Precision Planting®

PRECISION TECHNOLOGY INSTITUTE

2020 RESEARCH SUMMARY
PONTIAC, IL

2020 PTI Farm Research Summary

Table of Contents:

Year in Review ---------- 5-8
Top 10 Return on Investment Performers ---------- 9
Corn Summary of 2020 FurrowJet® Applications ---------- 88
Corn Summary of 2020 Conceal® Applications ---------- 113
Soybeans Table of Contents ---------- 133
Soybeans Summary of 2020 FurrowJet® & Conceal® Application ---------- 184
Wrap Up ---------- 187
2020 in Review---------- 188-190
Acknowledgments and Legal Statement ---------- 191

Corn Planting Principles:

Planting Date ----------10
Starter Fertilizer Response by Date ----------11-12
vSet® Planter Singulation ---------- 13
Planting Depth ---------- 14-16
Keeton® Seed Firmer ---------- 17
Keeton® Seed Firmer/Downforce ---------- 18
CleanSweep® Residue Management ---------- 19-20
Seed Trench Residue Management ---------- 21
Multi-Year Day of Emergence ---------- 22
2020 Crop Year Day of Emergence ---------- 23-24
High Speed Planting ---------- 25
Closing Wheel System ---------- 26-28
Downforce Management ---------- 29-31
Planter "All-Wrong" Study ---------- 32
20" Corn Irrigated Seeding Rate ---------- 46
Saturated Cold Germination Test ---------- 47-49
Force® 6.5G vDrive® Insecticide ---------- 89
30" vs 20" Row Corn ---------- 92-93
20" Row Corn Seeding Rate ---------- 94
30" Row Corn Seeding Rate ---------- 95
20" Solar Corridor ---------- 96
Leaf Orientation ---------- 114
Corn Strip Planting ---------- 115-116
Corn Veltyma™ Foliar Fungicide ---------- 117
Multi-Genetic Planting ---------- 118-119
Fendt® Momentum™ Pinch Row Compaction - 50-51
Fendt® Momentum™ vs Competitor Planter--------52

Corn Fertility:

Centuro™ Denitrification ---------- 53
Anvol® Volatilization w/ Post-Plant Rain ---------- 54
Anvol® Volatilization w/o Post-Plant Ran ---------- 55
Marco Safe "N" ---------- 56
Marco BioMarc ---------- 57
Marco QuickGrow™ LTE FurrowJet® ---------- 58
QLF BOOST Carbon Based Sugar ---------- 59
The Andersons® Corn Nutrition ---------- 60-61
AgroLiquid® accesS® Sulfur FurrowJet® ---------- 62
AgroLiquid Starter Fertilizer FurrowJet®---------- 63
Nachurs® Impulse FurrowJet® Center Placement – 64
Nachurs® Impulse FurrowJet® Wing Placement --- 65
Nachurs Impulse® Tri-Band Placement ---------- 66
Nachurs® Start2Fininsh ---------- 67
Pivot Bio PROVEN® Nitrogen Mgt. ---------- 68
Pivot Bio PROVEN® FurrowJet® ---------- 69
Pivot Bio PROVEN® Tank-Mix ---------- 70
Sunrise Coop PCT Nutrition ---------- 71
10-34-0 FurrowJet® ---------- 72
Phosphorus Placement ---------- 73
QLF® 7-21-3 MKP FurrowJet® ---------- 74
QLF Kelpak Seed Treatment ---------- 75
QLF AgroGold + SEATONIC FurrowJet® ---------- 76
QLF Boost Conceal® ---------- 77
QLF Amino-15 Foliar ---------- 78
Manticor™ LFR® FurrowJet® ---------- 79
Xanthion® In-Furrow ---------- 80
Loveland Products RISER® FurrowJet®---------- 81
Ethos™ XB In-Furrow ---------- 82
Capture® LFR® In-Furrow ---------- 83
Temitry™ LFR® In-Furrow ---------- 84
Xyway™ LFR® FurrowJet®---------- 85
SabrEx™/Excellorate™ In-Furrow ---------- 86
FurrowJet® Side-Wall ---------- 87
TerraNu™ Micro-Pak ---------- 90
Calcium Products SO4™ ---------- 91
pH Acidity ---------- 97-98
At-Plant Conceal® vs. Weed-N-Feed---------- 99
Single vs. Dual Band Conceal® Nitrogen ---------- 100

Precision Planting®

2020 PTI Results

Corn Fertility Continued:

Conceal® Nitrogen Rate/Placement ---------- 101-103
Conceal® K-Fuse® Potassium ---------- 104
Marco Nitro "K" ---------- 105
Dribble vs Conceal® Nitrogen ---------- 106-107
Nitrogen Sealer ---------- 108
Sidedress Placement ---------- 109
Nitrogen, Sulfur, Boron Conceal® ---------- 110-111
Boron Rate ---------- 112

Corn Harvest:

Chopping Corn Head ---------- 121
Yetter Devastator™ ---------- 122
SCiO™ Pocket Molecular Sensor ---------- 123-124
Bushel Plus (Harvest Loss Calculator) --------- 125-126
Pre-Harvest Yield Estimation ---------- 132

Corn Tillage:

Strip-Till Freshener ---------- 120
Corn Tillage ---------- 127-128
In-Line Ripper ---------- 129
Broadcast vs Banding ---------- 130-131

Corn Intensive Management:

Water Management and Recycling ---------- 33-35
NETAFIM™ Irrigation ---------- 36
Irrigation Moisture Probe ---------- 37-38
Conventional-Till Irrigated Continuous Corn ----39-41
Strip-Till Irrigated Corn High Yield ---------- 42-45

Soybean Planting Principles:

CleanSweep® Residue Management ---------- 136-137
Closing Wheels ---------- 138-140
FurrowForce® System Auto vs Manual Control --- 141
Planting Date ---------- 152
STP Opening Discs ---------- 155-156
Strip Planting ---------- 157-158
Downforce Management ---------- 159-160
Keeton® Seed Firmer ---------- 161
Keeton® Seed Firmer/Downforce ---------- 162
Singulation ---------- 164
Seeding Rate ---------- 165-166
High Speed ---------- 167

Soybean Fertility:

pH Acidity ---------- 149-150
Calcium Products 98G™ ---------- 151
Starter Fertilizer Response by Date ---------- 153-154
FurrowJet® Side Wall ---------- 163
Marco Quick Grow LTE FurrowJet®---------- 168
The Anderson's® Nutritional ---------- 169-170
Nachurs® Start2Finish ---------- 171
AgroLiquid® Fertilizer FurrowJet® ---------- 172
AgroLiquid® LiberateCa™ ---------- 173
AgroLiquid® S-Calate™ Calcium/Sulfur ---------- 174
Revytek™ Foliar Fungicide ---------- 175
Calcium Products SO4™ ---------- 176
Marco Fertilizer Conceal® 14-12-4-6s ---------- 177
Nachurs® Conceal® K-Fuse® Potassium ---------- 178
QLF® 7-21-3 MKP FurrowJet® ---------- 179
QLF Kelpak Seed Treatment ---------- 180
QLF AGRO GOLD™ + SEATONIC™ FurrowJet®----- 181
QLF Boost Conceal® ---------- 182
QLF Amino-15 Foliar ---------- 183

Soybean Harvest:

Chopping Head ---------- 185

Soybean Tillage:

Soybean Tillage ---------- 134-135

Soybean Intensive Management:

30"High Yield Irrigation Conventional Till-----142-145
20" High Yield Strip-Till Irrigated Cover Crop-146-148

Become a PTI Insider Today!

INSIDE PTI

InsidePTI is a new online video series where Jason Webster and the Precision Planting Team will give an inside look into all the trials listed in this summary report in *video* form. Sign up today to receive these agronomic videos mailed directly to your email inbox. To sign up, simply go to InsidePTI.com and soon you will get a behind the scenes look at the PTI Farm!

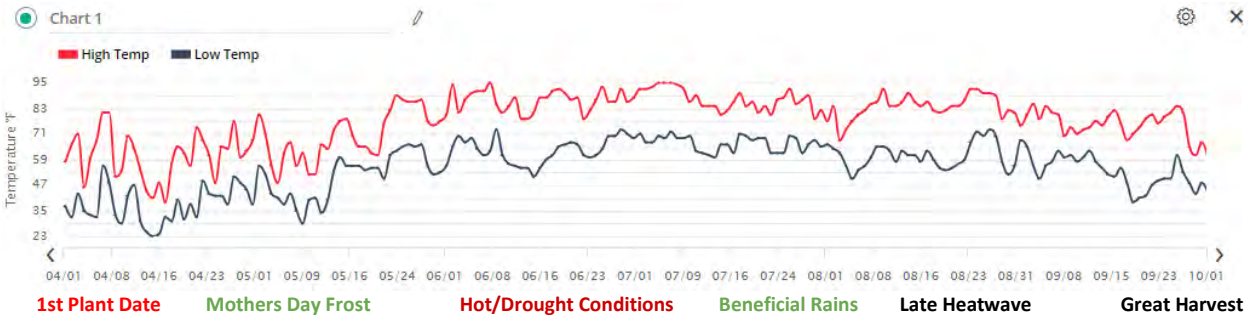
Become an Insider

A simple way to stay informed, as well as up to date on the research we are collecting here at the PTI Farm is to become an Insider. Subscribe to the InsidePTI weekly videos at insidepti.com for all of your agronomic needs.

2020 in Review

The Precision Technology Institute (PTI) in Pontiac, IL continued its 3rd year in 2020. This farm was originally acquired in the fall of 2017 and from that point, our Precision Planting® team has been working hard to design and develop the future vision of what the Precision Technology Institute should be.

During the summer of 2020, the global pandemic of Covid-19 changed our livelihoods and our society, and we were no different at the PTI Farm. Maximum crowds of fifty were mandated throughout the summer, but the PTI team endured and hosted thousands of growers from throughout the United States. Farmers visited the PTI research farm to dive into agronomy field trials, see and understand real world agronomic problems, and were even able to experience some of the latest and greatest state-of-the-art technology in our ride and drive "SandBox" area. Field days started in July and lasted until the 2nd week of September.



The above chart shows daily high and low temperatures at the PTI Farm from April through October 1.. Our first plots were planted on April 8th in cool but fairly dry conditions. During this time-frame, a large % of soybeans were planted due to the cold temperatures keeping corn planters in the toolshed. The weekend of Mother's Day brought concern to many that planted soybeans in the first week of April, as temperatures plummeted down to 27 degrees for 2 hours, causing frost damage to many beans in the area. Fortunately, no soybean replant was necessary at the PTI Farm.

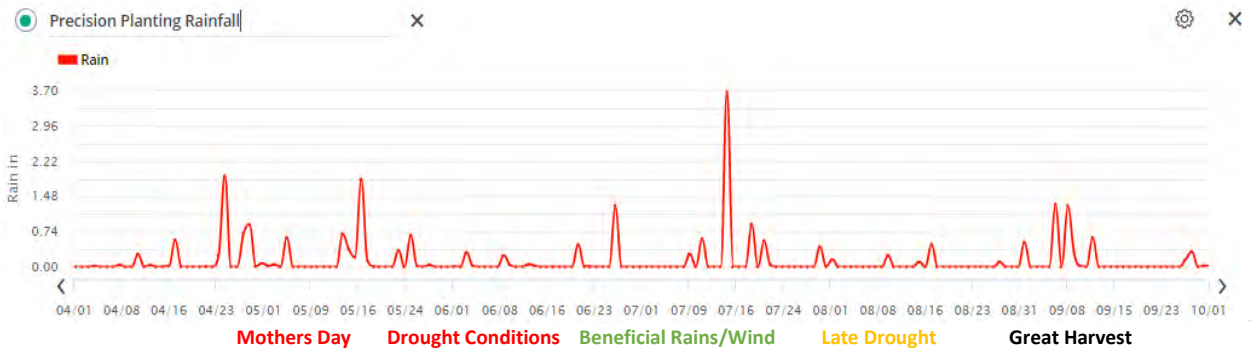
2020 in Review Continued

Once it warmed up, corn was planted quickly in the last 15-20 days of April in some of the best conditions we have seen in years.

However, rain events during the end of April through mid-May wreaked havoc on corn trying to emerge, but saturated soils and the lack of oxygen proved to result in many replant situations for a large percentage of growers.

The chart below illustrates rainfall totals from April to October.

April: 4.73”, May: 5.12”, June 2.47”, July 8.97”, August 1.09”, September 4.56”



After fighting the heavy rains, May 15-June 1 allowed for the remaining planting to be completed. As June came and gone, so did the rain. June offered only 2.47” of rain and much of the corn crop was suffering from hot dry conditions. July continued June’s hot dry stretch of being very hot and drought was ready to cause some major yield reductions. Fortunately, on July 11 rains did fall upon the PTI Farm, but came with a price.

2020 in Review Continued

July rains came with a significant price. 50mph winds swept thru the night of July 11 causing down corn on certain planting dates and specific hybrids. Much of the corn was cosmetic damage and most stood back up with no yield penalty, but it was ugly to watch. July's rain total of 8.97" saved the corn crop.

As August rolled in, it also brought challenges as well. The Iowa derecho that wreaked havoc on thousands of acres of corn on August 10 proved devastating in Iowa, but was much more forgiving to the the PTI Farm. 47mph winds did bring a high degree of greensnap, again dependent on corn planting date and hybrid sensitivity, but it certainly could have been worse.

A record hot 3rd week of August limited soybean top end yield potential and set the stage for many corn fields to "die and dry". Soybeans also were faced with some of the heaviest populations of bean leaf beetles we have ever seen and consequently needed foliar insecticide applications. August rainfall totaled 1.09".

2020 in Review Continued

In the end, corn yields varied from 150 to over 350 Bu/A., averaging near 230 Bu/A. Soybeans ranged from 50 to over 100 Bu/A. with averages near 65 Bu/A. 2020 was a challenging season with frost, flooding conditions, drought conditions, wind, greensnap and insect pressure. It is pretty much safe to say that we saw just about everything Mother Nature could throw at us again this past year. Even through the challenges, we did learn from the struggle. You will most certainly want to see the results from our irrigation studies, as it was ever so important at the PTI farm. This year we achieved corn yield advantages over 100 Bu/A. by offering drainage and the ability to recycle rainwater in the form of drip irrigation.

Precision Planting is excited to share our third year of PTI research farm results and findings. We hope they provide useful insights that help drive thoughtful consideration around future crop management decisions. This publication is intended to summarize and explain the many agronomic trials that were implemented in 2020. In most trials, both agronomic yield and economics are detailed to help understand return on investment. At the bottom of each trial summary page, a brief explanation is listed to show Planting Date, Hybrid or Variety, Population, Row Width, Crop Rotation, and Commodity Price/Bu. and Pricing information that pertains to the products being evaluated.

For the 2020 PTI Yield Summary Data, net returns are calculated with corn prices of $3.75/Bu. and soybeans at $9.75/Bu. These prices represent average **cash** prices for new crop 2020 corn from the period of October 1st, 2019 thru October 1st, 2020.For starter fertilizer trials, most have a $30 Reallocation credit applied to each product in testing. This approach allows us to use the total intended fertility needed for soil test build-up and yield maintenance, but allows the planned use of both dry fertilizer in the fall and liquid product on the planter without spending or over-applying more nutrients than needed. To accomplish this, we reduce our dry fertilizer rates by $30/A. to account for the reallocation. All control tests in each study get the additional $30/A. of dry fertilizer to achieve a typical 100% program without starter fertilizer on the planter.

Fall Dry Fertilizer: $30 Reduction + At-Plant Liquid Starter

2020 Return on Investment Performers

PTI Agronomic Study:	$ ROI/A.	Page #
Top 10:		
1. Strip-Till High Yield Irrigated Corn	$202.68	36
2. 20" High Yield Irrigated, Strip-Till, Cover Crop Soybeans Protocol	$159.42	146-148
3. Triple Split Conceal® N over 100% WNF: Corn N Mgt	$106.50	101-103
4. 30" High Yield Irrigated Soybeans Protocol	$93.35	142-145
5. Corn Strip Crop Planting	$88.13	116
6. Conventional-Till Irrigated High Yield Continuous Corn Protocol	$78.19	39-41
7. Split Application N Program over 100% WNF: Corn N Mgt	$72.61	101-103
8. GH3546X 75K over 175K: Soybean Seeding Rate	$61.08	165-166
9. Low pH & AgLime Soybean Study	$58.98	150
10. Nachurs imPulse FurrowJet Tri Band: 5Gal	$55.60	66
Bottom 10:		
1. May 23rd Late Plant Date: Soybeans	$-291.86	152
2. June 1st Late Planting: Corn	$-209.68	10
3. May 14th Plant Date: Soybeans	$-195.52	152
4. 42% Saturated Cold Germination Test: Corn	$-185.50	47-49
5. April 5th Early Planting: Corn	$-167.54	10
6. Strip Cropping: Soybeans	$-146.74	157-158
7. 1" Shallow Plant Depth: Corn	$-138.07	14-16
8. Planter All Wrong: Corn (Downforce, Residue Mgt, Singulation)	$-108.00	32
9. Too Light Downforce: Corn	$-83.62	29-31
10. Too Heavy Downforce: Corn	$-41.35	30

Corn Planting Date Study

Objective: To evaluate various corn planting dates throughout the spring to determine the optimum planting date and economic return on investment. Once optimum planting date is discovered, economics can then be analyzed to determine yield loss and cost per acre when planting dates were not implemented within the optimum planting window.

Results: Corn planted on April 11th and April 23rd achieved the highest yields of our planting date study at 240.5 and 241.9 Bu/A. (Table 1). The earliest corn planted on April 5th resulted in yield losses of **-44.7 Bu/A.** due to pushing planting too early in cool/wet cold conditions, consequently earning losses of **-$167.54/A.**

Table 2. illustrates after the optimum planting dates of April 11th and April 23rd, yields suffered an average yield loss of **-41.47 Bu/A.** over the next three weeks. This time frame equated to average losses of **-$155.59/A.** as a result of missing the optimum planting window.

Table 1.

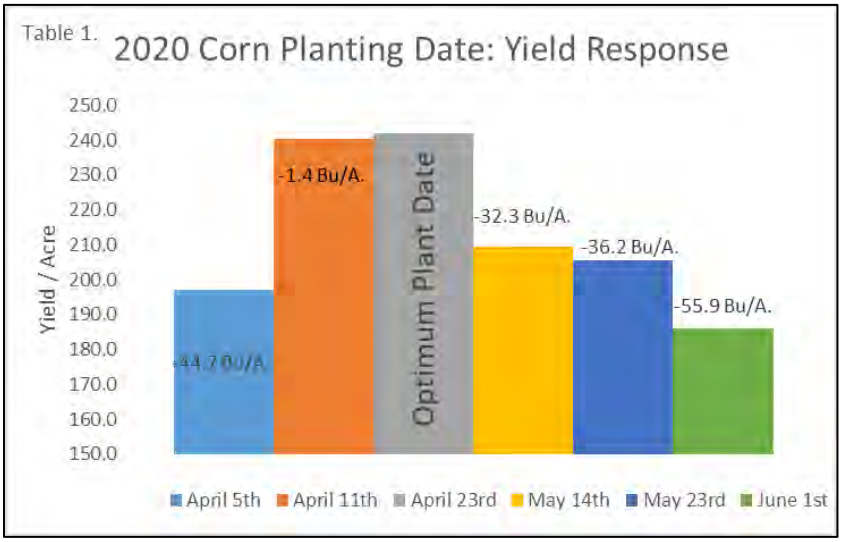


Table 2.

The last two planting dates of May 23rd and June 1st resulted in the lowest overall yields with over **-36.2** to **-55.9 Bu/A.** losses with diminished returns of **-$135.85** to **-$209.68/A.** respectively.

Planting Date: Varied *Hybrid: GH10D21* *Population: 36K* *Row Width: 20"* *Rotation: CAB* *Corn Price: $3.75*

Corn Starter Fertilizer Response by Planting Date Study

Objective: To monitor the performance of starter fertilizer at various planting dates. When does starter fertilizer give the highest returns? Does starter fertilizer respond differently at earlier planted dates versus later? In this study we evaluate four planting dates consisting of April 5th, April 11th, April 23rd, May 23rd with and without a starter fertilizer, monitoring its performance throughout the planting season.

The starter fertilizer program used for this study consists of the following:

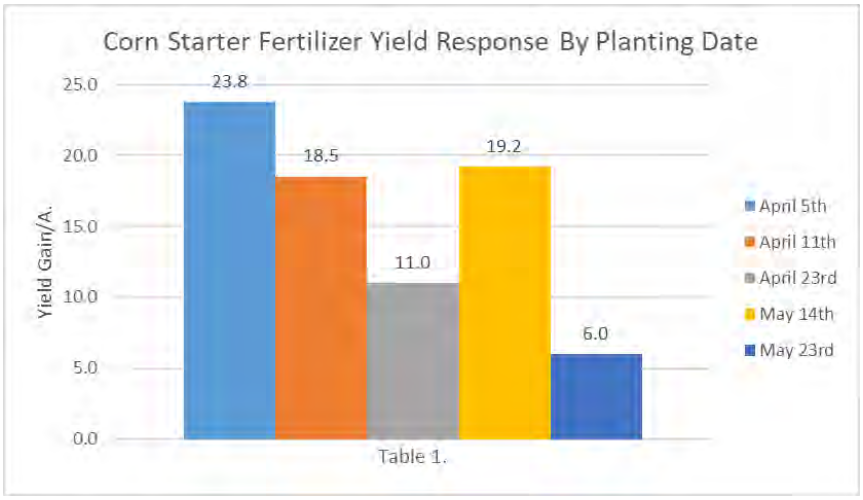
Product	Fertilizer Analysis	Placement of Fertilizer
2 Gal/A. Triple Option®	4-13-17-1S	FurrowJet® Center
2 Gal/A. Triple Option	4-13-17-1S	FurrowJet® Wings
10 Gal NutriStart BOOST	14-12-4-6S	Conceal® Single Band
30 Gal/A.UAN	32-0-0	Conceal® Single Band
4 Gal/A. K-Fuse	Potassium Sulfate	Conceal® Single Band

Figure 1. FurrowJet® Placement

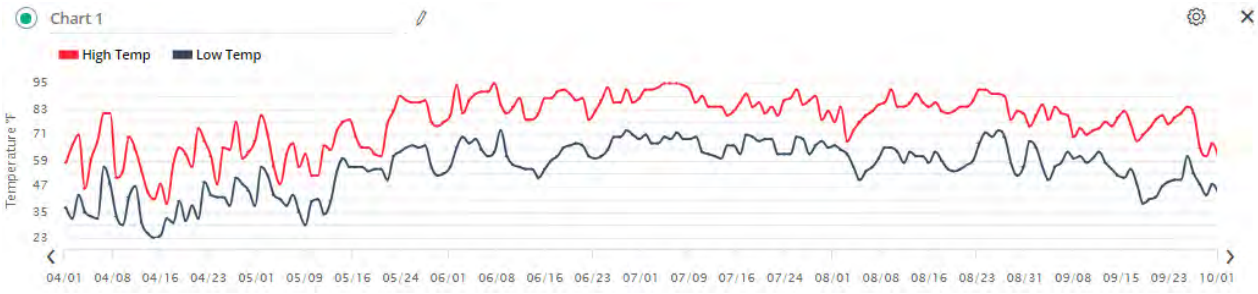
Figure 2. Conceal® Placement

Corn Starter Fertilizer Response by Planting Date Study Cont'd

Results: Table 1. illustrates that every planting date achieved yield gains from our starter fertilizer program. Best yield responses from starter fertilizer came during the colder planting events. April 5th resulted in incredible yield gains of +23.8 Bu/A., April 11th of +18.5 Bu/A. and a late cold stretch that occurred just before the May 14th offered +19.2 Bu/A. starter gains.



As planting dates shifted towards warmer soils of over 50 °F on April 23rd and May 23rd, starter fertilizer yield response decreased with yield gains of only +11.0 to +6.0 Bu/A. Table 2. Illustrates all planting dates entries achieved starter fertilizer net positive gains, except the latest planting date of May 23rd **(-$10.03/A.).**



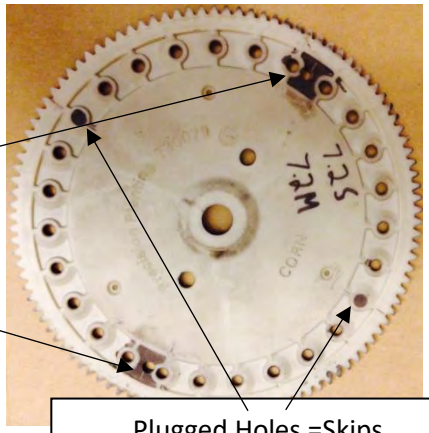
Planting Date: Varied *Hybrid: GH 10D21* *Population: 36K* *Row Width: 20"* *Rotation: CAB* *Corn Price: $3.75*

Triple Option:$18/A. *K-Fuse: $18.20/A.* *Nutristart BOOST 14-12-4-6S: $22.50/A.*

2020 PTI Results

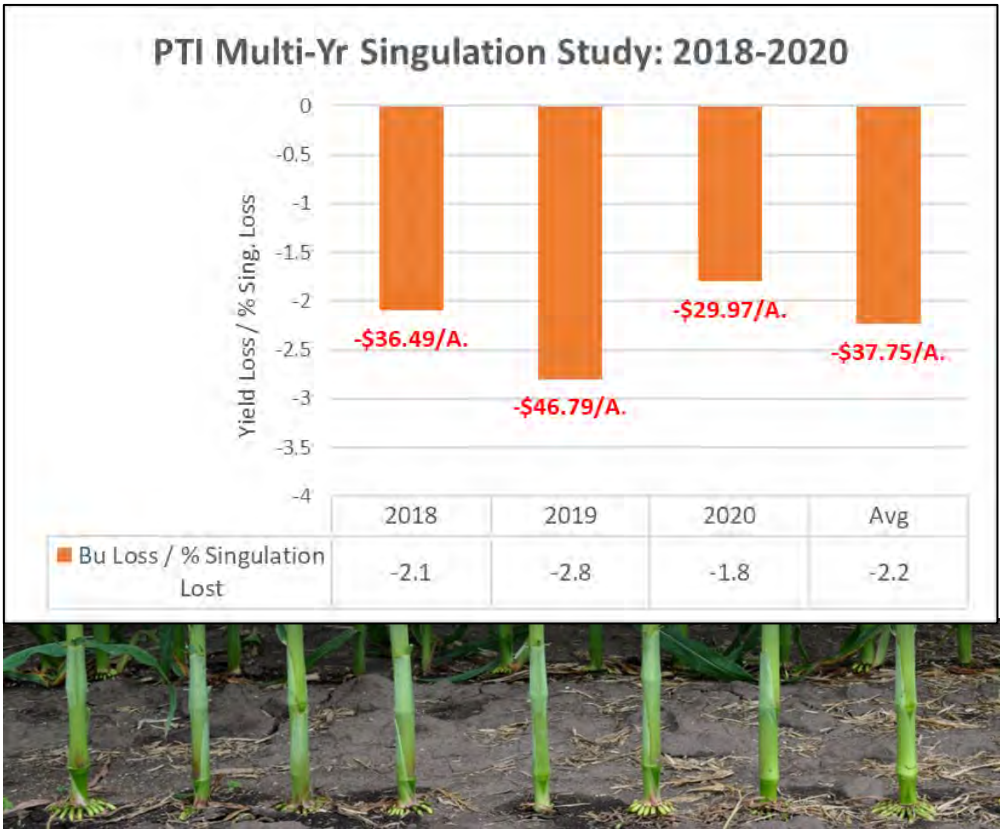
vSet® Planter Singulation Study

Objective: To evaluate how improper seed singulation affects corn yield. Modified vSet® seed plates with plugged and extra holes were used in order to create doubles and skips. These "goof" plates created an average of 95% spacing accuracy vs. the control at 99.5%.



