 bu/acre yield increase.

*(View the study on page 17.)*

### We Believe Stream Bars are a Viable Option for Applying Nitrogen in Corn Production

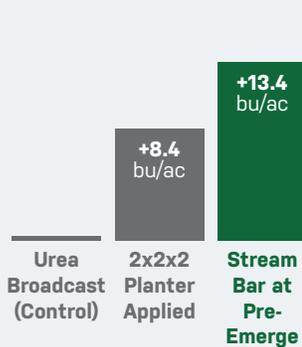
Growers should not feel pressured into applying their nitrogen in the fall with the concern that they will not get it on before planting. After all, applying nitrogen 5 to 6 months in advance is not "risk-free". We do not know what the weather will bring during that time and you could very easily lose a good chunk of your investment.

Based on the 2019 research trials, stream bars seem to be an effective means of placing the nitrogen where it needs to be—in the corn plant's root zone—while providing the timing flexibility many growers need with these small planting windows.

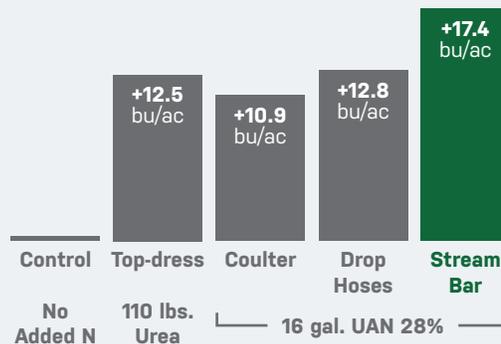


Applying UAN 28% with stream bars following planting.

#### Base Nitrogen Application Placement (60 lbs. Nitrogen)



#### In-Season Nitrogen Application Placement



## Data Analysis

### Using a stream bar for applying nitrogen delivered a strong ROI in 2019 research trials.

Based on the 2019 research trials, stream bars seem to be an effective means of placing the nitrogen where it needs to be—in the corn plant's root zone—while providing the timing flexibility many growers need with these small planting windows.

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