Results: The table below illustrates 95% seed singulation resulted in economic losses of **-$37.75/A.** over a 3-yr period of 2018-2020.

For each percentage of singulation lost, yield was decreased by an average of **-2.2 Bu/A.** or **-$8.39/A.**



Planting Date: June 11 *Hybrid:AgriGold 641-06* *Population: 36K* *Row Width: 30"* *Rotation: CAC* *Corn Price: $3.75*

Precision Planting

2020 PTI Results

Planting Depth Study

Objective: To evaluate yield and economic performance of various corn planting depths consisting of 1" to 3.5" in ½"increments.

Results: Tables 1-2. illustrate that the optimum planting depth for this study was 2". As planting depth was shallowed up to 1.5", yield was reduced by **-11.2 Bu/A.**, and more importantly suffered economic losses over **-$41/A.** The most drastic yield decline occurred at the shallowest depth in the study at 1", with yield deficits of **-37.6 Bu/A.**, and significant economic losses of just under **-$140/A.**

As planting depth was increased to 2.5" to 3.0", yield loss of **-0.8** to **-2.0 Bu/A.** occurred, resulting in lower economic returns by **-$2.89** to **-$7.33/A.** As we planted deeper to 3.5", yield fell by **-10.1 Bu/A.** and suffered economic losses of **-$37.06/A.**

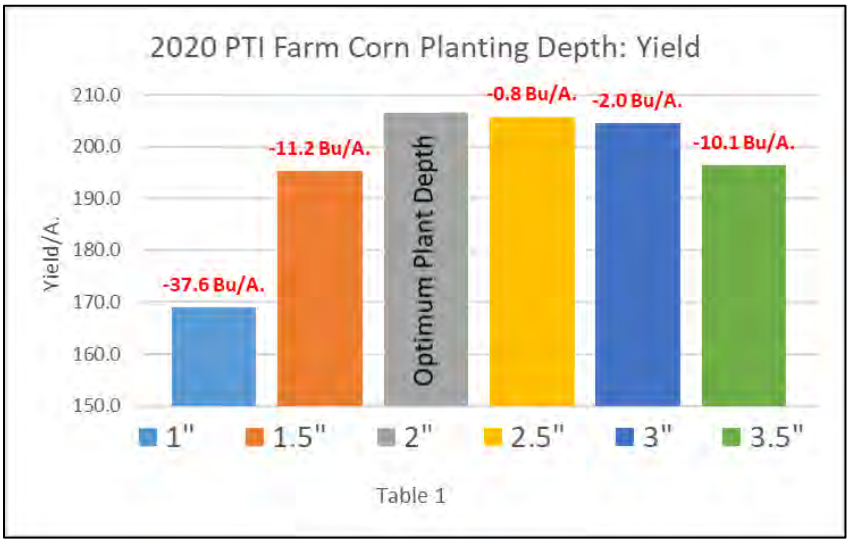


Table 1

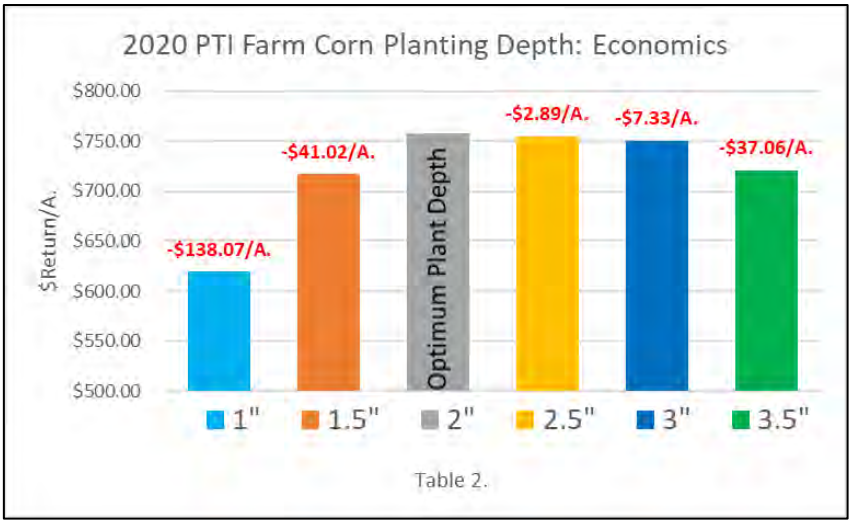


Table 2.

Figure 1. Seed Furrow

Planting Depth Study Continued

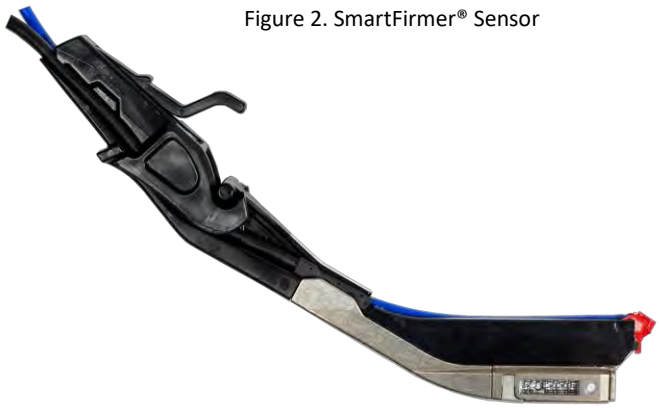


Figure 2. SmartFirmer® Sensor

Digging seeds is a time consuming yet important task at planting time (Figure 1). Getting your eyes on the furrow where the seeds are placed, will allow you to understand if those seeds are in an environment to thrive. Is the seed being planted into adequate moisture? Until now, we didn't know this for every seed, and we were unfortunately simply guessing.

With SmartFirmer® sensor (Figure 2) you can now have eyes in the furrow. Soil moisture is a critical component for seed germination, uniform plant emergence, and ultimately crop yield. SmartFirmer® sensor gives row-by-row visibility to soil moisture in the seed furrow, allowing farmers to choose the right planting depth as soil conditions change. Currently, the recommendation for ideal furrow moisture levels to achieve adequate corn emergence, is 32%.

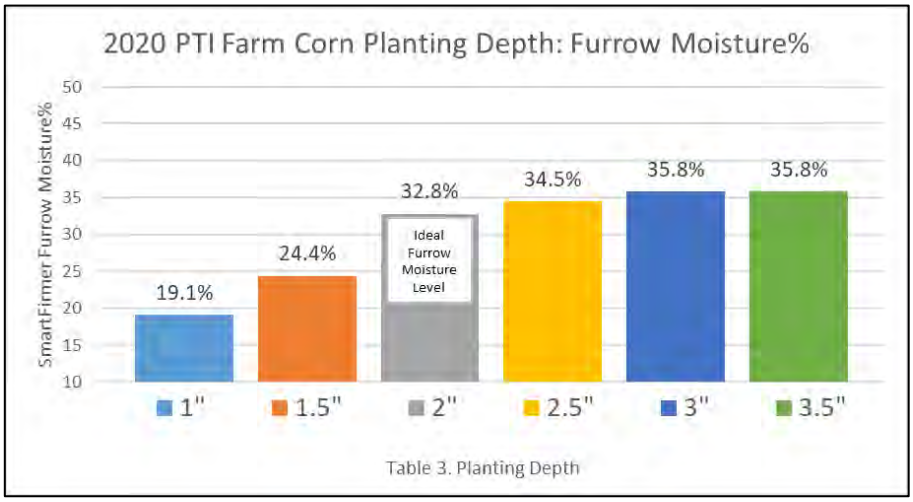


Table 3. Planting Depth

The telling story with this planting depth study is actual furrow moisture. Table 3. reveals the furrow moisture reported by SmartFirmer® sensor. Shallow planting depths were simply placing seed into dry soils of 19.1% to 24.4% moisture, lower than the ideal 32% soil moisture recommendation. Consequently, shallow plant depths resulted in yield losses mentioned above and from Table 1.

Optimum planting depth occurred at 2”, as it was the exact depth needed to achieve adequate soil moisture levels of 32%. As planting depth increased deeper than the optimum 2” depth, all sustained soil moisture levels above the recommended 32% levels. However, all consequently suffered yield losses as corn was unnecessarily planted too deep, since it did in fact have plenty of soil moisture for germination. The deeper planting depths just caused longer emergence delays, which led to yield loss.

Planting Depth Study Continued

Figure 3. 20|20® Monitor System

Using the 20|20® monitor (Figure 3) in tandem with SmartFirmer® sensor, we now have the ability to evaluate furrow moisture in real-time. Based on this real-time information, growers can make decisions based on actual sensing data.

Figure 2. illustrates SmartDepth™ system (Figure 4), a new unique product that takes the technology one additional step further, allowing planting depth to be changed on a planter, section or individual row basis. This can be done manually from the tractor cab and 20|20® console, or automatically using furrow moisture values from SmartFirmer® sensor (Figure 5).

Figure 4. New SmartDepth™ Control

Table 4. is exciting data that shows SmartDepth™ system in automatic mode out-performed the manual fixed optimum plant depth of 2" by +5.8 Bu/A. This system takes the guessing out of planting depth and allows growers to measure, react, and take control.

Figure 5. SmartDepth™ Customization Screen

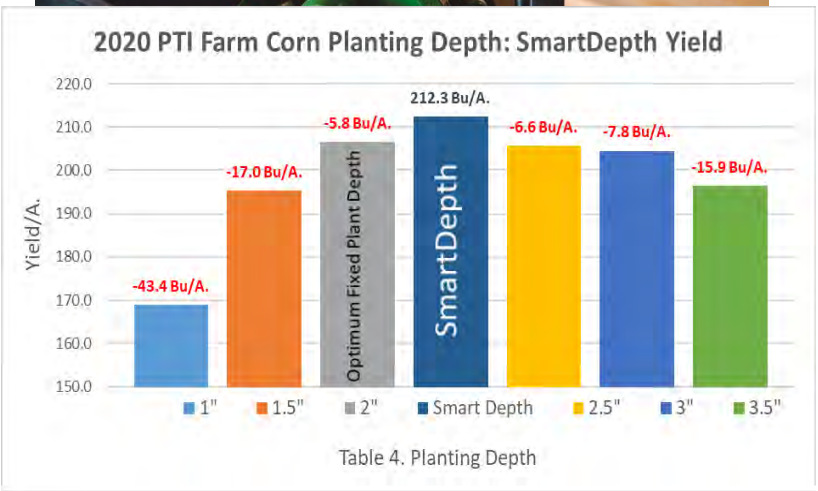


Table 4. Planting Depth

Planting Date: June 8 *Hybrid: AgriGold 641-52VT2* *Population: 36K* *Row Width: 30* *Rotation: CAC* *Corn Price: $3.75*

Keeton® Seed Firmer Study

Objective: This study evaluates the benefits of Keeton® Seed Firmers (Figure 1). Seeds don't always land right in the bottom of the trench where they belong. With its unique, in-the-trench design, the Keeton® Seed Firmer gently firms those seeds to the bottom of the V-trench (Figure 2). The end result is even depth, correct seed-to-soil contact, and most importantly uniform germination.

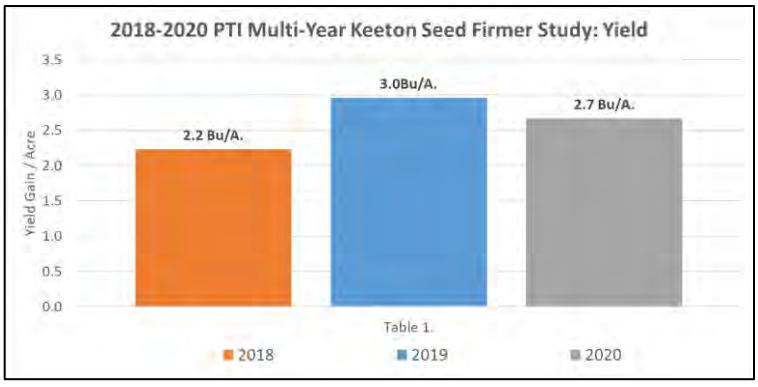
Results: Table 1. Illustrates multi-year yield data over the time period of 2018 – 2020 at the PTI Farm. The presence of Keeton® Seed Firmers resulted in average yield gains of +2.6 Bu/A.

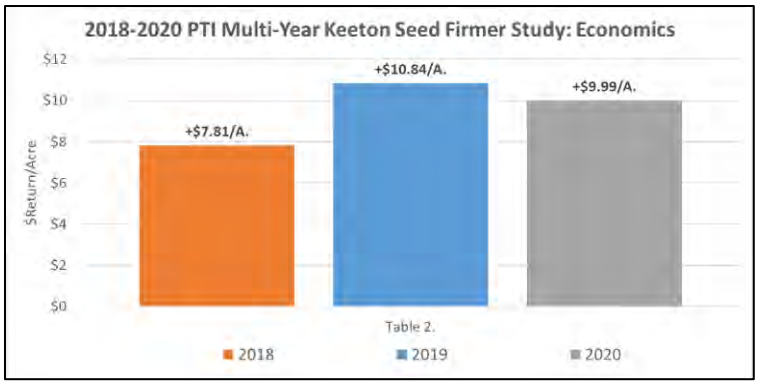
As for economics, Table 2. reveals multi-year yield data over the same time period indicating Keeton® Seed Firmers resulted in average economic gains of +$9.55/A. compared to not using a seed firmer.

At a cost of $35/row for Keeton® seed firmers and quick attach brackets for a 16-row planter, using the +$9.55/A. increase in revenue, break-even occurs at 59 acres.

Figure 1. Keeton® Seed Firmer

Figure 2. Good Seed to Soil Contact from Keeton® Firmer





Planting Date: June 11 *Hybrid: AgriGold 641-52VT2* *Population: 36K* *Row Width: 30* *Rotation: CAC* *Corn Price: $3.75*

Keeton® Seed Firmer/Downforce Study

Objective: This study evaluates the benefits of Keeton® Seed Firmers **in addition to both incorrect and correct downforce settings**. Seeds don't always land right in the bottom of the trench where they belong. With its unique, in-the-trench design, the Keeton® Seed Firmer gently firms those seeds to the bottom of the V-trench (Figure 1). The end result is even depth, correct seed-to-soil contact, and most importantly uniform germination.

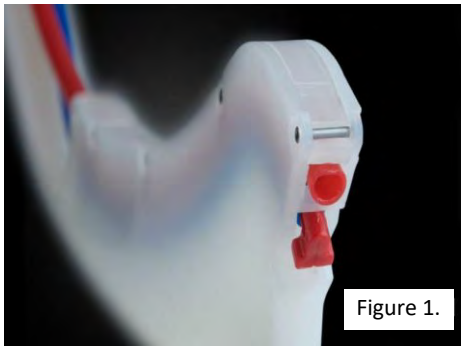
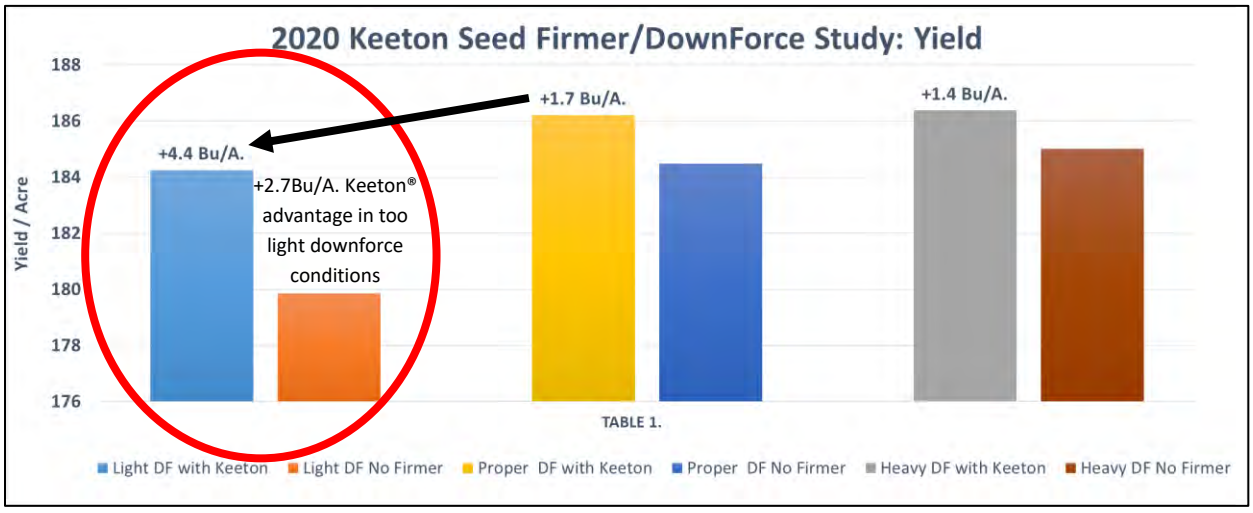


Figure 1.

Results: When too light of downforce is implemented, this usually results in loss of ground contact causing planting depth to shallow up. In these conditions, the presence of seed firmers resulted in yield gains of +4.4 Bu/A. compared to a +1.7 Bu/A. seed firmer advantage when downforce was correct. Using $3.75 corn, this +2.7 Bu/A resulted in additional economic gains of $10.13/A. compared to seed firmers in proper downforce situations.

This study shows that Keeton® seed firmers can in fact, aid an inadequate downforce setting by improving seed to soil contact and helping to minimize shallow planting due to loss of ground contact.

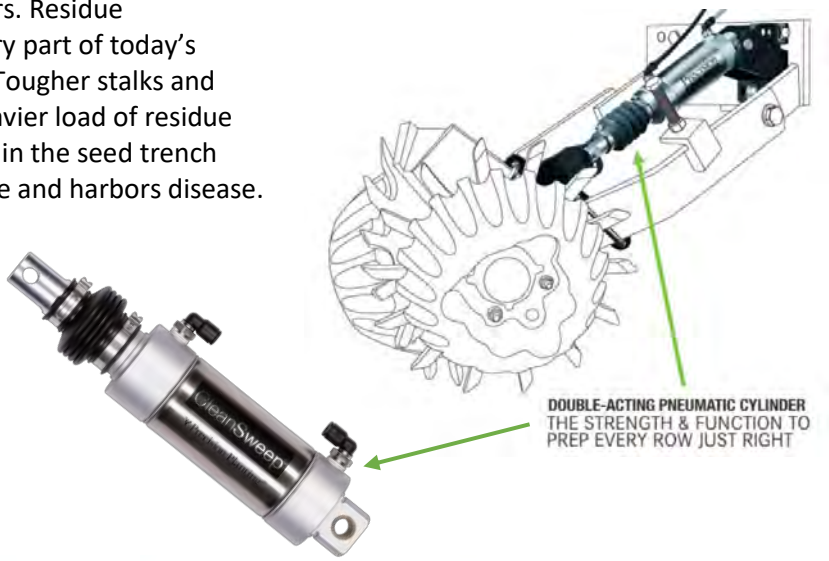


Planting Date: June 8 *Hybrid: AgriGold 641-52VT2* *Population: 36K* *Row Width: 30"* *Rotation: CAC* *Corn Price: $3.75*

CleanSweep® Residue Management Study

Objective: This study evaluates the benefits of planter row cleaners equipped with CleanSweep® cylinders. Residue management has become a necessary part of today's operation to maximize profitability. Tougher stalks and more corn-on-corn acres mean a heavier load of residue that needs to be controlled. Residue in the seed trench competes with seedlings for moisture and harbors disease. CleanSweep® cylinders puts row cleaners right where they need to be, moving residue but not the soil. Continuous adjustments can be made as field conditions change with the cab-mounted controller to easily lift or make more aggressive adjustments.

Figure 1. CleanSweep®



In this study, we use air pressure to adjust CleanSweep® cylinder settings on Yetter 2967 spike row cleaners to allow the ability to change and evaluate the aggressiveness of row cleaners. These settings were then evaluated to study yield and economic advantages.

These agronomic settings consisted of:

1. Lifting the row cleaners 100% to simulate the lack of row cleaners.
2. A "floating" (0# psi) position that allows the row cleaner to ride along top of the soil surface with no air control, lift, or down-pressure.
3. 20# of air down-pressure, just aggressive to wipe crop residue and clods out of the way to lead a clean path ahead of the planter gauge wheels and seed disk openers.

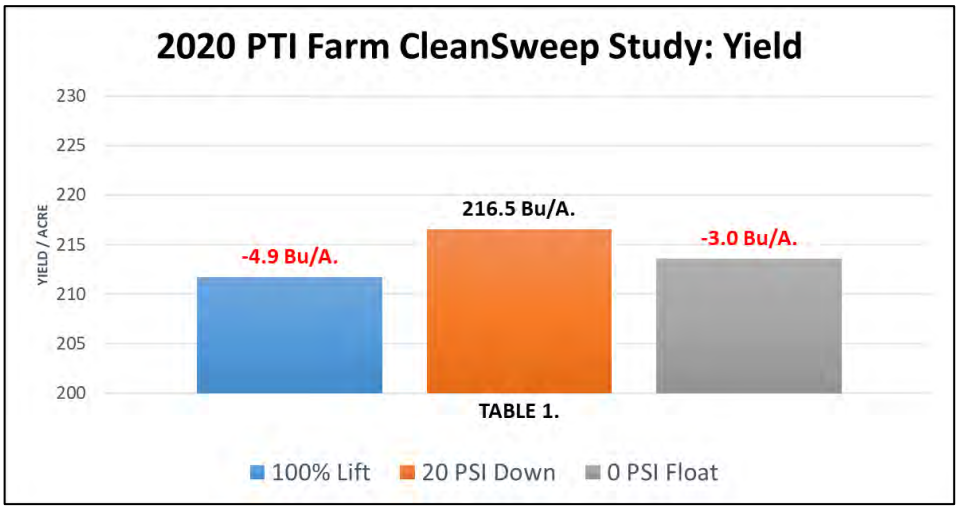
CleanSweep® Residue Management Study Continued

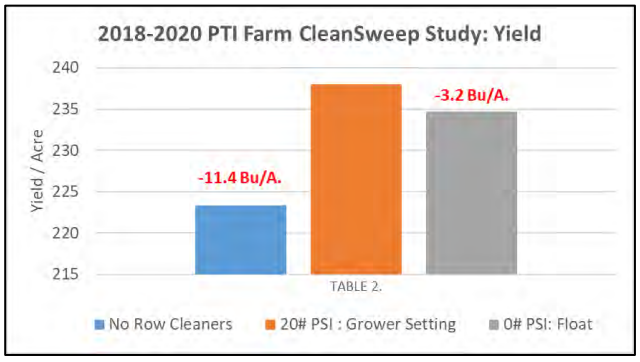
Results: Table 1. illustrates CleanSweep® cylinder yield results from the PTI Farm in 2020. Row cleaners provided a yield benefit of +4.9 Bu/A, compared to the 100% lift setting of no row cleaners. Floating row cleaners proved losses of **-3.0 Bu/A.** compared to the more aggressive setting of 20#psi.

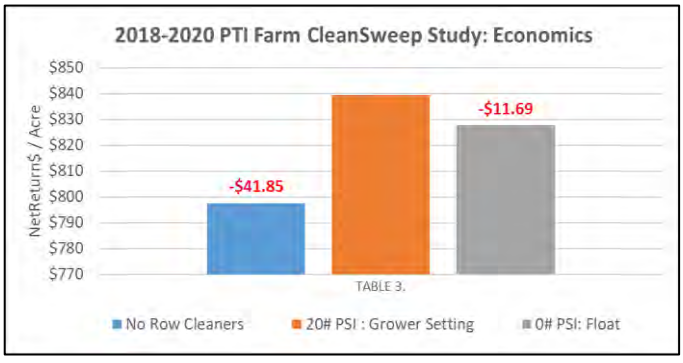
Figure 2. Yetter Row Cleaners with CleanSweep®

Tables 2-3 summarize multi-year average yield and economic gains from CleanSweep® cylinders during the growing seasons of 2018-2020. During this time period, row cleaners equipped with CleanSweep® cylinders at 20#psi down realized +11.4 yield gains compared to using no row cleaners. These gains resulted in gross revenue increases of +$41.85/A.

This same 20#psi setting also improved yields over the 0# float position by +3.2 Bu/A. and consequently improved gross returns by +$11.69/A.







Planting Date: June 8 Hybrid: AgriGold 641-52VT2 Tillage: Conventional Population: 36K Row Width: 30" Rotation: CAC Corn Price: $3.75

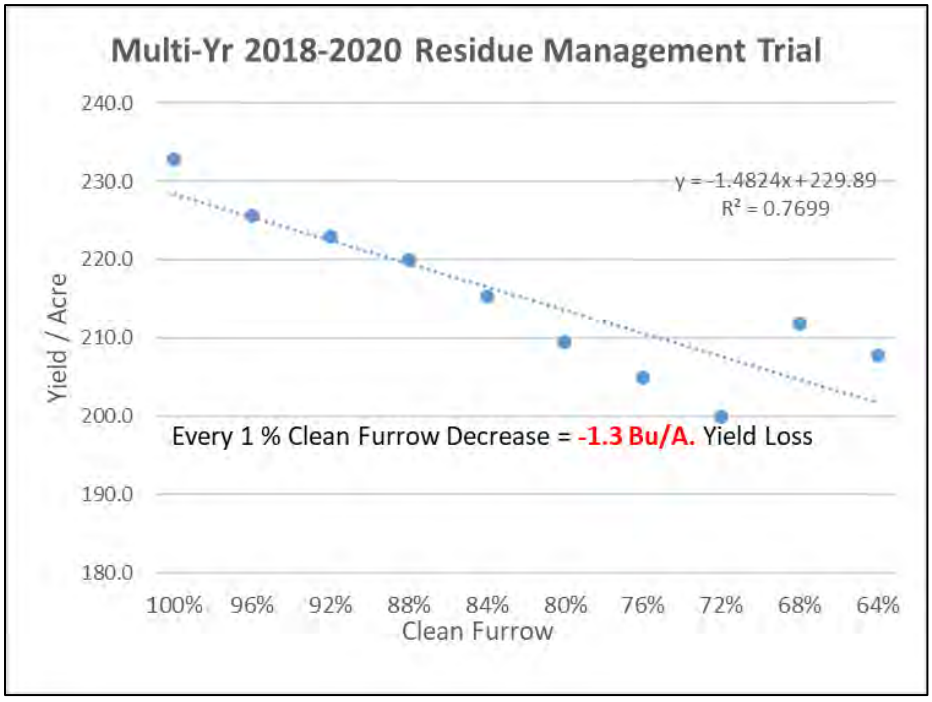
Seed Trench Residue Management Study

Objective: This study evaluates the impact of plant residue in the seed trench at planting (Figure 1). Last year's plant residue in the seed furrow can rob moisture away from the seed, cause air pockets, and create a lower percentage of seed-to-soil-contact. All these factors can delay germination and impact corn yields. This study attempts to quantify corn yield loss from varying percentages of residue on the seed at planting.

Figure 1.

To create a controlled environment, manual inoculation of corn residue was placed directly on corn seed in the furrow at percentages from 100% to 64% clean furrows.

Results: Table 1. illustrates the strong relationship of yield response to residue in the furrow. From 2018 to 2020, data suggests that every 1% loss in clean furrow decreased corn yield by **-1.3 Bu/A.** It should be noted that this controlled study only applies residue directly on the seed, with no other residue being distributed between the seed in the furrow. In typical field settings, residue would be more than likely be distributed throughout the seed furrow, thus increasing the total amount of residue and consequently causing a higher degree of corn yield loss. As a result, this summary of loss should be conservative.



Planting Date: 5/16 *Hybrid: Pioneer 1185AMXT* *Population: 36K* *Row Width: 30"* *Rotation: CAC* *Corn Price: $3.75*

Multi-Year Day of Emergence Study

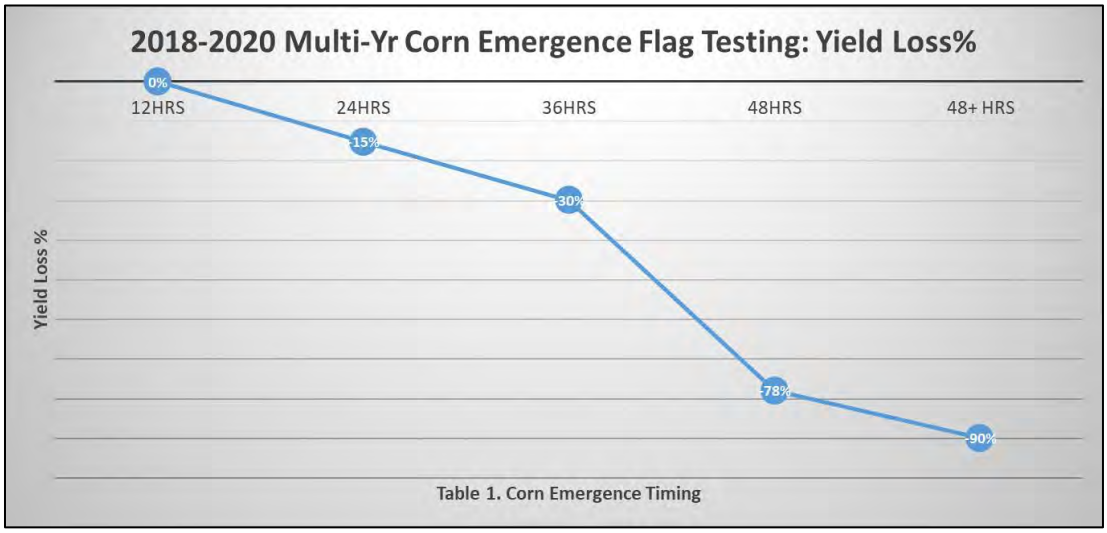
Objective: This 2018-2020 multi-year study illustrates the impact of yield loss when corn plants emerge from the soil surface on an inconsistent basis. Flag testing implementation (Figure 1.) was used to monitor the emergence timing of young plants each year. As corn first started to emerge from the soil surface, flags were placed at five different timings to identify the emergence of all plants within the study.

Figure 1.

Protocol:

12hours =	1st initial plants to emerge
24hours =	Plants that emerged 24 hours later
36hours =	Plants that emerged 36 hours later
48hours =	Plants that emerged 48 hours later
48+hours=	Plants that emerged >48 hours later

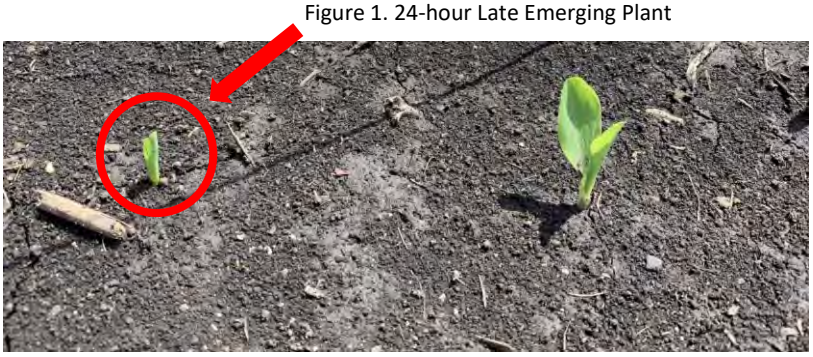
Results: Manual ear checks were completed to calculate potential yield loss from late emerging plants. Table 1. below summarizes yield loss as emergence varied over the 3-year study. Plants that emerge in the first 12 hours are considered the best achievable performance and therefore used at the baseline control with 100% yield potential. As plants emerged 24 hours later, **-15%** yield losses were realized compared to the first emergers. As emergence continued to 36-hour delay, yield fell to **-30%** losses. 48-hour delay in emergence resulted in yield deficits of **-78%** and finally, the latest emergers that came up >48-hours proved devastating losses of **-90%** of total yield.



2020 Crop Year Day of Emergence Study

Objective: This study evaluates the impact of yield loss when corn plants emerge from the soil surface on an inconsistent basis. 12-hour flag testing was implemented to monitor the emergence timing of young plants. As corn first started to emerge from the soil surface, flags were placed at five different timings to identify the emergence of all plants within the study.

Figure 1. 24-hour Late Emerging Plant



Protocol:

12hours = 1st initial plants to emerge

24hours = Plants that emerged 24 hours later

36hours = Plants that emerged 36 hours later

48hours = Plants that emerged 48 hours later

48+hours= Plants that emerged >48 hours later

Results: Table 1. illustrates the occurrence factors of emergence timing at each 12-hour interval. 77% of all plants did in fact emerge in the first 12-hour time period. Plants that emerged just 12-hours later in the 24-hour time period totaled 18% occurrence, while 36hours tallied 2%, 48hours 1% and 48+hours tallied 2%.

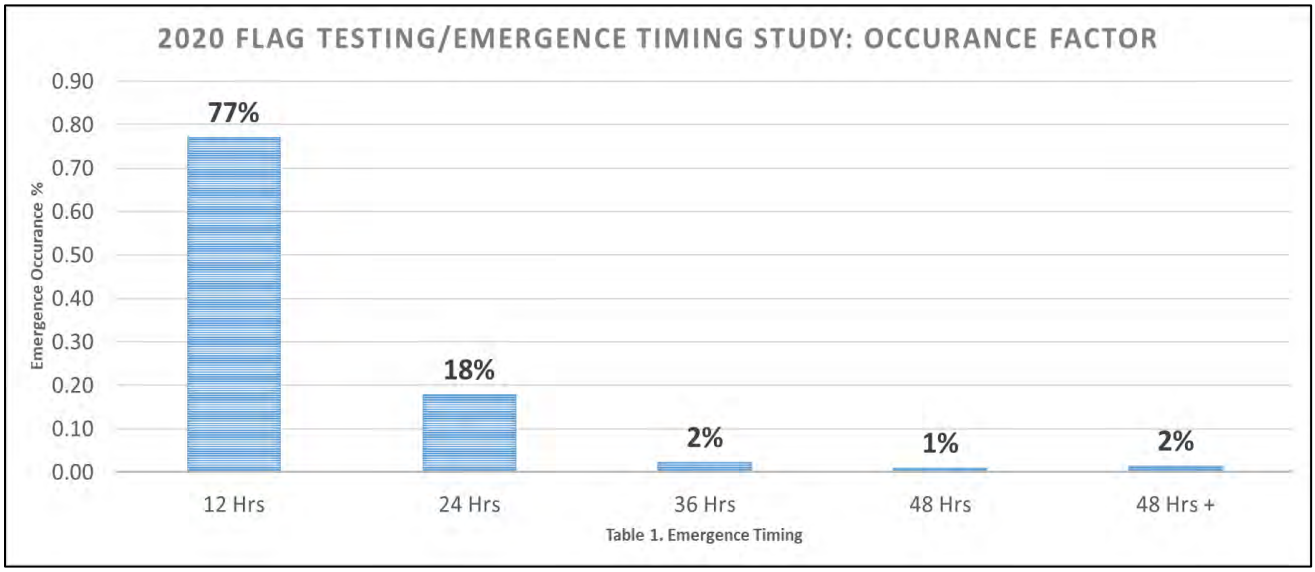


Table 1. Emergence Timing

2020 Crop Year Day of Emergence Study

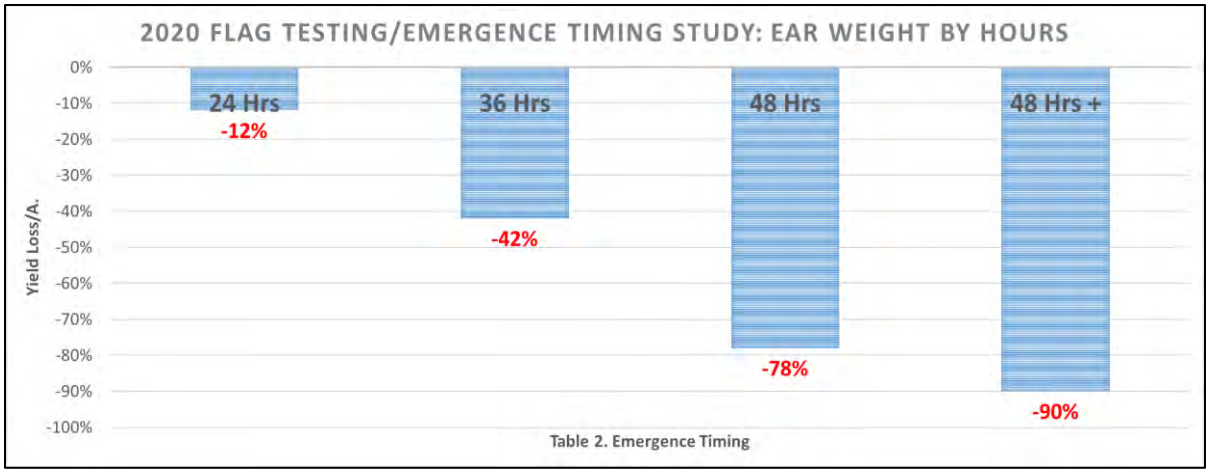
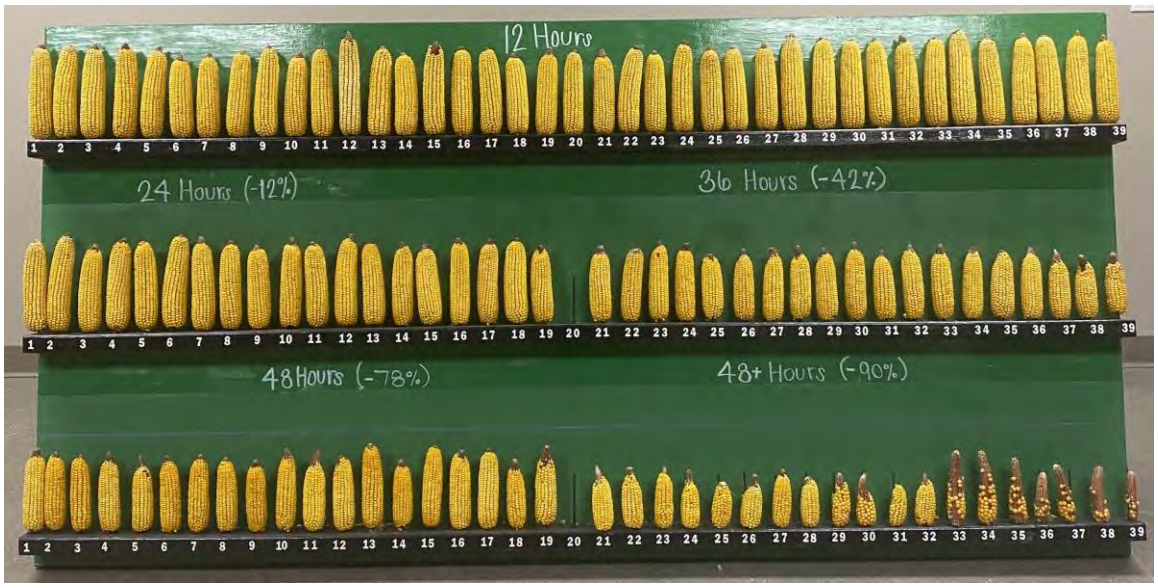


Table 2. reveals the yield losses from each occurrence factor from Table 2. Using 12-hour emergence as the baseline, as corn emerged just 12-hours later yield fell by **-12%. -42%** yield loss occurred at the 36-hour emergence, **-78%** at 48 hours, and finally any plant that came up later than 48 hours resulted in high frequency of barren stalks resulting in **-90%** yield losses.

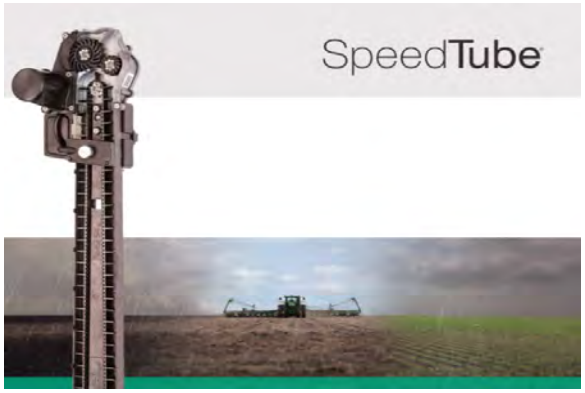
Pictured below is an ear board display of corn ears collected from this 2020 study at each emergence timing interval. The entire top row represents the baseline of 12-hour emergence. As each 12-hour emergence occurs, the ear board displays the ear size and yield loss associated from emerging late and competing with surrounding plants for water, nutrition, and sunlight.



In summary, uniform emergence is critical to maximize corn yield. Any delay of emergence can be significant in reducing ear size and weight and ultimately corn yield. We encourage growers to conduct flag testing/emergence timing studies on or work with a Precision Planting Premier Dealer to monitor individual performance in your fields.

Corn High Speed Planting Multi-Year Study

Objective: To evaluate yield response of planting speeds of 6, 8, and 10 MPH with a SpeedTube® system. This high-speed planting technology takes the place of conventional seed tubes and consists rather of a flighted belt that takes gravity out of the equation. By hand delivering each seed to the furrow, there is no opportunity for seeds to ricochet into the trench. Even at twice normal planting speeds, seed arrives safely at the bottom of the trench, spaced evenly, every time. All entries in this study utilize SpeedTube® technology.



Results: In this multi-year study over 2018-2020, corn yield from planting speeds of 6 to 10 MPH varied only 1.1 Bu/A. between all speed intervals. This yield difference indicates faster planting speeds of 8 to 10 MPH yielded within 99.4% to 99.8% of the slower 6MPH. This data would suggest that growers can faster without sacrificing planter performance. Our experience with high-speed planting at the PTI Farm has been important two-fold. First, high-speed planting has allowed us to be patient and wait for fields to get fit, then we are confident we can plant quickly in those good planting conditions. Second, planting windows can be brief due to frequent rains throughout the spring, allowing high speed planting to achieve more acres planted daily within these windows.

Planting Date: May 20 *Hybrid: DKC 64-34* *Population: 34K* *Row Width: 30”* *Rotation: CAB* *Corn Price: $3.75*

Corn Closing Wheel/Tillage System Study

Objective: To evaluate the performance of five different closing systems in three different tillage practices. Closing wheels are designed to close the seed trench, eliminate sidewall compaction/smearing, remove air pockets, all at the same time achieving good seed-to-soil contact. This study evaluates five distinct types of closing wheel systems in strip, vertical, and no-till situations.

FurrowForce® Closing and Sensing/Control System:

Advantages: Lifts and fractures sidewall compaction/smear
2nd stage stitching, removal of air pocket
automatic sensing of soil variability
Automatic Control to ensure proper settings

Single Rubber/Yetter Cast Spike Closing System:

Advantages: Lifts and fractures sidewall compaction/smear
Combination of sealing and aggressive Fracture

Disadvantages: Spikes can be aggressive

Dual Yetter Poly Twister™ Spike Closing System:

Advantages: Lifts and fractures sidewall compaction/smear
Center ring acts as depth maintainer

Disadvantages: Lightweight wheels require increased tension

Single Rubber/Yetter Poly Twister Spike Closing System:

Combination of above two systems for variable soils

Corn Closing Wheel/Tillage System Study

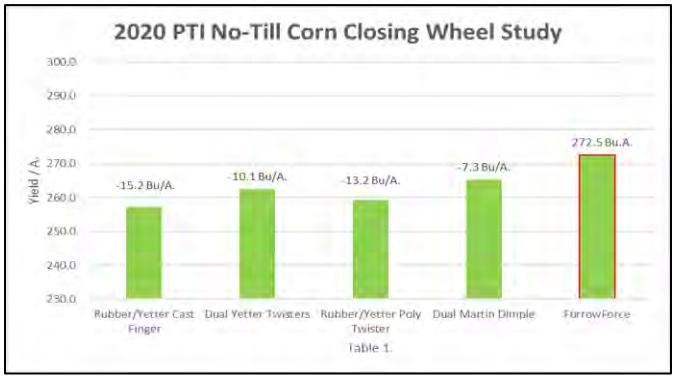
Dual Martin-Till® Dimple Spike™ Closing System:

Advantages: Lifts and fractures sidewall compaction/smear

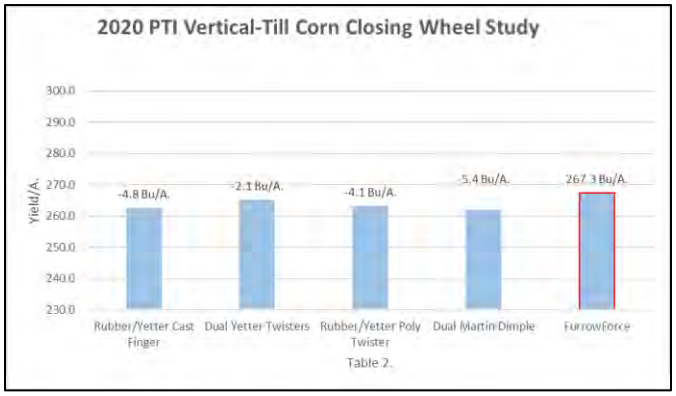
Versatile heavy wheel, great for reduced tillage

Depth Maintaining

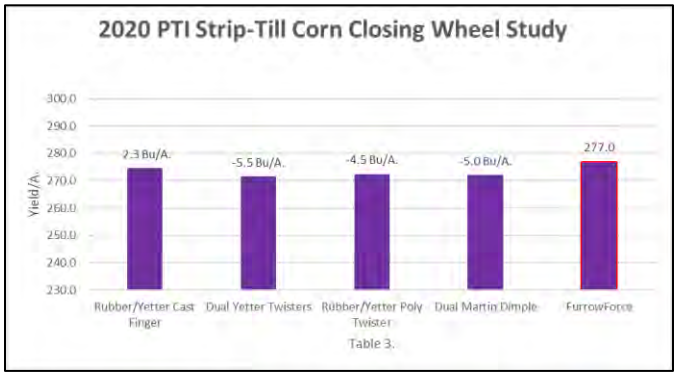
Disadvantages: Extra weight can be aggressive



No-Till Results: The FurrowForce® automated sensing and control closing system in a no-till environment shined with positive yield gains over all other closing systems. All the non-sensing/control systems incurred yield losses of **-7.3** to **-15.2 Bu/A.** (Table 1.) Corn priced at $3.75/Bu. equates to additional returns of +$27.38 to +$57.00/A. for the FurrowForce® system.



Vertical-Till Results: The FurrowForce® automated sensing and control closing system in vertical-till environments also proved positive yield gains over all other closing systems. All the non-sensing/control closing systems incurred yield losses of **-2.1** to **-5.4 Bu/A.** (Table 2)**.** Corn priced at $3.75/Bu., equates to additional returns of +$7.88 to +$20.25/A. for the FurrowForce® system.



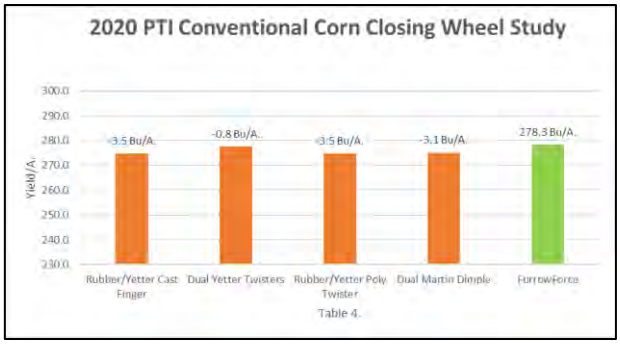
Strip-Till Results: The FurrowForce® automated sensing and control closing system in strip-till environments also proved positive yield gains over all other closing systems. All the non-sensing/control closing systems incurred yield losses of **-2.3** to **-5.5 Bu/A.** (Table 3)**.** Corn priced at $3.75/Bu., equates to additional returns of +$8.63 to +$20.63/A. for the FurrowForce® system.

Precision Planting®

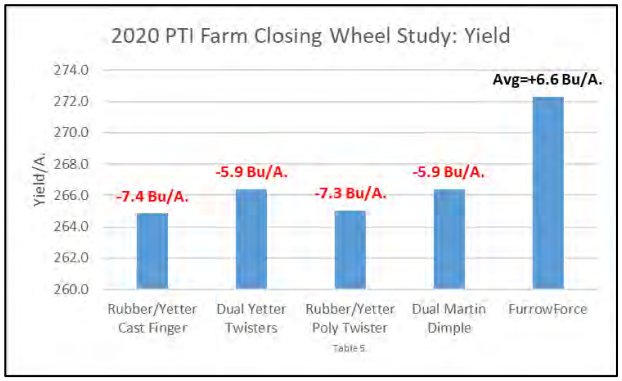
2020 PTI Results

Corn Closing Wheel/Tillage System Study

Conventional Tillage Results: The dual Yetter Poly Twister proved highest yields in conventional tillage with +0.8/A. advantage over the FurrowForce® automated sensing and control closing system (Table 3). All other non-sensing/control closing systems incurred yield losses of **-3.1** to **-3.5 Bu/A.**, thus resulting into additional returns of +$11.63 to +$13.13/A. for the FurrowForce® system.

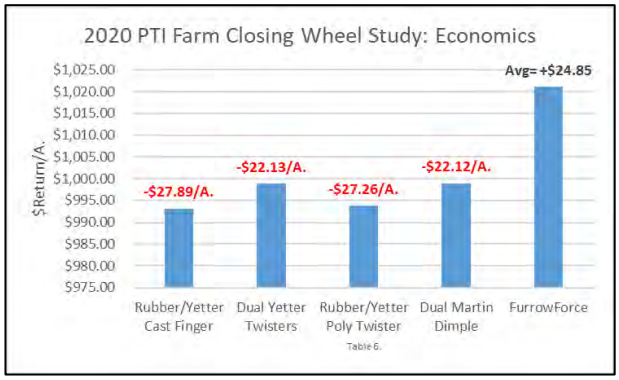


Tables 5-6 highlights non-sensing closing wheels suffered average yield losses of **-6.6 Bu/A.** resulting in economic losses averaging **-$24.85/A.** in comparison to the FurrowForce® sensing and auto-control system.



In summary, for years planters have struggled with closing systems with manual settings that offered the inability to account for and change for varying soil conditions.

Today, we are excited that technology finally exists where farmers can use sensing technology on the planter row unit to determine how much force is needed on closing systems to address soil variability. By using a robust 2-stage closing system, load pin and sensing architecture, partnered with a 20|20® monitor, farmers can be confident of closing the seed trench, eliminating sidewall compaction/smearing, and removing air pockets all while planting through various seedbed conditions on a pass-to-pass basis.



Planting Date: 5/5 *Hybrid: DKC 65-95* *Population: 36K* *Row Width: 30"* *Rotation: CAB* *Corn Price: $3.75*

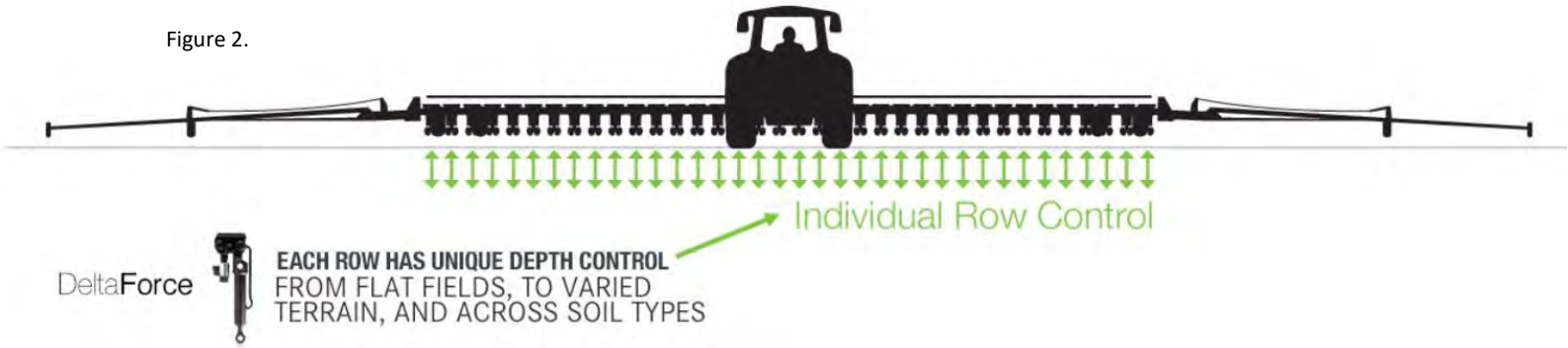
DownForce Management Study

Objective: Planter row unit downforce is a common agronomic issue that often goes unaddressed. This study evaluates yield impact of implementing proper downforce compared to too light or too heavy row unit settings. When downforce matches field conditions, the depth of planting is consistent and correct. Too light of row unit downforce causes planting depth to shallow up, potentially placing seed in dry soil, creating poorly rooted plants that struggle for water and nutrients. Conversely, too much downforce can lead to furrow side-wall compaction also creating an environment that can cause limited plant access to water and nutrients.

Figure 1. DeltaForce® Cylinder

DeltaForce® system replaces the springs or air bags on your planter with hydraulic cylinders (Figure 1). It automatically increases or reduces weight with military precision, on each row individually. When one row encounters conditions different than another (wheel tracks, old roadbeds, clay knobs, headlands, etc.), each will adjust independently (Figure 2). Row by row, foot by foot, and seed by seed, you produce an environment that fosters uniform germination, optimum growth and maximum yield.

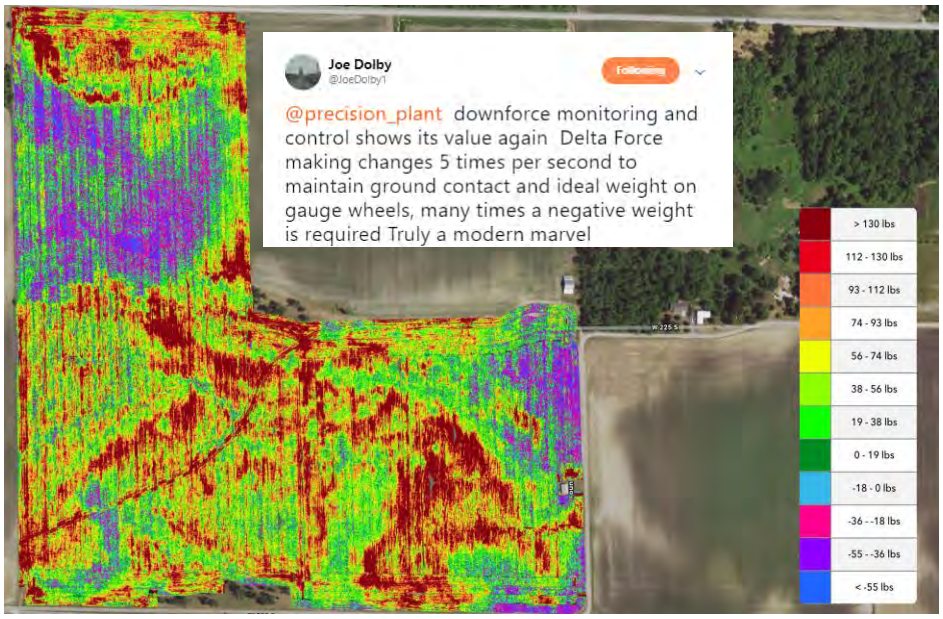
Figure 2.

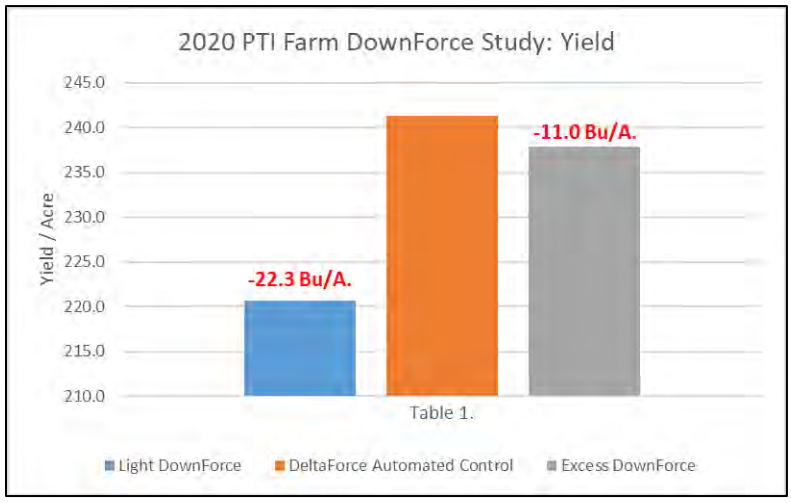


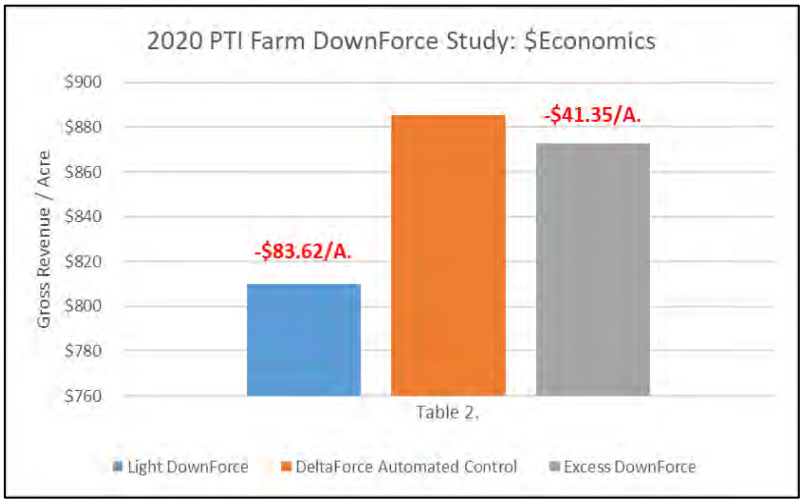
DownForce Management Study Continued

Results: Table 1. illustrates the yield response of DeltaForce® automated control (Custom 120#) compared to excess and too light of downforce settings. Too light of downforce (175# lift, 100# down) resulted in the largest losses of the study with yield decreases of **-22.3 Bu/A.**, while excess downforce (550# down, 100# up) offered losses of **-11.0 Bu/A.**

Table 2. reveals the economics of the automated downforce system. Light downforce suffered the largest overall losses of **-$83.62/A.,** while excess downforce resulted in near half the losses at **-$41.35/A.**







DownForce Management Study Continued

Table 3. illustrates multi-year downforce yield results over the time period of 2018 – 2020 at the Precision Planting PTI Farm. During these growing seasons, light downforce resulted in yield losses of **-18.6 Bu/A.** compared to automated control with DeltaForce® system. Excess settings resulted in losses as well, however at only **-6.4 Bu/A.**

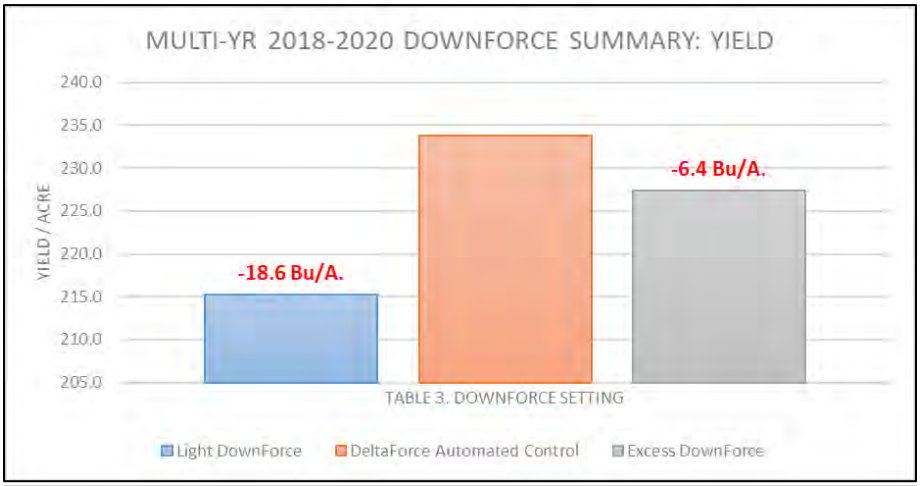
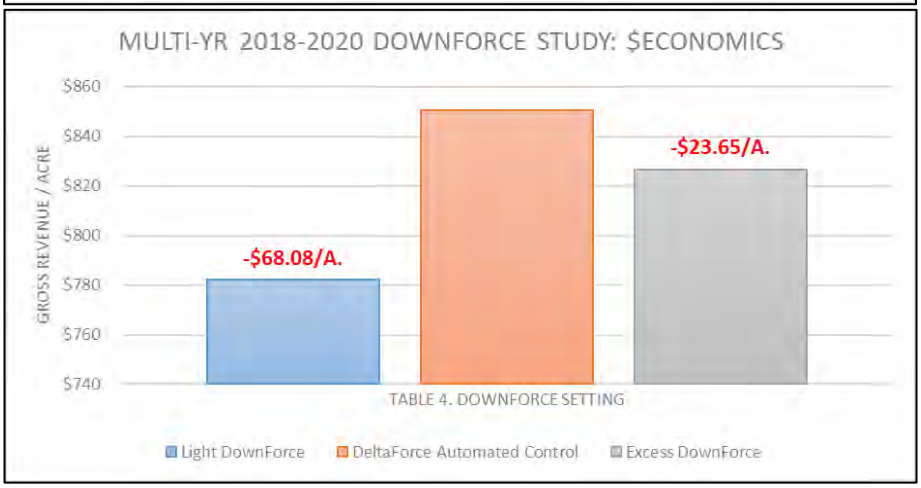


Table 4. depicts the same multi-year time period, but economics rather than yield. Over 2018-2020, light downforce resulted in economic losses of **-$68.08/A.** and excess downforce of **-$23.65/A**.



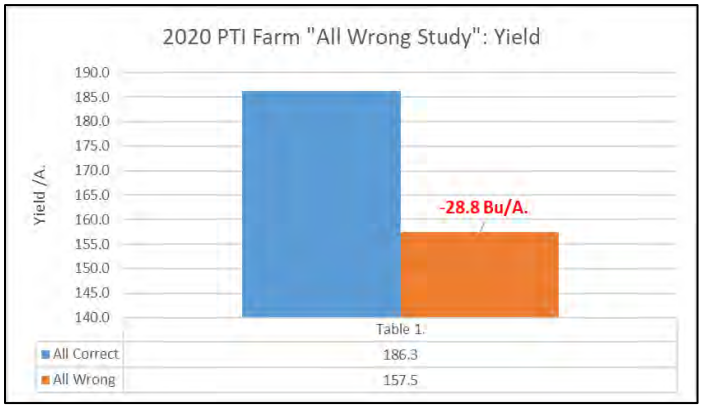
In summary, when downforce matches field conditions, the depth of planting is consistent and correct. By measuring with the DeltaForce® system, farmers can react and take control to ensure proper downforce and eliminate yield and economic losses.

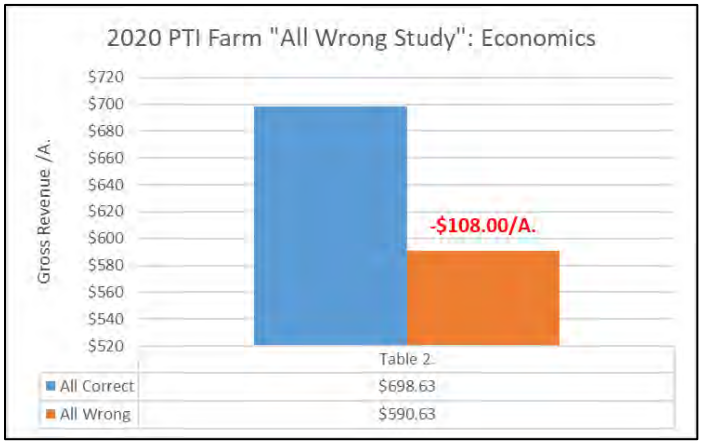
Planting Date: June 11 *Hybrid: AgriGold 641-54VT2RIB* *Population: 36K* *Row Width: 30”* *Rotation: CAC* *Corn Price: $3.75*

Planter "All Wrong Study"

Objective: This planter trial is designed to simulate yield and economic effects when a grower gets downforce, residue manager settings, and singulation incorrect on the planter all at the same time. For this study we implemented light downforce, "goof" plates to achieve 95% singulation, and removed the use of residue managers.

Results: Table 1. reveals "All Wrong" planter settings caused yield losses of **-28.8 Bu/A.** Table 2. calculates economic losses of **-$108.00/A.** when all three planter settings are incorrect. For more information on individual performance of these attributes, please see pages 29-31 for down force management, pages 19-21 for residue management trials, and page 13 for singulation studies.





Planting Date: May 27 *Hybrid: AgriGold 641-54VT2RIB* *Population: 36K* *Row Width: 30"* *Rotation: CAC* *Corn Price: $3.75*

Water Management and Recycling Study

Objective: When the Precision Technology Institute was acquired back in the Fall of 2017, we quickly learned that our new research site was a "wet farm". We learned there was very little field tile to drain our soils to prevent yield losses. Our focus then turned to adding and installing field tile, but problems occurred with that idea as the farm had no good outlet to release the water. Interstate-55 on the west side of the farm prevents outletting water through the present road system and to make matters worse, the City of Pontiac resides on the east side of the farm with having no good outlet to release water without draining into municipal sewer drains.

Figure 1. Drainage Issues at PTI

Knowing that we ultimately needed to add field tile to our farm to achieve high yields and consistent research trials, we investigated on how to create and sustain our own farm outlet to capture water. In the winter of 2018, we began the construction of a new "reservoir" that would be a large body of water designed to act as an outlet for our field tile installed on the farm. This reservoir is nearly 2.5 acres in size and dug near 25' deep to create enough volume to hold as much water as possible. It was dug on the lowest elevation of the farm, typically where water would stand and remove crops. This size of reservoir was designed as such to act as an outlet for 80 tillable acres. We also chose this design as an 80-acre farm is quite common in size and relatable to most farmers. As we built this system, it was our intention from day one to keep this project practical, realistic, and purposely as a system that many farmers could employ on their farms that could also have drainage issues but no outlet currently.

Figure 2. Digging of "Farm Reservoir"

Figure 3. Farm Reservoir Installation

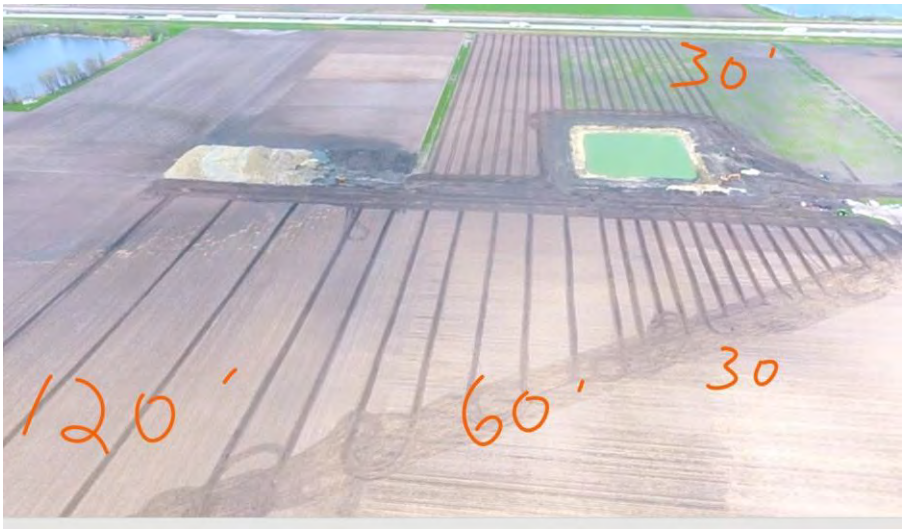
Water Management and Recycling Study Continued

Once the reservoir was complete, we then began the focus on water capture, an especially important piece to this project. To accomplish this, field tile was installed so that rainwater could be collected from entering the soil profile and filtered through our new field tile drainage system.

Figure 4. ADI® V-Plow Tile Installation

Figure 4. illustrates phase 1 of our project included field tile V-Plowed on mostly 30’ or 60’ patterns, but some 120’ tile was installed to compare agronomic yield and economic returns of various sizes of field tile (Figure 5). It is our intention and desire to monitor this tile performance over the next two decades to understand how tile performs and how long it takes to pay for the system economically.

Figure 5. 30’, 60’, 120’ Tile Patterns



Water mains were installed around the farm reservoir to then collect and direct water from our new tile system into a station designed to “lift” water from the drainage system and deposits water to fill the reservoir.

ADI Ag Drainage Inc.

Water Management and Recycling Study Continued

The water in the farm reservoir is held in place until July and August where it is available to be "recycled" for irrigation purposes (Figure 6). The recycling of rainwater in this project is truly unique and offers sustainability advantages for farmers that have both drainage issues and the lack of water for irrigation of crops.

Figure 6. Completed Farm Reservoir

An important attribute to the PTI Farm's Water Management Project is the ability to recycle rainwater. Since field tile is collecting and depositing excess rainwater into the reservoir, millions of gallons of water are available to use as irrigation. The crop is fed by delivery from drip tape irrigation. This method of irrigating a crop uses a NETAFIM™ drip tape with small pressure regulated emitters evenly spaced at 24" apart. Drip tape in this study is not sub-surface irrigation, rather the team at PTI installed this system on the soil surface to demonstrate how the system works. Multiple agronomic studies have been implemented as a result of this study in the 2020 Yield Summary Report.

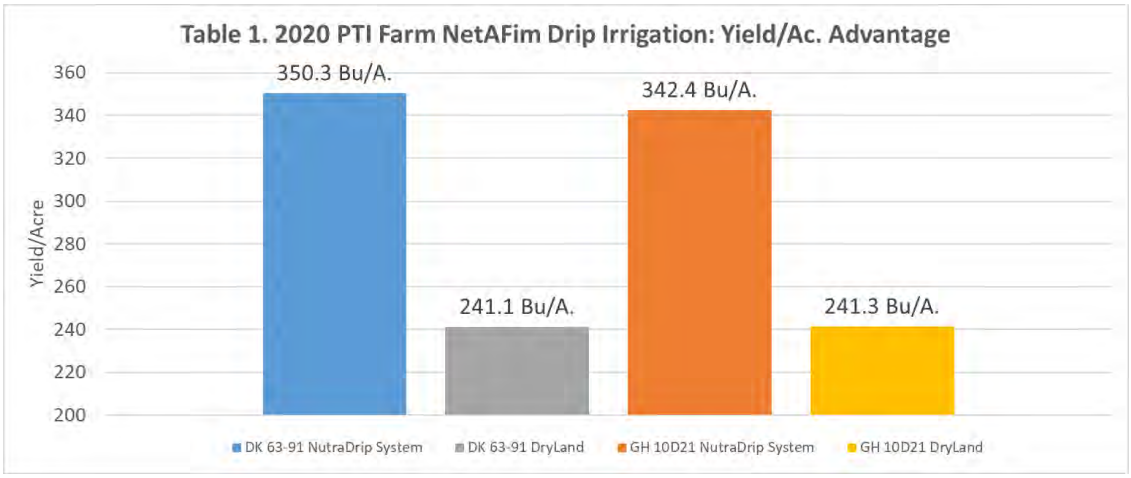
Figure 7. NETAFIM™ Drip Tape

NETAFIM™
GROW MORE WITH LESS

NETAFIM™ Irrigation Study

Objective: This study evaluates NETAFIM drip tape irrigation designed by NutraDrip Irrigation Systems and its' ability to feed corn with water and nutrients for high yield potential. This method of irrigating a crop uses NETAFIM drip tape with small pressure regulated emitters evenly spaced at 24" apart. Drip tape in this study is not sub-surface irrigation, rather the team at PTI installed this system on the soil surface to demonstrate how the system works, to growers who came to visit the PTI Farm. Water was accessed from our new water recycling management program. See pages 33-35 of the 2020 PTI Yield Summary Report for more details on this project.

Results: Findings illustrate that drip irrigation resulted in average corn yields of 350.3 to 342.4 Bu/A., an average +105.2 Bu/A. (between the two hybrids tested) increase over the non-irrigated control. 9" of rain was applied through drip irrigation throughout the growing season from June - September. Fertigation was also implemented to apply 119lbs of additional UAN 32% (totaling 299#), Boron, Copper, Sulfur, Plant Food. All treatments incurred additional expenses of $121.82/A., as well as $70/A. in irrigation costs.



After cost of fertigation and additional yield gains of +105.2 Bu/A., the NETAFIM irrigation system designed by NutraDrip Irrigation Systems resulted in additional net economic gains of +$202.68/A.

NETAFIM™ GROW MORE WITH LESS

NutraDrip Irrigation Systems

Planting Date: 4/27 *Hybrid: DKC 63-91/GH 10D21* *Population: 37K* *Row Width: 30"* *Rotation: CAB* *Corn Price: $3.75*

Irrigation Moisture Probe Study

Objective: This study evaluates the use of Sentek moisture probes to monitor soil moisture to determine when irrigation scheduling should be turned on and off. Sentek moisture probes are used in tandem with NETAFIM irrigation drip tape equipped with small pressure regulated emitters evenly spaced at 24" apart.

Sentek

NETAFIM™ GROW MORE WITH LESS

NutraDrip Irrigation Systems

Precision Planting

2020 PTI Results

Irrigation Moisture Probe Study

Sentek moisture probes were installed and monitored throughout the growing season at depths of 0" to 36". Graphs were plotted to signify how much soil moisture was in the soil profile and more importantly, where the corn plant was using the water. These graphs were helpful to determine "optimum or full" and "recharge or stress" levels.

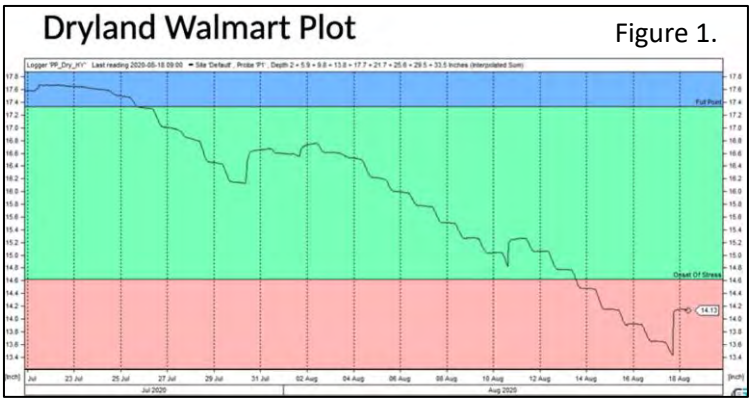


Figure 1.

Results: Figure 1. illustrates the dryland corn with no irrigation. Notice how soil moisture levels crashed throughout July and August and ultimately indicated high stress levels.

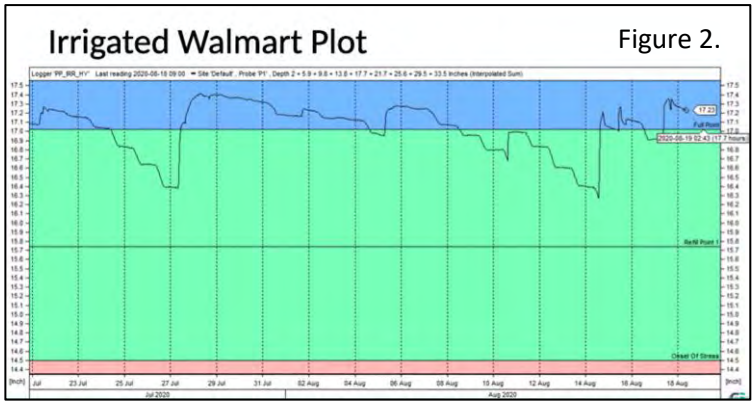
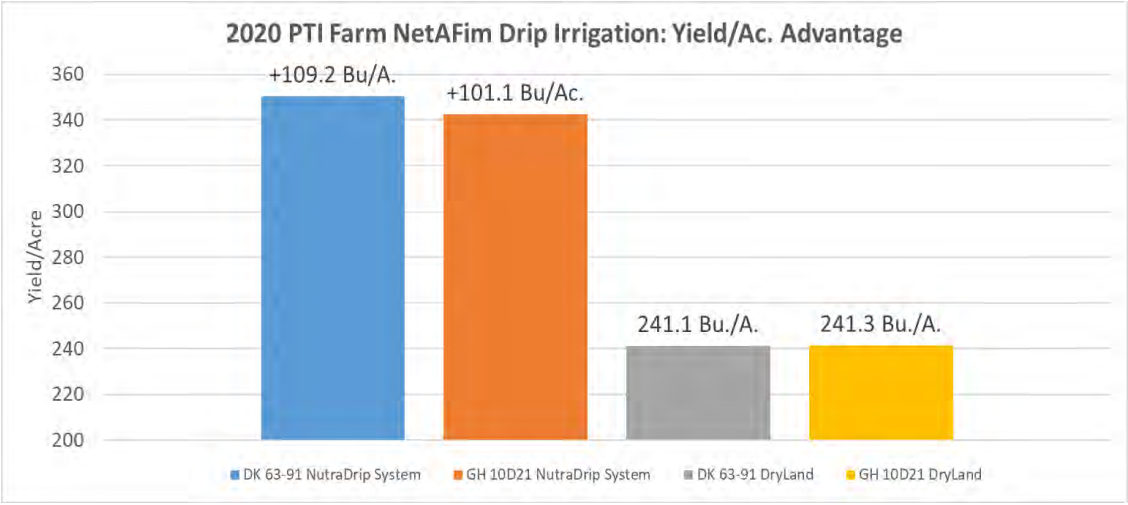


Figure 2.

However, Figure 2. indicates a much different scenario in the irrigated portion of the study with soil moisture near the "optimum or full" point most of the growing season.

Table 1. illustrates that drip irrigation resulted in average corn yields of 350.3 to 342.4 Bu/A., a +105.2 Bu/A. increase over the non-irrigated control. Sentek moisture probes were a critical component to these high corn yields. Having the ability to measure soil moisture levels to help predict irrigation scheduling will be important as we irrigate our crops at the PTI Farm in the future.



Planting Date: 4/27 *Hybrid: DKC 63-91/GH 10D21* *Population: 37K* *Row Width: 30"* *Rotation: CAB* *Corn Price: $3.75*

Conventional Till Irrigated Continuous Corn High Yield Study

Objective: In 2020 we took the opportunity to use the water management and recycling system at the PTI Farm to act as host to one of our many high yield management trials on the farm. Our goal was to learn how to implement high yielding programs and what it takes to drive corn yield, knowing that we would have sufficient drainage and ample irrigation water throughout the growing season. The following was our corn high yield program recipe in a continuous corn rotation:

FurrowJet Center: At-Plant

- 2 Gal/A. Nachurs FirstDown
- 1 Pt/A. QLF Kelpak
- 1.5 Pt/A. AgroGold+SEATONIC
- 1.25 Gal/A. Nutrient Mgt Specialists Whole Shot
- 2 Gal/A. Nutrient Mgt Specialists Compost Tea

FurrowJet Wing: At-Plant

- 96oz Ocean Blue Ag NutriShield
- 2 Gal/A. Nutrient Mgt Specialists Sea-Phos
- 3 Gal/A. Nachurs FirstDown
- 4 Gal/A. Water

Conceal® Dual Band: At-Plant

- 4 Gal/A. Ammonium ThioSulfate
- 4 Gal/A. Nachurs K-Fuse
- 2 Gal/A. QLF Boost
- 2 Qt/A. Nachurs 10% Boron
- 30 Gal/A. UAN 32%

V8 Side-Dress

- 30 Gal/A. 32% UAN
- 6 Gal/A. PowerPro Ocean Blue Ag

Foliar: 275 GDU's

- 1Qt Nachurs FinishLine
- 1 Gal/A. Nachurs TripleOption
- 64oz Ocean Blue Ag Elevation
- 2 Gal /A. QLF Boost

Foliar: V10

- 2 Gal/A. QLF Boost
- 1 Gal/A. GrainGain Ocean Blue Ag

V10-V12 Fertigation

- 10 Gal/A. 32% UAN

V12-Tassel Fertigation

- 7.5 Gal/A. 32% UAN

After Tassel Fertigation

- 7.5 Gal/A. 32% UAN

Foliar: Tassel 1

- 13.7oz/A. Miravis Neo Syngenta
- 2 Gal/A. QLF Amino-15
- 1 Gal/A. Nachurs FirstDown
- 1 Gal/A. Nachurs Balance

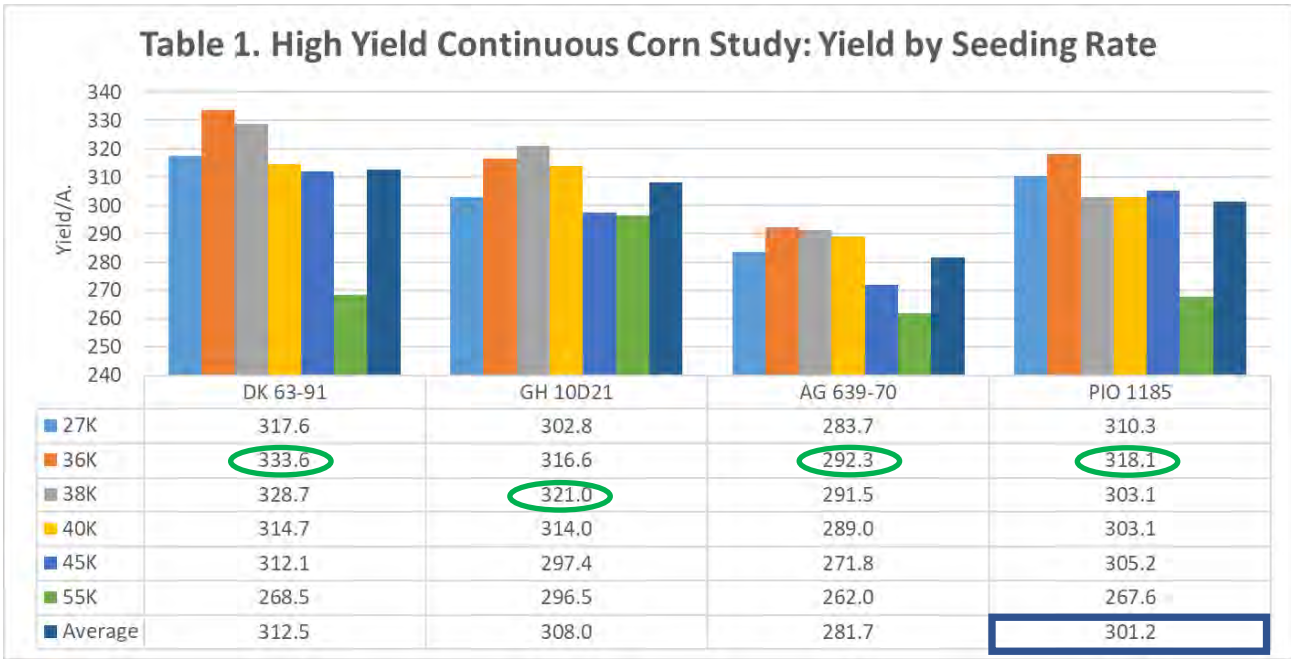
Foliar: Tassel 2

- 13.7oz/A. TrivaPro Syngenta
- 1 Gal/A. QLF Boost

Conventional Till Irrigated Continuous Corn High Yield Study

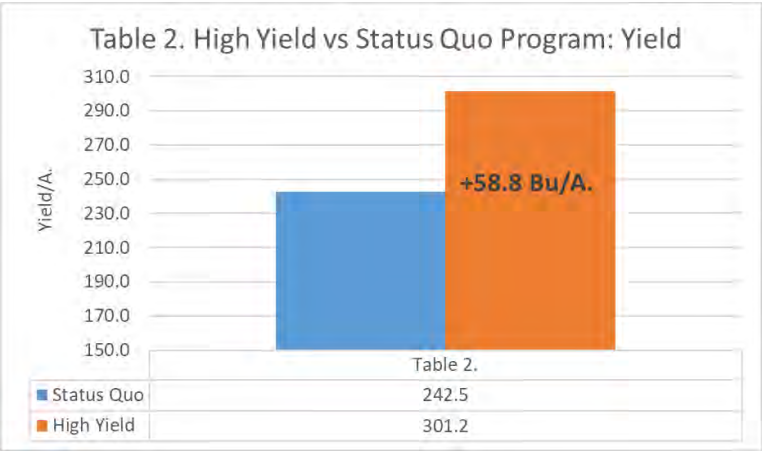
Four corn hybrids were planted in this high management yield study, including Dekalb 63-91, Golden Harvest 10D21, AgriGold 639-70, and Pioneer 1185 at seeding rates of 27K, 36K, 38K, 40K, 45K, and 55K.

Table 1. illustrates the average yield for all four corn hybrids tallied 301.2 Bu/A., with three of the four hybrids each averaging over 300 Bu/A.. Dekalb 63-91 captured the highest yield at 333.6 Bu/A.



	DK 63-91	GH 10D21	AG 639-70	PIO 1185
27K	317.6	302.8	283.7	310.3
36K	333.6	316.6	292.3	318.1
38K	328.7	321.0	291.5	303.1
40K	314.7	314.0	289.0	303.1
45K	312.1	297.4	271.8	305.2
55K	268.5	296.5	262.0	267.6
Average	312.5	308.0	281.7	301.2

Table 2. reports the overall yield advantage for the high yield program at +58.8 Bu/A. The status quo treatment (control) for this study received all seeding rates and treatments, with the exception of all at-plant FurrowJet® center/wing and Conceal® system treatments.



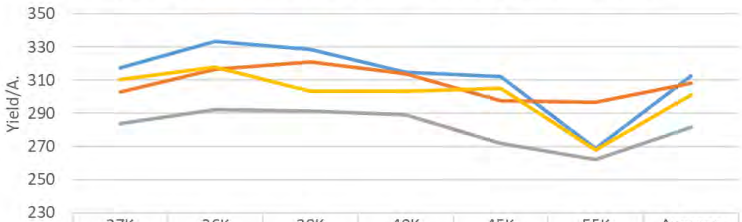
Conventional Till Irrigated Continuous Corn High Yield Study

Table 3. illustrates the high yield corn entries by seeding rate. Since all the entries received 9.8" of rain via drip irrigation, seeding rates were evaluated from 27K to 55K pops. Surprisingly, even with irrigation, highest yields were obtained at 36K for DK 63-91, AgriGold 639-70, and Pioneer 1185. Golden Harvest 10D21 topped out at 38K, having a more fixed or determinate ear. As seeding rates were pushed to 40K, 45K, and 55K, yields decreased for all four corn hybrids. In fact, 55K was the lowest yield for ALL four corn hybrids.

High Yield Corn Summary:

- Highest yield obtained was 333.6 Bu./A. with all four hybrids averaging 301.2 Bu.A.
- Pushing seeding rates past 38K did not result in higher yields, in fact 55K pops was lowest yield for all hybrids
- High yield treatments tallied +58.5 Bu/A. gains. Even with additional costs of $120/A., these yield gains resulted in economic gains of $78.19/A.

Table 3. High Yield Cont.Corn Trial: Yield by Seeding Rate



	27K	36K	38K	40K	45K	55K	Average
DK 63-91	317.6	333.6	328.7	314.7	312.1	268.5	312.5
GH 10D21	302.8	316.6	321.0	314.0	297.4	296.5	308.0
AG 639-70	283.7	292.3	291.5	289.0	271.8	262.0	281.7
PIO 1185	310.3	318.1	303.1	303.1	305.2	267.6	301.2

Strip-Till Irrigated Corn High Yield Management Study

Objective: This study evaluates the yield and economic impact of implementing a strip-till irrigated high yield management program in a corn soybean rotation. Our goal was to learn how to implement high yielding programs and what it takes to drive corn yield, knowing that we would have ample irrigation throughout the growing season. This study's main objective was high yield potential, however, we developed a protocol to ultimately evaluate at-plant nutritional applications in FurrowJet® center, FurrowJet® wings, and dual band Conceal® system placements. To implement this protocol, we isolated these as individual treatments, but all received the foliar and side-dressing applications to help drive yield potential. The following served as our high yield protocol management program:

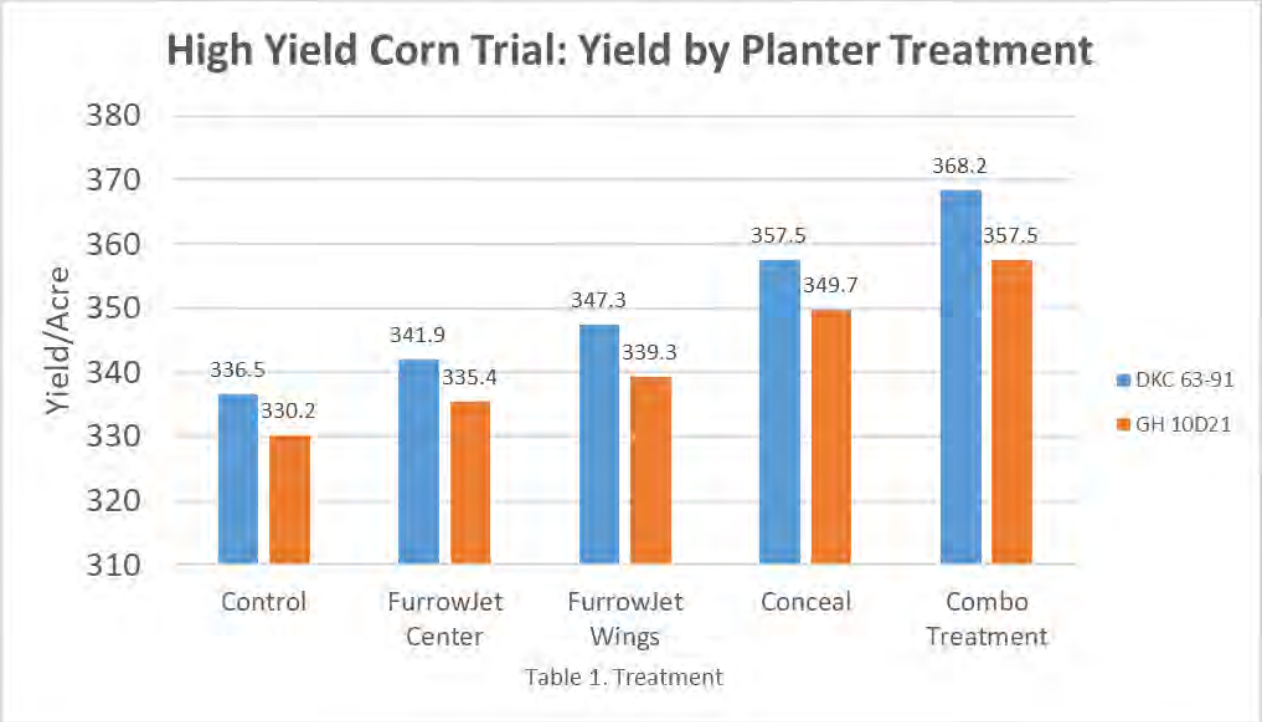
At-Plant Isolated Individual Treatments:

FurrowJet Center: At-Plant • 1 Gal/A. QLF Boost • 1.5 Pt/A. AgroGold+SEATONIC	**FurrowJet Wing: At-Plant** • 1Pt/A. QLF Kelpak • 3 Gal/A. QLF 7-21-3 MKP • 2 Gal/A. Water	**Conceal® Dual Band: At-Plant** • 4 Gal/A. Ammonium ThioSulfate • 2.5 Gal/A. Nachurs K-Fuse • 3 Gal/A. QLF Boost • 2 Qt/A. Nachurs 10% Boron • 30 Gal/A. UAN 32%
Foliar: 275 GDU's • 1Qt Nachurs FinishLine • 1 Gal/A. Nachurs TripleOption • 2 Gal /A. QLF Boost	**V8 Side-Dress** • 30 Gal/A. 32% UAN • 2.5 Gal/A. Nachurs K-Flex • 3 Gal/A. Ammonium ThioSulfate	
Foliar: V10 • 3 Gal/A. QLF Amino-15 • 1 Gal/A. Nachurs TripleOption • 1Qt/A. Nachurs FinishLine	**V10-V12 Fertigation** • 10 Gal/A. 32% UAN	**V12-Tassel Fertigation** • 7.5 Gal/A. 32% UAN
Foliar: Tassel 1 • 13.7oz/A. Miravis Neo Syngenta • 3 Gal/A. QLF Amino-15 • 1 Gal/A. Nachurs FirstDown • 1 Gal/A. Nachurs Balance	**Foliar: Tassel 2** • 13.7oz/A. TrivaPro Syngenta • 1 Gal/A. QLF Boost • 1Pt/A. Nachurs Humi-Flex FA	**After Tassel Fertigation** • 7.5 Gal/A. 32% UAN

Strip-Till Irrigated Corn High Yield Management Study

Table 1. illustrates the average yields of DeKalb 63-91 and Golden Harvest 10D21 in each of the five individual treatments. DeKalb 63-91 obtained the highest yield in this study at 368.2 Bu/A. Golden Harvest 10D21 tallied its high yield at 357.5 Bu/A.

These excellent yields were possible as a result of our NETAFIM irrigation drip tape designed by NutraDrip Irrigations Systems. 9.0" of irrigation water was applied to this study to offset the lack of rainfall. These high yields are the largest tallied to date at the PTI Farm and we look forward to pushing this number even higher in the future!



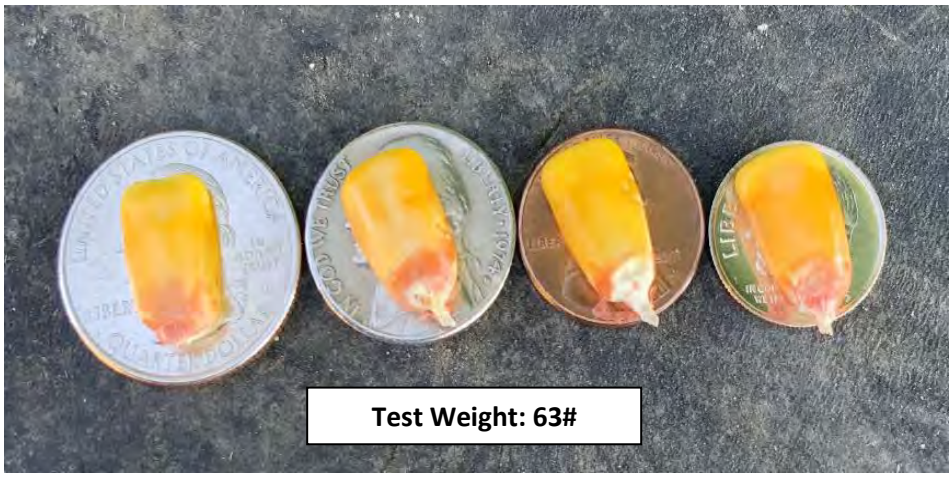
368.2 Bu/A.

NETAFIM™ GROW MORE WITH LESS

NutraDrip Irrigation Systems

Strip-Till Irrigated Corn High Yield Management Study

With any high yield program, a large factor in contribution to yield itself is overall weight of the grain. The pictures below illustrate the kernel size of DeKalb 63-91 on top of a quarter, nickel, penny, and dime. Fertigation along with a solid foliar program allowed the ability to keep corn healthy and green all season long, even to harvest.



This plant health advantage packed kernels with starch which inevitably led to large kernel size along with heavy test weight. It was very common to have load tickets from the grain terminal with 61-63# test weight corn.

Non-irrigated corn demonstrated crop stress numerous times throughout the growing season. The picture on bottom illustrates the “die and dry” effects that many non-irrigated corn plots suffered through at the PTI Farm. After cost of fertigation and additional yield gains of +105.2 Bu/A., net economic gains of +$202.68/A. were realized as a result of the high yield management.

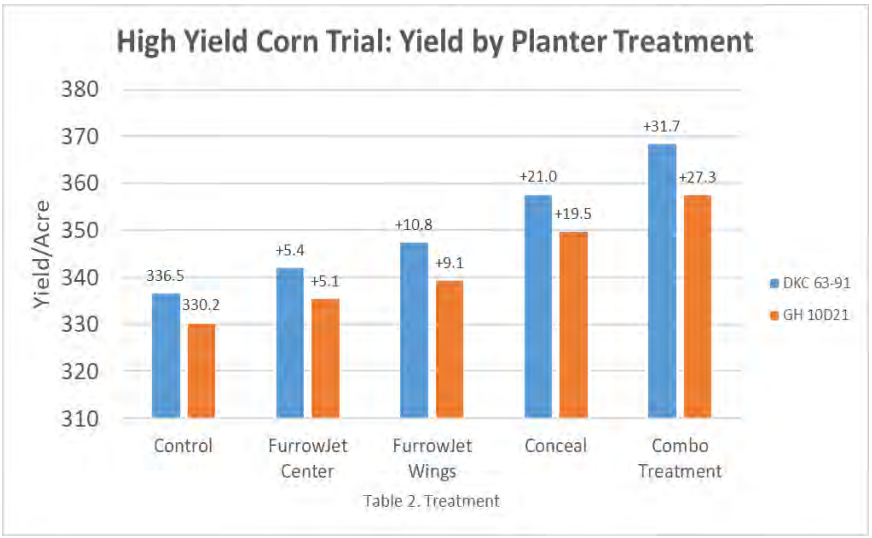
Strip-Till Irrigated Corn High Yield Management Study

A major objective of this high yield corn study was the individual yield contributions of at-plant FurrowJet® and Conceal® systems nutritional treatments. The table below illustrates the protocol for rates and products applied in each segment:

FurrowJet® Center: At-Plant	FurrowJet® Wings: At-Plant	Conceal® Dual Band: At-Plant
1 Gal/A. QLF Boost	1Pt/A. QLF Kelpak	4 Gal/A. Ammonium ThioSulfate
1.5 Pt/A. QLF AgroGold + SEATONIC	3 Gal/A. QLF 7-21-3 MKP	2.5 Gal/A. Nachurs K-Fuse
	2 Gal/A. Water	3 Gal/A. QLF Boost
		2 Qt/A. Nachurs 10% Boron
		30 Gal/A. UAN 32%
		

FurrowJet® center applications averaged +5.3 Bu/A. yield gains, while FurrowJet® wings tallied gains of +10Bu/A. Conceal® systems applications garnered the highest individual gains, with +20.3 Bu/A. yield increases.

Lastly, the combination treatment which included all three nutrition placements, reported gains of +29.5 Bu/A. over the non-treated control.



Planting Date: 4/27 *Hybrid: DKC 63-91/GH 10D21* *Population: 37K* *Row Width: 30"* *Rotation: CAB* *Corn Price: $3.75*

20” Corn Irrigated Seeding Rate Study

Objective: This study evaluates yield and economic impact of two corn hybrids at seeding rates of 30K, 36K, and 42K in a high yield irrigated environment.

Results: Table 1. illustrates corn yield of Golden Harvest 10D21 preferring higher seeding rates. Both agronomic and economic yield occurred at the highest 42K seeding rate with yields of 306.7 Bu/A. Table 3. illustrates economic losses of **-$4.19/A.** when dropping pop to 36K. Losses are nearly 6X of that at **-$26.60/A.** when planted at the lowest 30K pops.

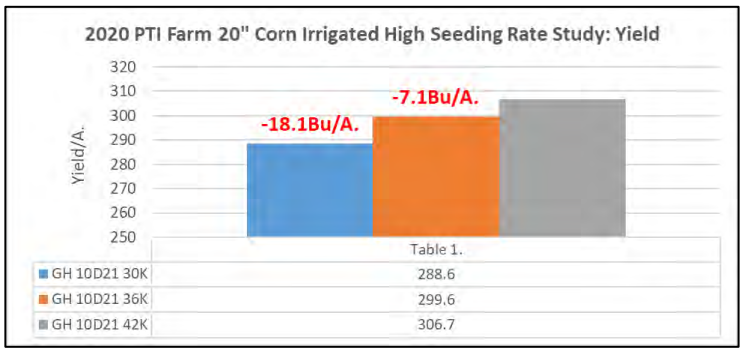
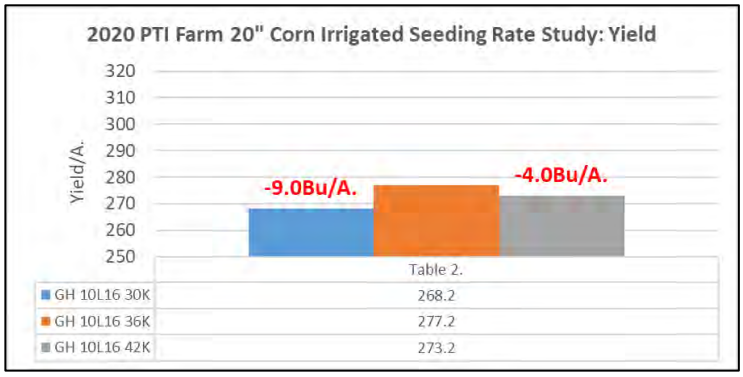
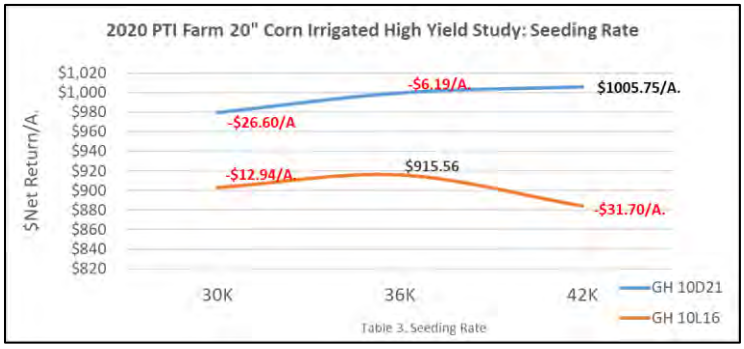


Table 2. illustrates corn yield of Golden Harvest 10L16 and seeding rate was quite different as compared to the hybrid above. Both agronomic and economic yield occurred at the 36K seeding rate with yields of 277.2 Bu/A. Table 3. suggests economic losses of **-$31.70/A.** when planted at the highest 42K pops. Losses were near a third of that at **-$12.94/A.** when planted at the lowest 30K pops.



Knowing the characteristics and agronomics of corn hybrids that we select for the farm is important to establish correct seeding rate. In this study, GH 10D21 has a determinate ear, thus generally needing higher pops to push yield. When planted at too low of pops, economic losses quicky accelerated up near **-$27/A.**



However, GH 10L16 is more of a flex hybrid that when pushed too high, cost the grower over **-$31/A.** in losses. Moral of the story is to work with seedsman and know the hybrids purchased, so that they can be placed properly on the correct soils and planted at suitable seeding rates.

Planting Date: May 17 Hybrid: GH 10D21, GH 10L16 Population: 30,36,42K Row Width: 20” Rotation: CAC Corn Price: $3.75 Seed: $275/Bag

Saturated Cold Germination Corn Study

Objective: To evaluate the correlation of yield and economic response of corn hybrids that have a contrast in saturated cold germination scores. In general, there are three germination tests farmers can utilize to estimate emergence under various environmental conditions.

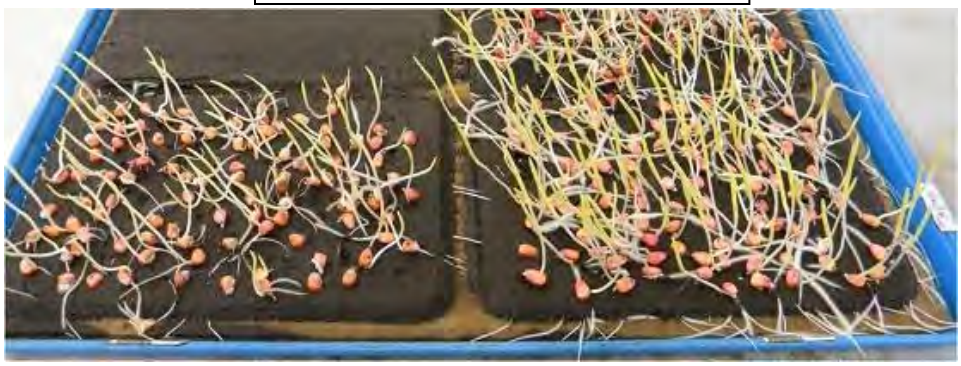
- **Warm Germ:** Seed placed in moist soil, at 77 °F for 7 days. Simulates a grower planting in ideal, warm soil temperatures. Does **not** predict how seeds will emerge under stressful, cold and/or wet soil.
- **Cold Germ:** Seed placed in cold, 50 °F soils, for 7 days, then transitioned to 77 °F soil to for 4 days. Simulates a grower planting in cold soils. Predicts how seeds will emerge under cold conditions, but does **not** account for saturated soils.
- **Saturated Cold Germ:** Seed placed in 100% saturated, cold 50 °F soil for 7 days, then transitioned to 77°F soil for 4 days. Simulates a grower planting in both cold, wet soils.

A total of 22 corn hybrids were tested at the PTI Farm in 2020 using Midwest Labs in Omaha, NE and Illinois Crop Improvement in Champaign, IL.

This study evaluates two corn hybrids with similar average germination scores for both warm/cold germination tests, however drastic differences in saturated cold germination scores. Table 1. illustrates the germination scores for two hybrids we shall just call Hybrid A and Hybrid B. Both hybrids achieved 98-96% germ scores in both warm and cold tests, however Hybrid B scored a 42% saturated cold germ score while Hybrid B an 86%. Knowing this before planting, our goal was to evaluate each hybrid planted in cold and wet conditions in April as well as warm and dry conditions later in the spring.

Table 1.	Warm Germ %	Cold Germ %	Saturated Cold Germ %
Hybrid A	98%	98%	86%
Hybrid B	98%	96%	42%

Figure 1. Saturated Cold Germ Testing



Saturated Cold Germination Corn Study Continued

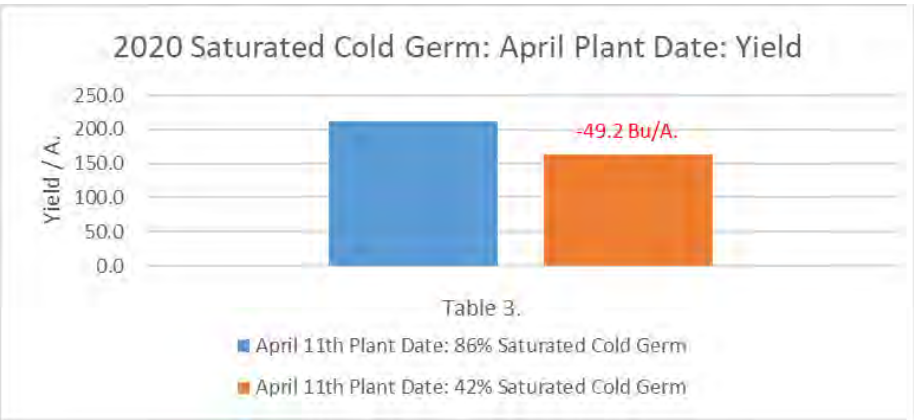
Table 2. reveals the emergence scores of both hybrids, planted in cold, wet conditions in April versus warmer, drier conditions on June 1st. Note that Hybrid B suffered a **-45%** emergence reduction, a likely result of the cold saturated germ score of only 42%. In contrast, Hybrid A with a saturated cold germ of 86%, only suffered **-10.6%** emergence reductions.

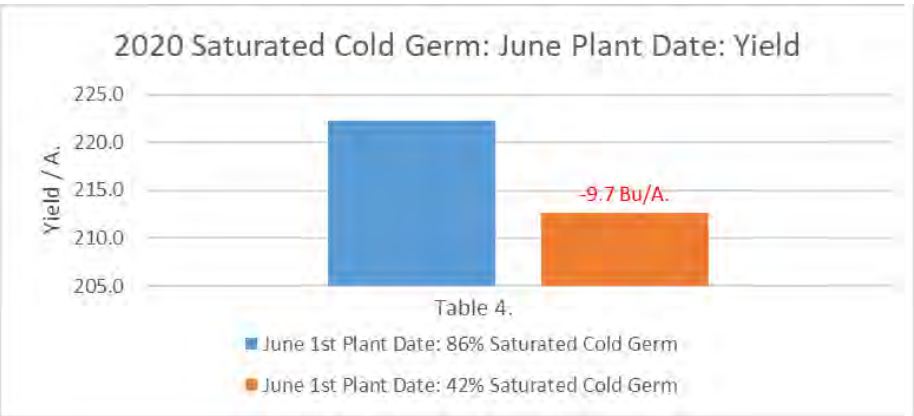
Conversely, when both hybrids were planted later in warm soils on June 1st, only **-4** to **-5%** emergence reductions occurred.

Table 2.	Emergence Scores	
Planted at 36,500 Population	Hybrid A: 87% High Germ	Hybrid B: 40% Low Germ
April 26th Planting Date	32,600	20,200
June 5th Planting Date	34,900	34,750

Saturated Cold Germination Corn Study Continued

Table 3 illustrates the yield difference of Hybrid A vs Hybrid B when planted in the early April 11th plant date entry. Hybrid B with the low saturated cold germ score, resulted in yield losses of **-49.2 Bu/A.** compared to Hybrid A with the higher (87%) saturated cold sat score. This yield deficit equated to negative economic losses of **-$184.50/A.** Conversely, Table 4 reveals only a **-9.7 Bu/A.** yield difference when the two hybrids were planted side by side on June 1st in warmer soils.





In summary, a saturated cold germ test is a cheap insurance policy to verify when and if a corn hybrid should be planted during the spring. Every year at the PTI Farm we test our hybrids and inevitably we find hybrids that score badly. Knowing this, we can position that hybrid to later planting dates when soils are warmer and stand establishment issues could be less significant. Contact your local seed company and ask them for saturated cold germ results. If they are not available, a simple lab test could give a grower some valuable insight.

Midwest Laboratories®

ILLINOIS CROP IMPROVEMENT ASSOCIATION

A saturated cold germination test does not imply that a corn hybrid is an inferior product and should not be planted or even returned for another hybrid. It simple informs a grower when to plant the hybrid and if it can handle cold wet saturated soils.

For the PTI Farm in **both** 2019 and 2020, low saturated cold germ scores of 40-42% have cost us **-49.2** to **-55.8 Bu/A.** yield losses when those hybrids were planted in cold wet soils early in the planting season. These yield losses equated to net economic deficits of **-$184.50/A.** to **-$204.69/A**

Fendt® Momentum™ Planter Pinch Row Compaction Study

Objective: To evaluate the yield benefit of AGCO's all new Fendt® Momentum™ planter, equipped with a Load Logic System. In 2020, AGCO released the all-new Fendt® Momentum™ planter equipped with key agronomic features to help alleviate pinch row compaction. One of those key features is the Load Logic system that includes both an automated weight transfer and tire inflation system. The primary focus in this year's Fendt® Momentum™ planter trial was to evaluate Load Logic under a wide range of growing conditions and management practices. Five Load Logic trials were successfully completed in South Dakota, North Dakota, Minnesota, Illinois, and Ohio.

One objective to understand was actual yields of the center portion of the planter, versus the planter wing rows.

At all locations, the center segment of each planter pass was harvested separately from the wing segments in order to compare the yield difference from compaction. The center row-units (e.g. middle 6 of 16-row planter) are exposed to tire tracks from both the tractor and planter, whereas the wing row-units (e.g. outside 5 of 16-row planter) are less impacted by tire tracks.

At three locations (IL, MN, & SD), we found little to no yield difference between the center and wing segment regardless of the weight management mode. At these locations, soil conditions were extremely fit at planting, which resulted in little compaction created by either the tractor or planter. Even without a weight management system there was essentially no yield loss in the center segment of the planter at these locations.

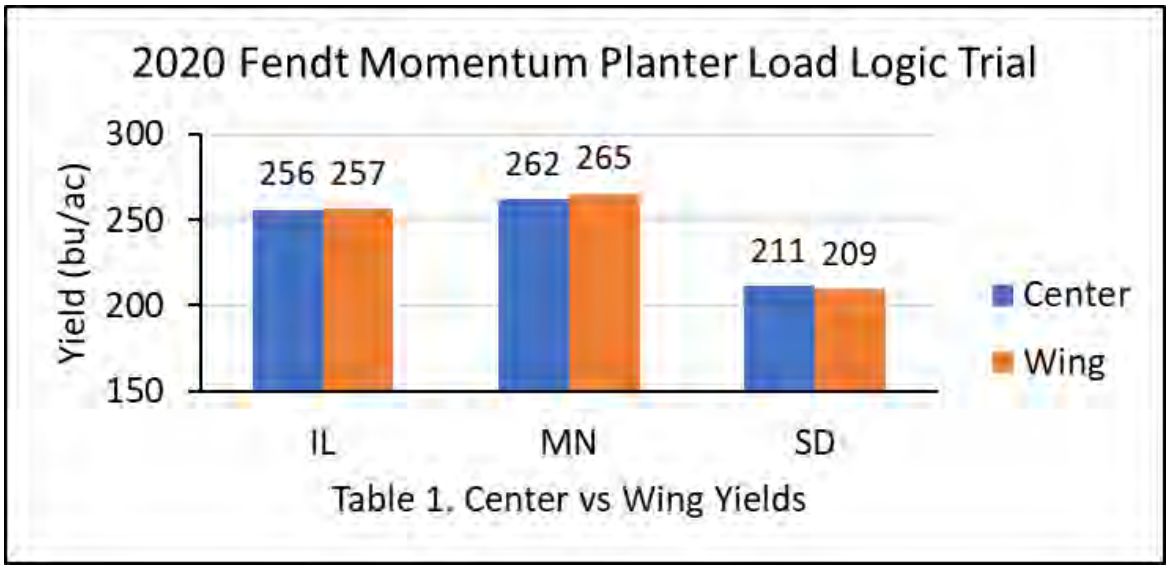


Table 1. Center vs Wing Yields

Fendt® Momentum™ Planter Pinch Row Compaction Study Continued

However, in North Dakota, soil conditions at planting were wet, and thus, the threat of soil compaction was high and pinch row compaction resulted in **-13 Bu/A.** losses. Using the Fendt® Momentum™ weight transfer system, pinch row compaction was reduced by nearly 70%, resulting in yield losses of only **-4 Bu/A.**

Soil conditions at planting were wet, and thus, the threat of soil compaction was high. Distributing the weight evenly across all tires helped improve yield in the center segment of the planter. The wing segments yielded the same in both treatments, which was expected. Even with the weight management system turned on, there was still yield loss in the center segment of the planter, which can be attributed to compaction created by the tractor. Overall, these results suggest that in challenging planting conditions, the weight transfer system provided yield benefit.

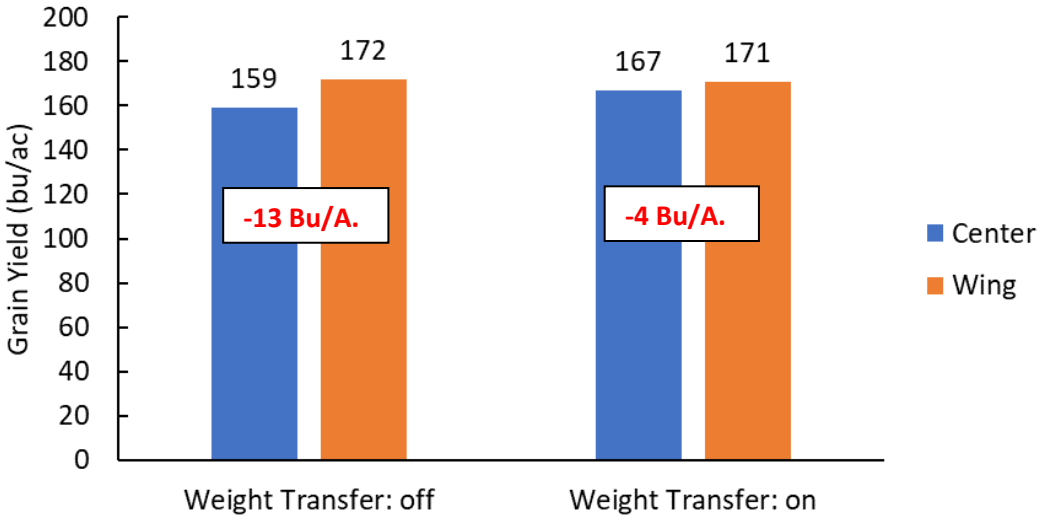


Table 2. Yield difference between center and wing segments of a Momentum™ planter (24R22) where the weight transfer system was turned off or on. Trial was located near Casselton, ND.

In summary, compaction created by the tractor/planter can reduce yield in the center segment of a planter, especially in wet-challenging soil conditions where the threat of soil compaction is high. In challenging planting conditions, weight transfer system can help alleviate compaction and avoid yield loss**.** Both the tractor and planter can influence yield loss created by compaction, and therefore, is important to manage compaction from both pieces of equipment

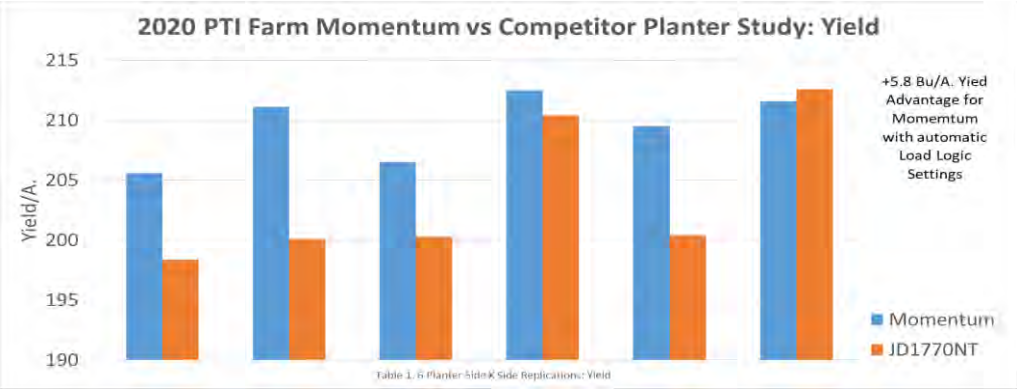
Fendt® Momentum™ Planter Study

Objective: To evaluate the yield benefit of AGCO's all new Fendt® Momentum™ planter, equipped with a Load Logic System. In 2020, AGCO released the all-new Fendt® Momentum™ planter (Figure 1.) equipped with key agronomic features to help alleviate pinch row compaction. One of those key features is the Load Logic system that includes both an automated weight transfer and tire inflation system.

In this study, we compare a 16-row John Deere 1770NT planter (Figure 2.) to that of the new Fendt® Momentum™ planter. Each planter was built to exact specifications consisting of Yetter residue managers with CleanSweep®, Dual Band Conceal®, FurrowForce® , vSet®, vDrive®, and DeltaForce® configurations. A Fendt® 1050 row crop tractor pulled the 16-row Momentum™ planter, while a Fendt® 936 tractor led the John Deere 1770NT.

Tire inflations for the John Deere planter consisted of 10.2psi in the front and 11.6psi rear of the 936 Fendt® tractor and 50psi in all center and wing tires of the planter. The Momentum™ planter was set to automatic weight transfer mode, low tire inflation of 10.2psi in the front tires, 11.6psi on the rear tires of the Fendt® 1050 tractor, and 35psi in the planter tires.

Results: Table 1. illustrates the Momentum™ planter equipped with the Load Logic weight transfer and tire inflation system out-performed the John Deere 1770NT planter in 5 of 6 replications by an average of +5.8 Bu/A.

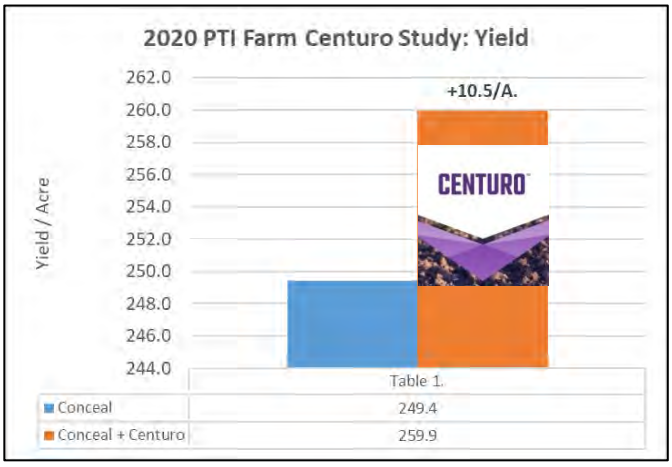


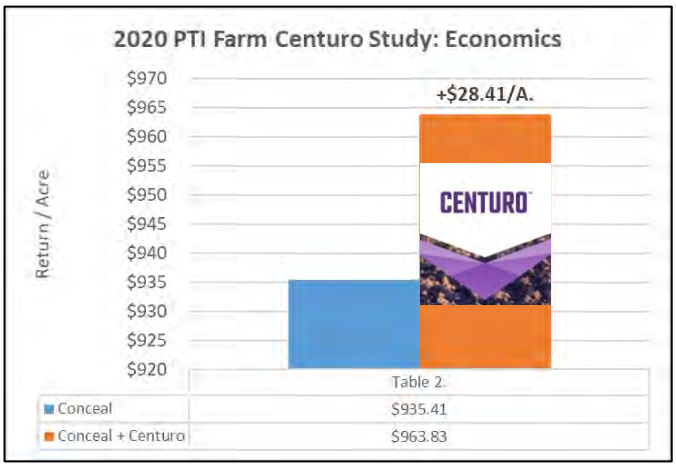
Centuro™ Denitrification Study

Objective: To evaluate Centuro, a nitrification inhibitor (Pronitridine) used to inhibit the oxidation of ammoniacal nitrogen to nitrate nitrogen. In this study, Centuro is tank mixed with 36 Gal/A. UAN 32% nitrogen and applied via dual band Conceal® system at 1.5 Gal/Ton.

Results: Due to persistent rainfall and saturated soil conditions, Centuro offered protection to nitrogen losses and proved yield gains of +10.5 Bu/A. (Table 1).

Table 2. illustrates a positive return on investment of +$28.41/A. as a result.



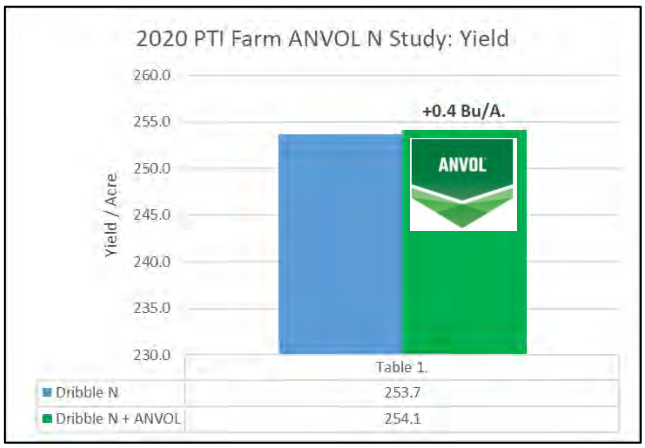


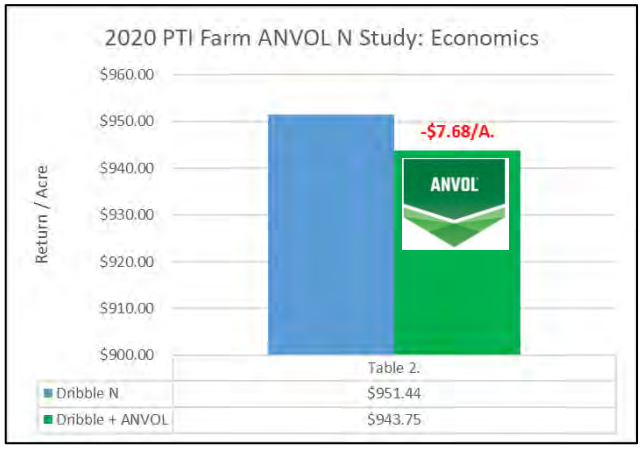
Planting Date: May 11 *Hybrid: DKC 65-95* *Population: 36K* *Row Width: 30"* *Rotation: CAC* *Corn Price: $3.75* *Centuro: $35/Gal*

ANVOL® Volatilization Study with Post-Plant Rain

Objective: To evaluate yield and economic impact of ANVOL, a nitrogen stabilization tool from Koch Agronomic Services. Driven by Duromide technology, ANVOL stabilizer protects nitrogen investment by inhibiting urease, preventing ammonia volatilization and preserving nitrogen for crop uptake.

ANVOL is tank mixed with 36 Gal/A. UAN 32% nitrogen and applied via dual surface spitters behind closing wheels on the planter (Figure 1). With-in hours after planting this plot and applying the nitrogen with and without ANVOL, this location received 2" of rain. This rain incorporated the nitrogen into the soil and thus eliminated the need for nitrogen volatilization products.





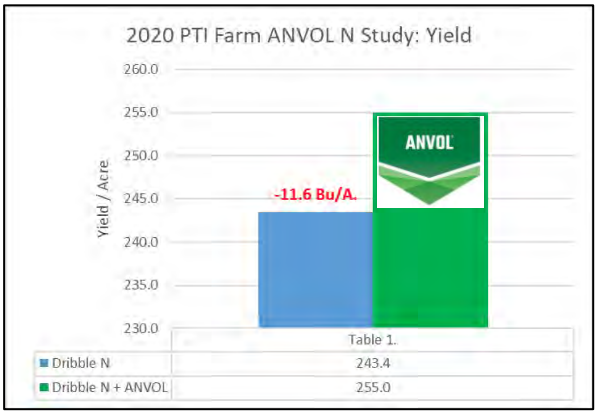
Results: Due to rainfall immediately after planting, ANVOL offered no significant yield benefit or protection to surface nitrogen losses. Economic losses occurred at **-$7.68/A.** (Table 2).

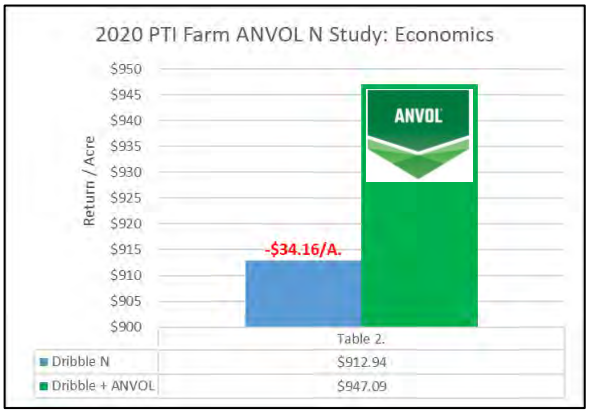
Planting Date: May 11 *Hybrid: DKC 65-95* *Population: 36K* *Row Width: 30"* *Rotation: CAC* *Corn Price: $3.75* *Anvol: $28/Gal*

ANVOL® Volatilization Study without Post-Plant Rain

Objective: To evaluate yield and economic impact of ANVOL, a nitrogen stabilization tool from Koch Agronomic Services. Driven by Duromide technology, ANVOL stabilizer protects nitrogen investment by inhibiting urease, preventing ammonia volatilization and preserving nitrogen for crop uptake.

ANVOL is tank mixed with 36 Gal/A. UAN 32% nitrogen and applied via dual surface spitters behind closing wheels on the planter (see below). After planting this plot and applying the nitrogen with and without ANVOL, this location received zero rain, thus increasing the need for nitrogen volatilization products such as ANVOL.





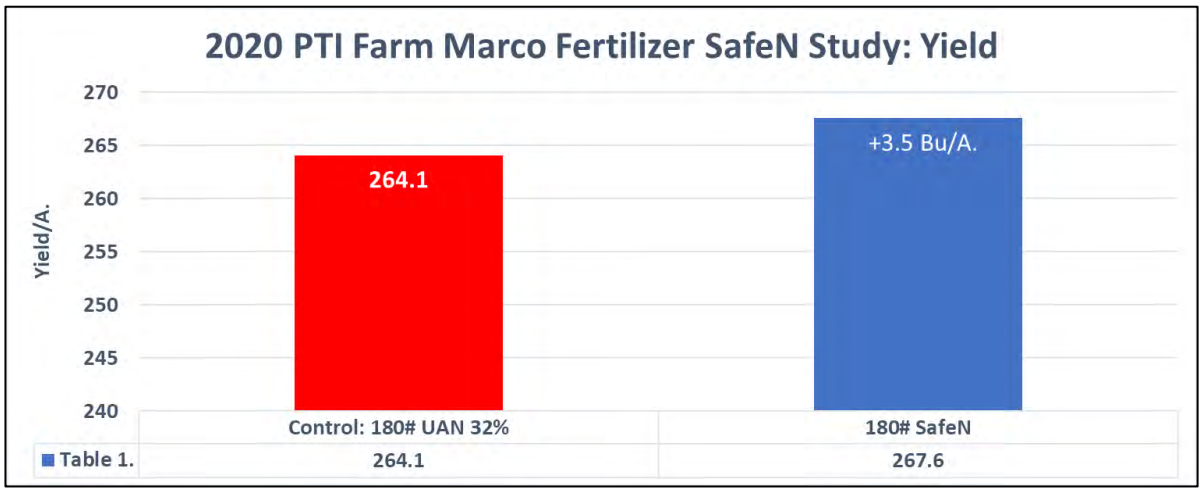
Results: Dribble applications **not protected** with ANVOL, resulted in yield losses of **-11.6 Bu/A**. with economic losses of **-$34.16/A.**. These losses should be taken into consideration when surfacing applying nitrogen, without incorporation by rain or tillage.

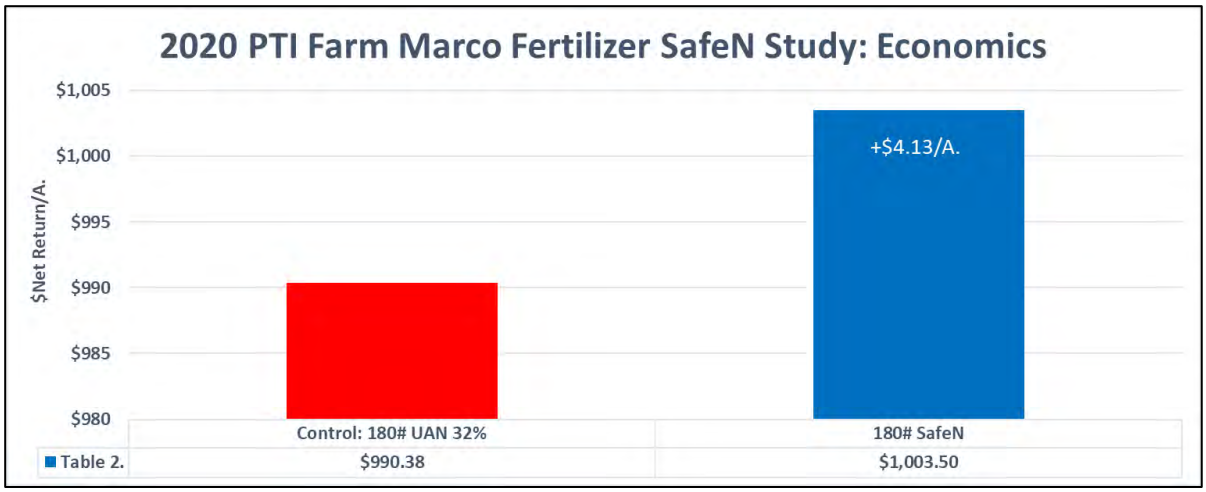
Planting Date: May 28 *Hybrid: DKC 40-77* *Population: 36K* *Row Width: 30"* *Rotation: CAC* *Corn Price: $3.75* *Anvol: $28/Gal*

Marco Safe "N" Study

Objective: To evaluate the yield and net return of Marco Fertilizer's Safe "N" Complete. Safe "N" is a 29-0-0-4S liquid nitrogen fertilizer partnered with 4% sulfur from ammonium thiosulfate (ATS). ATS has been researched as means to inhibit the nitrification process by slowing the breakdown of urease enzymes.

In this study Safe "N" is applied at a 180# N pre-plant Weed-N-Feed application in a corn-soybean rotation.





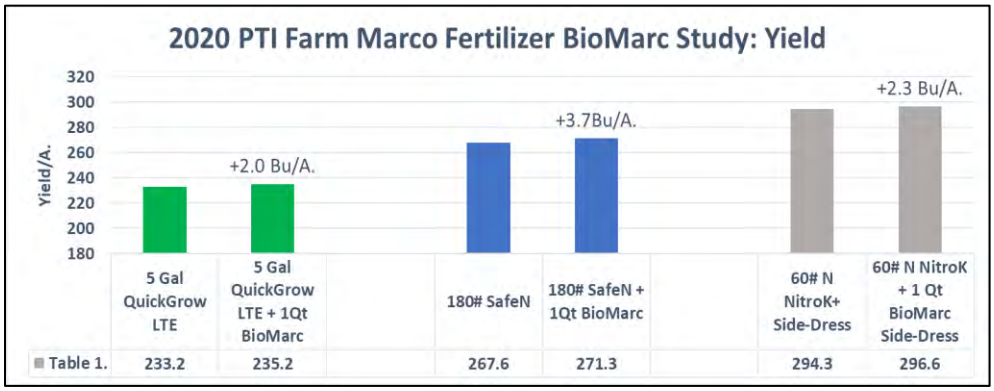
Results: SafeN nitrogen/sulfur treatments offered yield gains of +3.5 with positive economic returns of +$4.13/A.

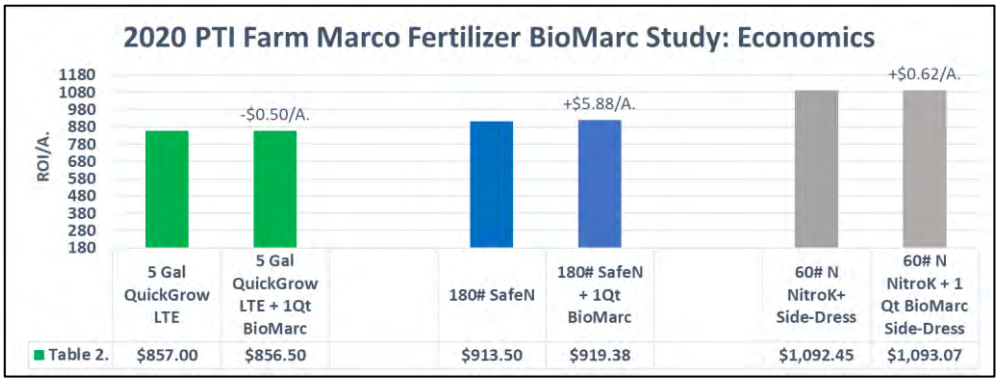
Planting Date: 4/27 Hybrid: DKC 53-91 Population: 36K Row Width: 30" Rotation: CAB Corn Price: $3.75 Fertilizer Pricing: SafeN: $0.50/# UAN: $0.45/#

Marco BioMarc Study

Objective: To evaluate the yield and net return of Marco Fertilizer's BioMarc, a unique combination of naturally extracted biostimulants, including kelp-based materials, coupled with nutrient-enabling technologies that enhance liquid fertilizer performance.

BioMarc was tested in three different corn studies including SafeN pre-plant nitrogen, FurrowJet® system with Marco QuickGrow LTE starter fertilizer, and NitroK side-dress studies all listed in the 2020 PTI Yield Summary Book, listed on pages 56,58, and 105.





Results: As a tank-mix partner, BioMarc resulted in average yield contributions of +2.0 to +3.7 Bu/A. throughout our 2020 corn trials. These yield gains resulted in average economic gains ranging from **-$0.50/A.** to +$5.88/A.

Planting Date: 4/27 Hybrid: DKC 53-91 Population: 36K Row Width: 30" Rotation: CAB Corn $3.75 BioMarc:$32/Gal SafeN: $0.50/# UAN: $0.45/# NitroK:$11.18/A.

Precision Planting®

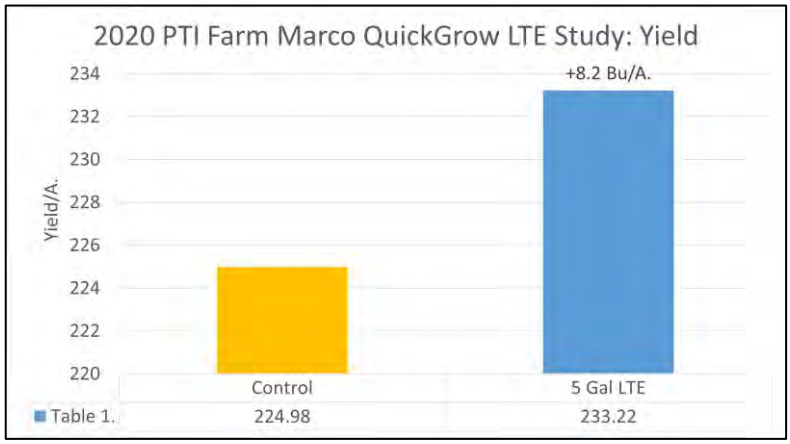
2020 PTI Results

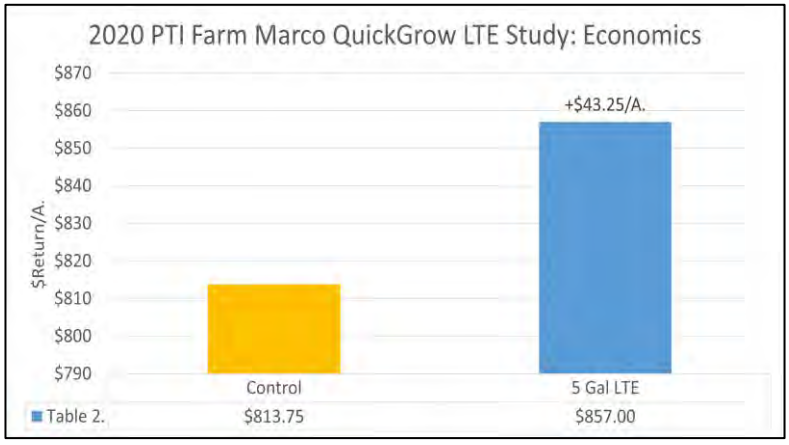
Marco QuickGrow™ LTE FurrowJet® Study

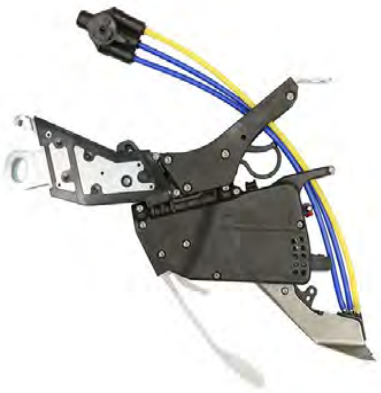
Objective: To evaluate the yield and net return of Marco Fertilizer's QuickGrow LTE 6-20-4-.25Zn-2.7S liquid starter fertilizer at a rate of 5 Gal/A. applied in an at-plant 3-way FurrowJet® system application. QuickGrow LTE is a 70% polyphosphate and 30% orthophosphate formulation of nitrogen, phosphorus, potassium, sulfur, and EDTA Zn.

Results: Table 1. illustrates that applications of 5 Gal/A. rates of Marco QuickGrow LTE resulted in yield gains of +8.2 Bu/A.

As we focus on return on investment (Table 2.), calculates that 5 Gal/A. rates proved additional net revenue of +$43.25/A. over the untreated control.







MARCO Liquid Fertility

Planting Date: 4/27 Hybrid: DKC 53-91 Population: 36K Row Width: 30" Rotation: CAB Corn Price: $3.75 LTE $3.50/Gal $30 Fert. Reallocation

QLF Boost Carbon Based Sugar Study

Objective: To evaluate yield and net return of QLF Agronomy's Liquid Carbon-Based Fertilizer (L-CBF) BOOST 4-0-3-2S added to 5 Gal/A of Marco Fertilizer LTE applied through FurrowJet® system. BOOST is a concentrated source of available carbon in a low pH chemistry package, L-CBF BOOST 4-0-3-2S enhances soil biology creating more plant available nutrients. Derived from sugar cane molasses (30% sugar) with an added fermentation yeast extract for enhanced biological function, and paired with non-protein nitrogen, sulfate sulfur, and strong acids, L-CBF BOOST 4-0-3-2S is not only an added energy source for soil microbes, but also a safer approach to improving fertilizer performance.

For this agronomic study, Boost is tank-mixed with Marco Fertilizer's QuickGrow™ LTE, a 70% polyphosphate and 30% orthophosphate 6-20-4-.25Zn-2.7S formulation of nitrogen, phosphorus, potassium, sulfur, and EDTA Zn. All treatments are applied as a Furrow tri-band application.

Results: Table 1. illustrates that Boost contributed an additional +3.2 Bu/A. at the 1 Gal/A. rate, while 2 Gal/A. provided +5 Bu/A. gains. These yield gains resulted in a positive on investment of +$8.72 and +$12.19/A.

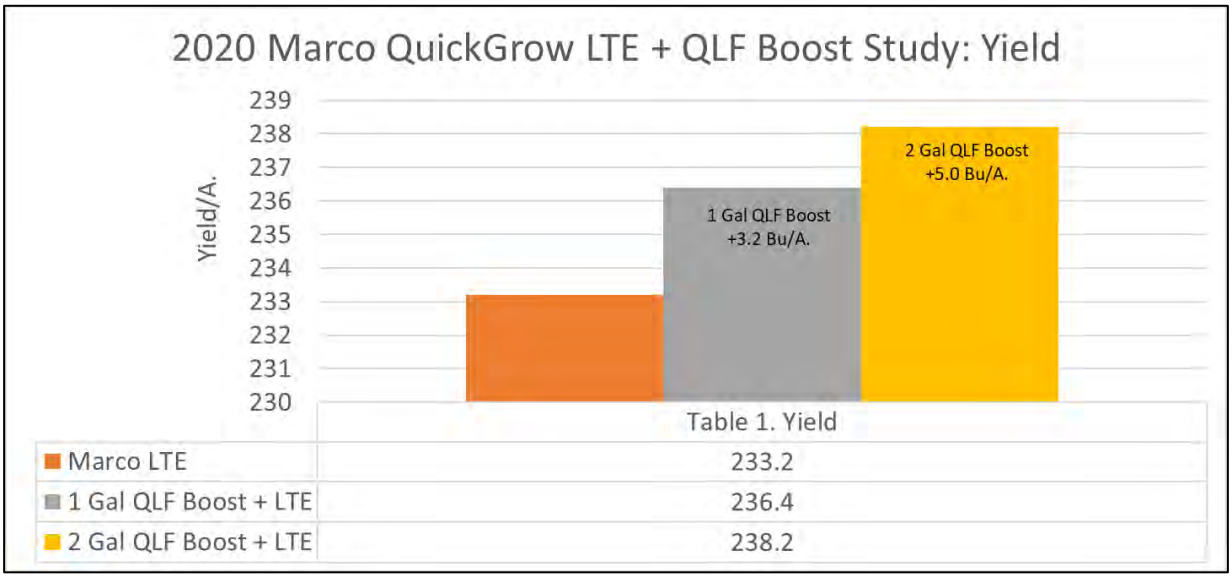


Table 1. Yield	
Marco LTE	233.2
1 Gal QLF Boost + LTE	236.4
2 Gal QLF Boost + LTE	238.2

Planting Date: 4/27 Hybrid: DKC 61-41 Population: 36K Row Width: 30" Rotation: CAB Corn Price: $3.75 BOOST: $3.28/Gal $30 Fert. Reallocation

The Anderson's® Corn Nutritional Study

Objective: To evaluate the yield and economic impact of a corn liquid starter fertilizer nutritional program from The Andersons. This trial consisted of the following.

Protocol:

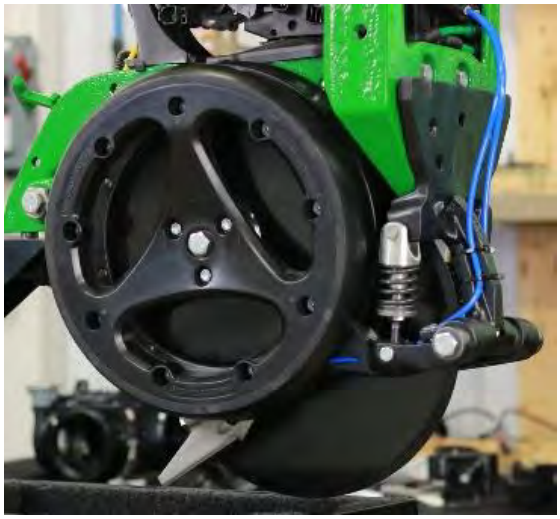
Program 1: 5 Gal/A. Season Pass 6-18-6 + MicroCarb + 1pt BioPass FurrowJet® Wings

Program 2: 5 Gal/A. Season Pass 6-18-6 + MicroCarb + 1pt BioPass FurrowJet® Center

Program 3: Program 2 + 5oz RGS + 3 Gal ATS Conceal® System

Figure 1. FurrowJet® Center and Wing Placement

Figure 2. Conceal®



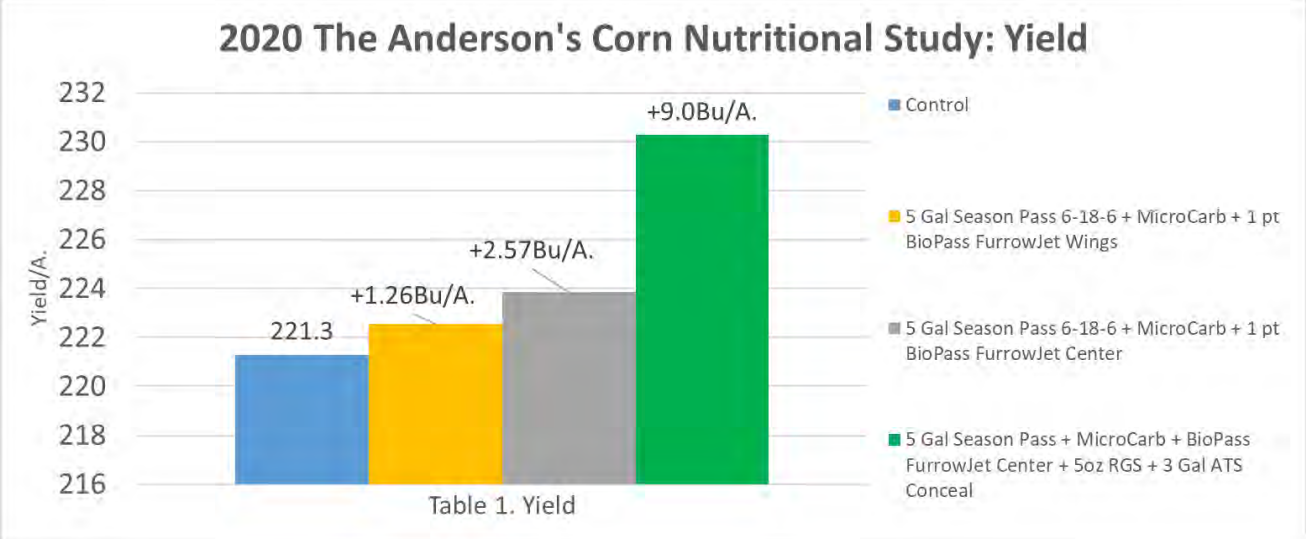
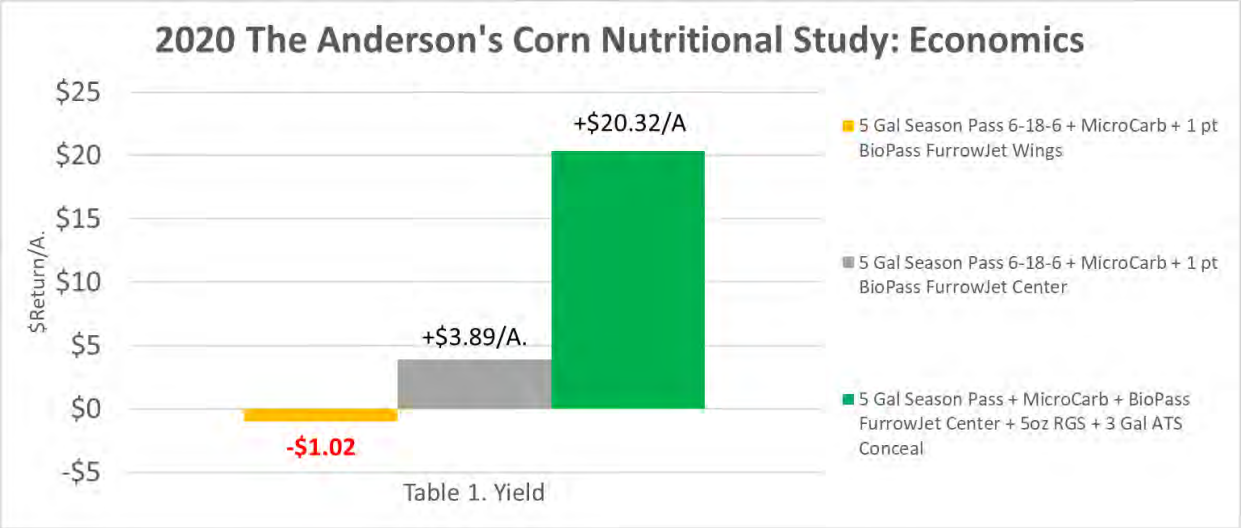


Table 1. Yield

The Anderson's® Corn Nutritional Study Continued



Results: Nutritional treatments in this study provided yield gains of +1.26Bu/A. to +9.0Bu/A., with net returns ranging from **-$1.02/A.** to +$20.32/A. The combination treatment of FurrowJet® Center + Conceal® system proved highest yield and net return at +9.0Bu/A., and +$20.32.

RGS® (ROOT GROWTH STIMULATOR)
Season Pass® WITH MICROCARB®
BIO PASS™

Planting Date: 5/27 *Hybrid: DKC 59-82* *Population: 36K* *Row Width: 30"* *Rotation: CAB* *Corn Price: $3.75* *RGS: $2.27/A.*

Season Pass: $22.50/A *BioPass: $13.25/A.* *ATS: $5.28/A.* *Fert Reallocation: $30*

AgroLiquid accesS™ Sulfur FurrowJet® Study

Objective: This study evaluates AgroLiquid's accesS, a 7-0-0-17S high-efficiency liquid sulfur fertilizer as a FurrowJet® **wing only** (Figure 1.) application at 0, 1, 2, 3, and 4 Gal/A.

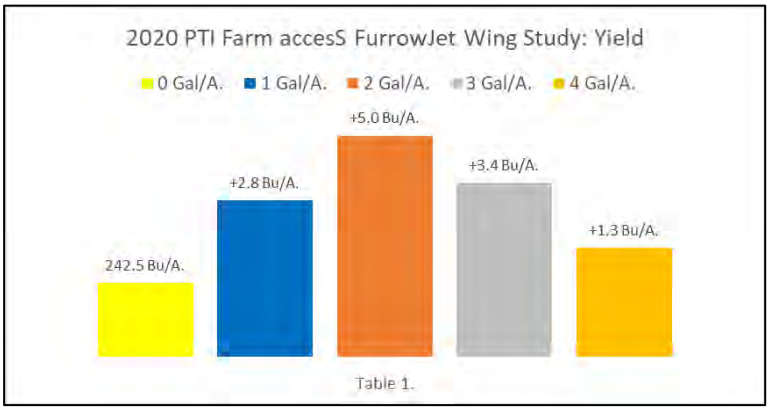


Table 1.

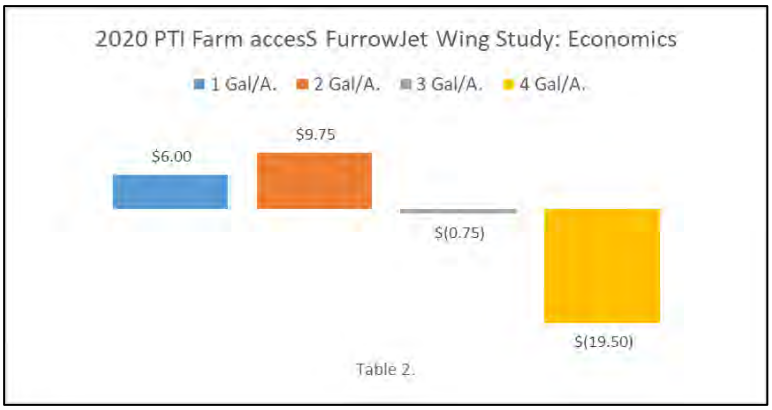


Table 2.

accesS™

Composition Guarantee Analysis

Nitrogen (N)	7.00% 7.00% Ammoniacal Nitrogen
Sulfur (S)	17.00% 17.00% Combined Sulfur
Iron (Fe)	0.25% 0.25% Water Soluble Iron (Fe)
Manganese (Mn)	0.05% 0.05% Water Soluble Manganese (Mn)
Zinc (Zn)	0.05% 0.05% Water Soluble Zinc (Zn)

Figure 1: FurrowJet® Wing Only Application

Results: Table 1. illustrates yield response which ranged from +1.3 to +5.0 Bu/A. from accesS applications. 2 Gal/A. rates proved both agronomic and economic optimum at +5.0 Bu/A., with positive net returns of +$9.75/A.

As rates were pushed higher than 2 Gal/A., yields diminished and resulted in negative losses of **-$0.75/A.** to **-$19.50/A.** respectively.

Planting Date: 5/27 *Hybrid: DKC 59-82* *Population: 36K* *Row Width: 30"* *Rotation: CAB* *Corn Price: $3.75* *accesS: $4.50/Gal*

Precision Planting®

2020 PTI Results

AgroLiquid® Starter Fertilizer Study

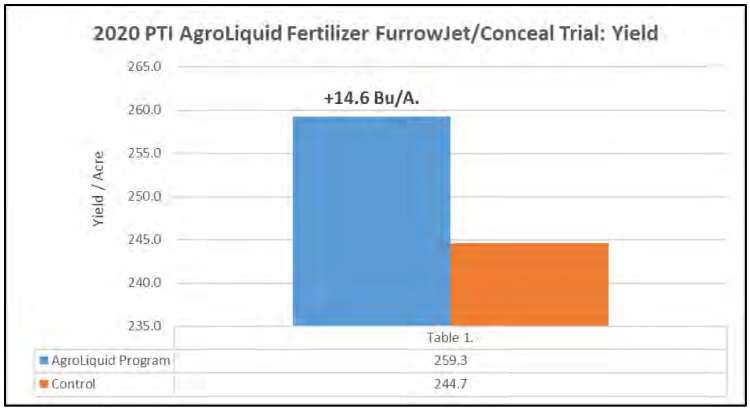
Objective: To evaluate the yield and net return of a blend of AgroLiquid starter fertilizers (Table 1). The following products are used in this FurrowJet/Conceal® system relay study as a single at-plant application.

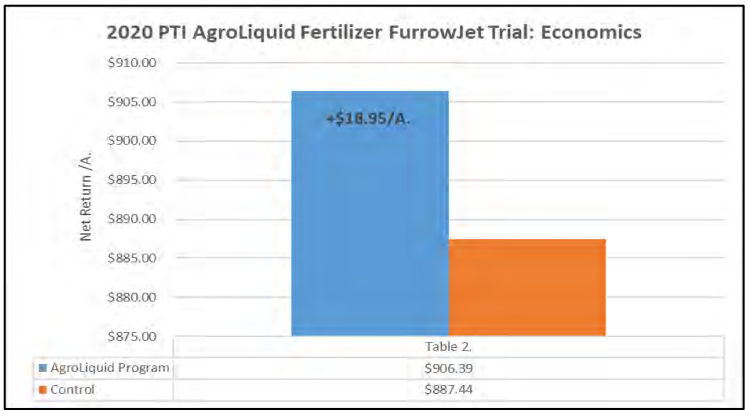
Figure 1. Conceal® and FurrowJet® Fertility Placement

Table 1.

Product/A.		Application
2-Gal Pro-Germinator®	9-24-3	FurrowJet®
3 Gal Kalibrate™	2-1-6	FurrowJet®
2 Qt Micro 500	.02B-.25Cu-.37Fe-1.2Mn-1.8Zn	FurrowJet®
1 Qt Manganese	4% Manganese Sulfate	FurrowJet®
30 Gal UAN	32-0-0	Conceal®
2 Gal accesS®	7-0-0-17S-.25Fe-.05Mn-.05Zn	Conceal®

Results: Table 1. illustrates the AgroLiquid fertility program achieved an excellent average yield gain of +14.6 Bu/A. Table 2. depicts net returns tallied a positive return on investment of +$18.95/A.





Planting Date: 5/25 *Hybrid: DKC 59-82* *Population: 36K* *Row Width: 30"* *Rotation: CAB* *Corn Price: $3.75* *$30/A Fert. Reallocation*

ProGerminator: $6.20/Gal *Kalibrate: $6.35/Gal* *Micro500: $16.78/Gal* *Manganese: $20.34/Gal* *UAN: $0.45* *accesS: $4.50*

Nachurs imPulse® FurrowJet® Center Placement Trial

NACHURS®

Objective: To evaluate the effect on yield and economics when Nachurs imPulse 10-18-4 starter fertilizer (Figure 3) is placed at 2 to 7 Gal/A. in FurrowJet® **center** only configurations (Figures 1-2). NACHURS imPulse is a premium 100% orthophosphate in-furrow liquid fertilizer that contains NACHURS Bio-K technology.

Figure 1. FurrowJet® Side View

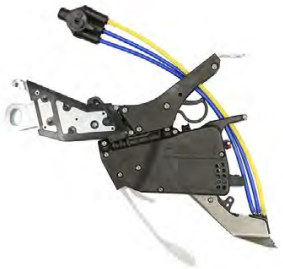
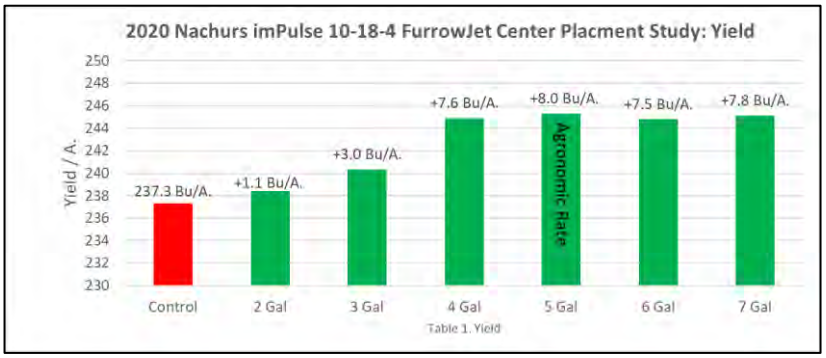
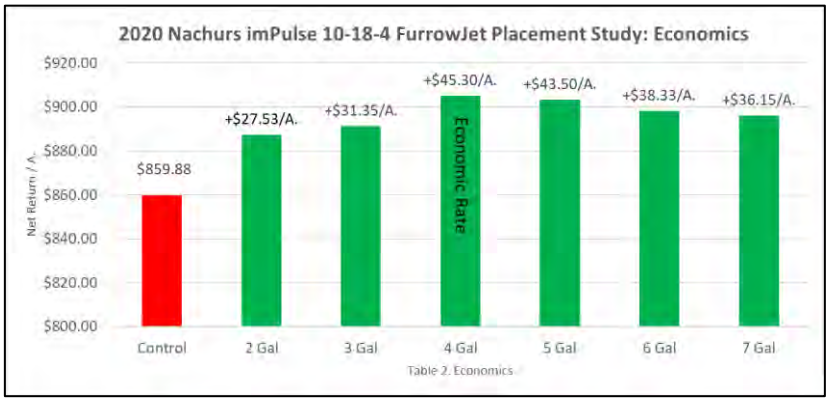


Figure 2. FurrowJet® Placement

Figure 3. Nachurs imPulse® Starter





Results: Tables 1-2, illustrate that all rates of imPulse 10-18-4 resulted in yield gains from +1.1. to +8.0 Bu/A., with positive return on investment from +$27.53/A. to +$45.30/A. 5 Gal/A. achieved agronomic optimum yield at +8.0 Bu/A., however economic optimum rate occurred at 4 Gal/A. with a positive return on investment of +$45.30/A. As rates increased above 5 Gal/A., no additional yield response was observed.

10-18-4 Liquid Fertilizer

Nutrients Supplied
(pounds per gallon)

Total Nitrogen (N)	1.06
Available Phosphate (P_2O_5)	1.91
Soluble Potash (K_2O)	0.42

Derived from: ammonium hydroxide, urea, phosphoric acid, potassium acetate, and potassium hydroxide.

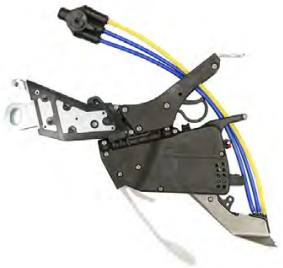
Planting Date: 5/25 *Hybrid: DKC 59-82* *Population: 36K* *Row Width: 30"* *Rotation: CAB* *Corn Price: $3.75* *$30/A Fert. Reallocation*

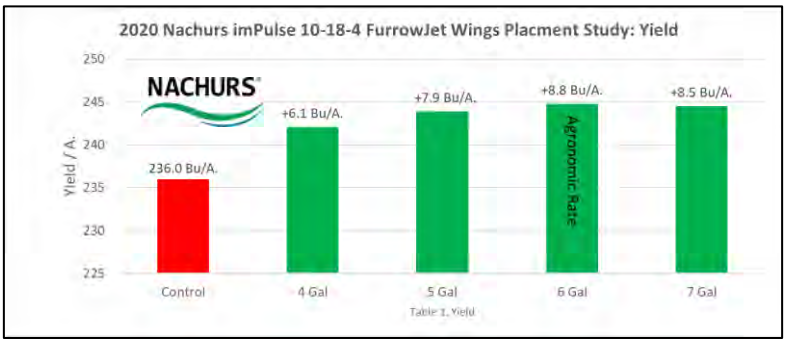
imPulse: $3.30/Gal

Nachurs® imPulse® FurrowJet® Wing Placement Trial

Objective: To evaluate the effect on yield and economics when Nachurs imPulse 10-18-4 starter fertilizer (Figure 3) is placed at 4 to 7 Gal/A. in FurrowJet® **wing** only configurations (Figures 1-2). NACHURS imPulse is a premium 100% orthophosphate in-furrow liquid fertilizer that contains NACHURS Bio-K technology.

Figure 1. FurrowJet® Side View





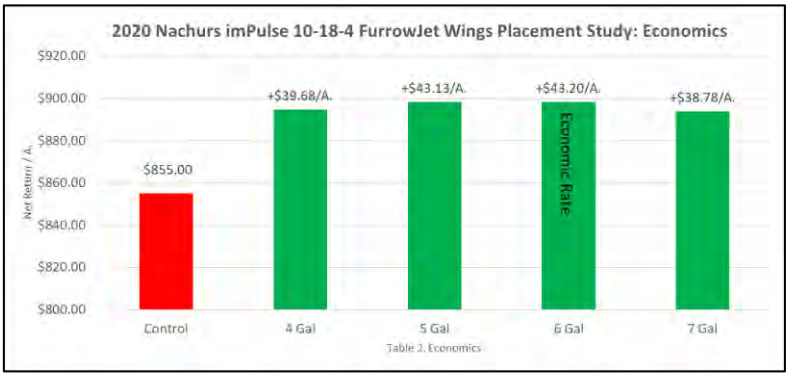


Figure 2. FurrowJet® Placement

Figure 3. Nachurs imPulse® Starter

10-18-4 Liquid Fertilizer

Nutrients Supplied
(pounds per gallon)

Total Nitrogen (N)	1.06
Available Phosphate (P_2O_5)	1.91
Soluble Potash (K_2O)	0.42

Derived from: ammonium hydroxide, urea, phosphoric acid, potassium acetate, and potassium hydroxide.

Results: Tables 1-2, illustrate that all rates of imPulse 10-18-4 resulted in yield gains and positive return on investment. However, 6 Gal/A. achieved agronomic optimum yield at +8.8 Bu/A. as well as economic optimum rate with a positive return on investment of +$43.20/A.

Planting Date: 5/25 Hybrid: DKC 59-82 Population: 36K Row Width: 30" Rotation: CAB Corn Price: $3.75 $30/A Fert. Re-Allocation imPulse: $3.30/Gal

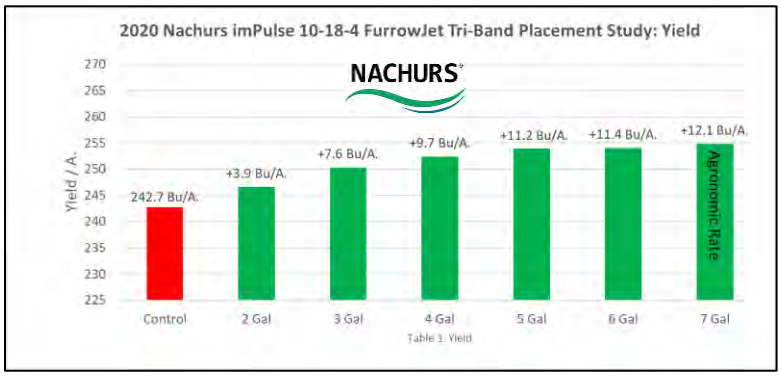
Nachurs® imPulse® FurrowJet® Tri-Band Placement Trial

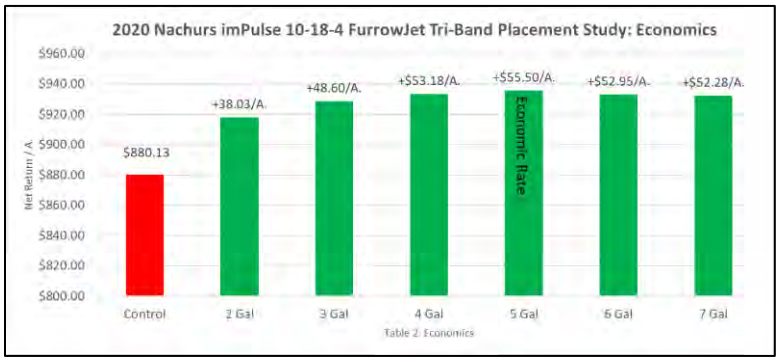
Objective: To evaluate the effect on yield and economics when Nachurs imPulse 10-18-4 starter fertilizer (Figure 3) is placed at 2 to 7 Gal/A. in FurrowJet® **tri-band** configurations (Figures 1-2). NACHURS imPulse is a premium 100% orthophosphate in-furrow liquid fertilizer that contains NACHURS Bio-K technology.

Figure 1. FurrowJet® Side View

Figure 2. FurrowJet® Placement

Figure 3. Nachurs imPulse® Starter





Results: Tables 1-2, illustrate all rates of imPulse 10-18-4 resulted in yield gains and positive return on investment. However, the highest rate evaluated in this study of 7 Gal/A. achieved agronomic optimum yield at +12.1 Bu/A. However, after cost of product, economic optimum rate occurred at the 5 Gal/A. rate with a positive return on investment of +$55.50/A.

10-18-4 Liquid Fertilizer

Nutrients Supplied
(pounds per gallon)

Total Nitrogen (N)	1.06
Available Phosphate (P_2O_5)	1.91
Soluble Potash (K_2O)	0.42

Derived from: ammonium hydroxide, urea, phosphoric acid, potassium acetate, and potassium hydroxide.

Planting Date: 5/25 Hybrid: DKC 59-82 Population: 36K Row Width: 30" Rotation: CAB Corn Price: $3.75 $30/A Fert. Re-Allocation imPulse: $3.30/Gal

Nachurs® Start2Finish™ Corn Fertility Trial

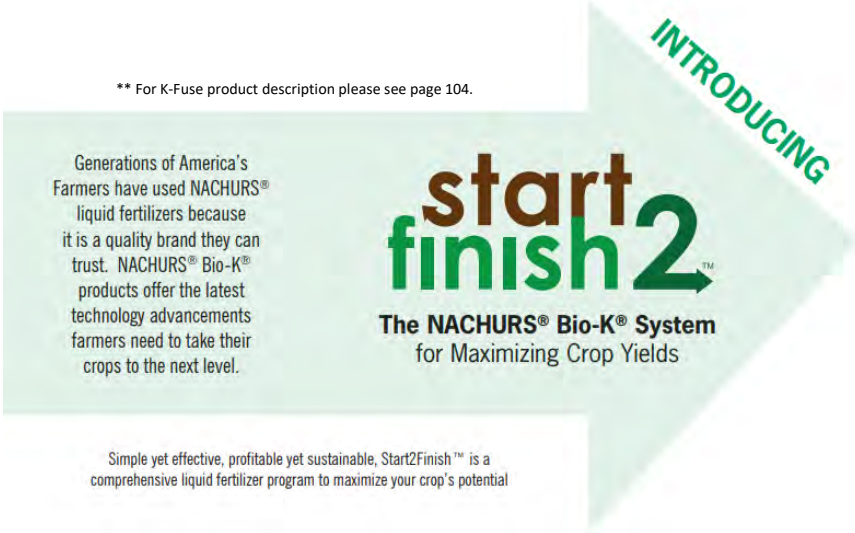
Objective: To evaluate the effect on yield and economics of Nachur's Start2Finish corn fertility program. This 3-way program consists of the following treatments:

At-Plant: 5 Gal/A. impulse® applied via FurrowJet® 3-way band

At-Plant: 2 Gal/A. K-Fuse®* applied via Conceal® dual band

Foliar: 1 Qt/A. FinishLine® + 1Gal TripleOption®

** For K-Fuse product description please see page 104.



NACHURS imPulse

NACHURS imPulse is a premium 100% orthophosphate in-furrow liquid fertilizer that contains NACHURS Bio-K technology, the most plant available source of potassium. Highly available phosphate and potassium promotes improved early season plant health and increased stress tolerance. Specially formulated for corn and wheat crops, NACHURS imPulse offers quick and uniform plant emergence which aides in achieving maximum yield potential.

NACHURS imPulse is seed safe when used at recommended rates, is non-corrosive to equipment, and has excellent cold-weather stability when stored properly (i.e. in flat bottom tanks).

NACHURS Finish Line

(8-4-6-0.1B-0.2Cu-1Mn-1Zn)

NACHURS Finish Line is a uniquely balanced foliar product with low use rates that have a proven record of increasing ROI on many crops. This foliar product is manufactured with the highest quality raw materials containing plant available orthophosphate, fully chelated micronutrients, surfactants, compatibility agents and organic acids as well as the latest potassium technology: NACHURS Bio-K. This ensures compatibility with most crop protection products and provides the best available nutrients essential for maximizing yield potential.*

NACHURS Triple Option

NACHURS Triple Option is a versatile NPKS liquid fertilizer that contains 100% orthophosphate, sulfur, and NACHURS Bio-K technology, the most plant available source of potassium. NACHURS Triple Option is a high orthophosphate fertilizer offering immediate nutrient availability. Adapted for use on all crops, NACHURS Triple Option offers the flexibility for in-furrow, foliar, fertigation, and transplant applications. It is also compatible with many crop protection products and other crop technologies, aligning to promote crop yield and quality.

Results: Tables 1-2 illustrate that Nachurs Start2Finish proved agronomic gains of +13.1 Bu/A., along with positive economic gains of +$31.80/A.

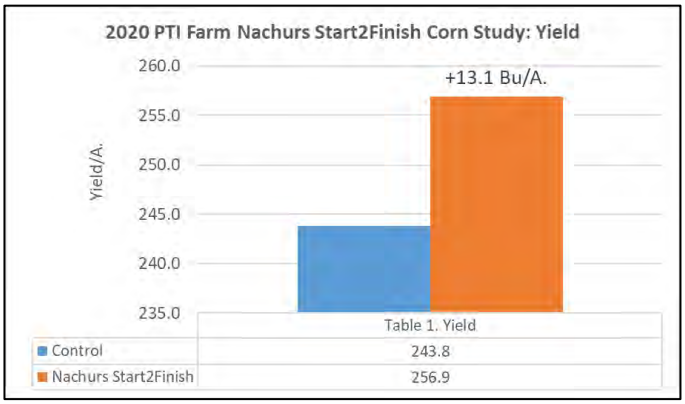


Table 1. Yield

Control	243.8
Nachurs Start2Finish	256.9

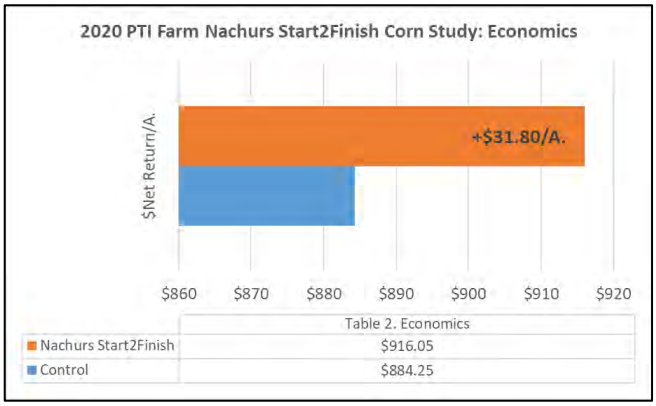


Table 2. Economics

Nachurs Start2Finish	$916.05
Control	$884.25

Planting Date: 5/27 Hybrid: DKC 59-82 Population: 36K Row Width: 30" Rotation: CAB Corn Price: $3.75

$30/A Fert.Re-Allocation imPulse: $3.30/A. K-Fuse: $4.55/Gal. FinishLine:$12.95/Gal TripleOption: $4.65/Gal

Precision Planting®

2020 PTI Results

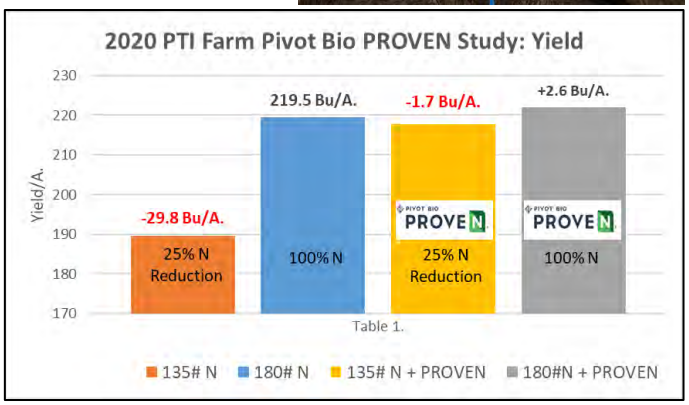
Pivot Bio PROVEN® Nitrogen Mgt. Study

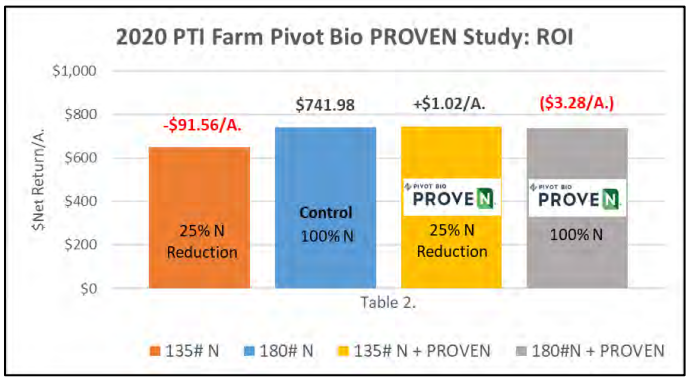
Objective: To evaluate the effect on yield and economics using Pivot Bio's PROVEN, the first nitrogen-producing microbe for corn. Pivot Bio PROVEN microbes are applied in-furrow during planting. These microbes create a symbiotic relationship with the corn plant, producing nitrogen and delivering it directly to the roots of the corn plant. Microbes then continually feed nitrogen to the corn plant throughout the growing season. Pivot Bio PROVEN microbes adhere to the roots of the corn plant and support a reliable and consistent method for delivering plant nutrition. For this agronomic study, nitrogen rate is evaluated at 100% full rates (180#N) as well as **-25%** N reductions (135#). Pivot Bio PROVEN is applied in-furrow at planting via FurrowJet® (center only) in these treatments as well.

PIVOT BIO PROVEN

Figure 1. FurrowJet® At-Plant Application

Results: Table 1. illustrates the control in the study being 100% nitrogen rates (180#N), offering base yields of 219.5 Bu./A. Applying PROVEN through FurrowJet® (center) plus 100% N rate increased yields +2.6 Bu/A. However, this offered negative economic returns of **-$3.28/A.** (Table2). -25% reductions of nitrogen (135#N) offered **-29.8 Bu/A.** yield losses compared to the full 100% base of 180#N, resulting in net economic losses of **-$91.56/A.**. When PROVEN was applied via FurrowJet® system in addition to these -25% N reductions, yield improved within **-1.7 Bu/A.** of the 100% N rates control.





In summary, PROVEN treatments offered the ability to reduce nitrogen rates without sacrificing profitability. Yield may have fallen short by **-1.7 Bu/A.**, however with the -25% reduction of nitrogen savings, profitability was increased by +$1.02/A. (Table 2). In the end, this was a win-win situation, a win for the environment with lower applied nitrogen rates, as well as win for agronomics and economics.

Planting Date: 5/27 Hybrid: DKC 59-82 Population: 36K Row Width: 30" Rotation: CAB Corn Price: $3.75 UAN 32%: $0.45/# PROVEN: $13/A.

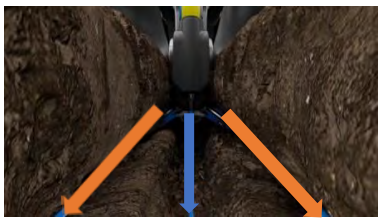
Precision Planting

2020 PTI Results

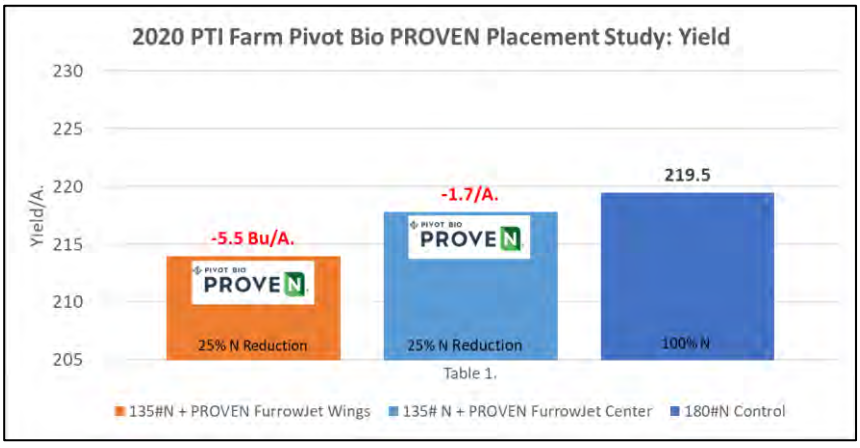
Pivot Bio PROVEN® FurrowJet® Placement Study

Objective: To evaluate the yield and economics of in-furrow **placement** of Pivot Bio's PROVEN, the first nitrogen-producing microbe for corn applied via a FurrowJet® wing or center application. Pivot Bio PROVEN microbes are applied in-furrow during planting. Microbes in PROVEN create a symbiotic relationship with the corn plant, produce nitrogen and deliver it directly to the roots of the corn plant. Microbes then continually feed nitrogen to the corn plant throughout the growing season. Pivot Bio PROVEN microbes adhere to the roots of the corn plant and supports a reliable and consistent method for delivering plant nutrition. For this agronomic study, nitrogen rate is evaluated at 100% full rates (180# total N) as well as **-25%** N reductions (135# total N). Pivot Bio PROVEN is then applied in-furrow at planting via FurrowJet® system, to focus on the efficiency of FurrowJet® center versus wing applications (Figure 1).

Figure 1. FurrowJet® Wing vs Center Placement



Results: Table 1. illustrates Pivot Bio PROVEN resulted in advantages for FurrowJet® center treatments by +3.8 Bu/A. over FurrowJet® wing only applications. This yield difference equated to additional revenue of +$12.32/A. (Table 2.).



This first-year study proved an advantage for near-seed, in-furrow applications. For growers wanting to apply this type of application, a SmartFirmer® sensor (Figure 2.) or Keeton® Seed Firmer could also be utilized.

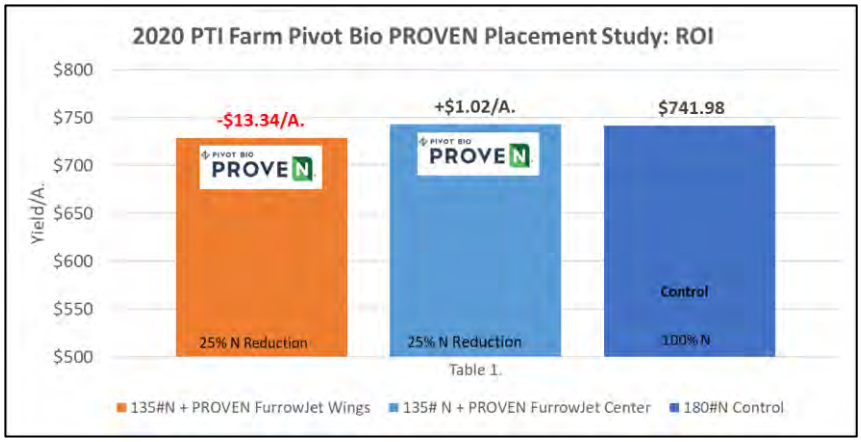
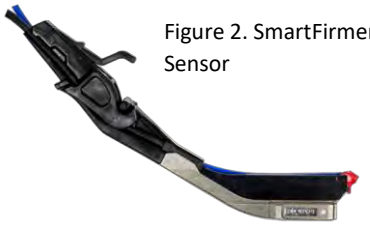


Figure 2. SmartFirmer® Sensor



Planting Date: 5/27 Hybrid: DKC 59-82 Population: 36K Row Width: 30" Rotation: CAB Corn Price: $3.75 UAN 32%: $0.45/# PROVEN: $13/A.

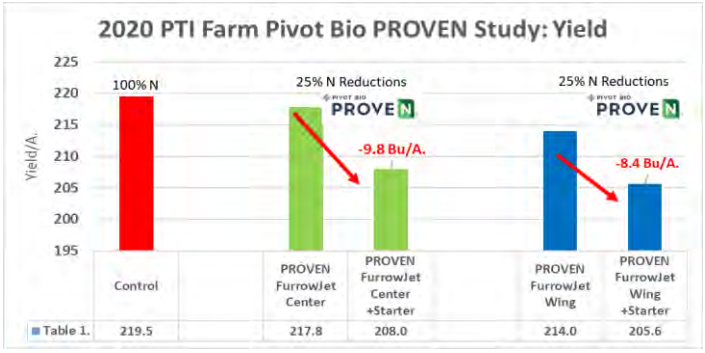
Pivot Bio PROVEN® Tank-mix Starter Fertilizer Study

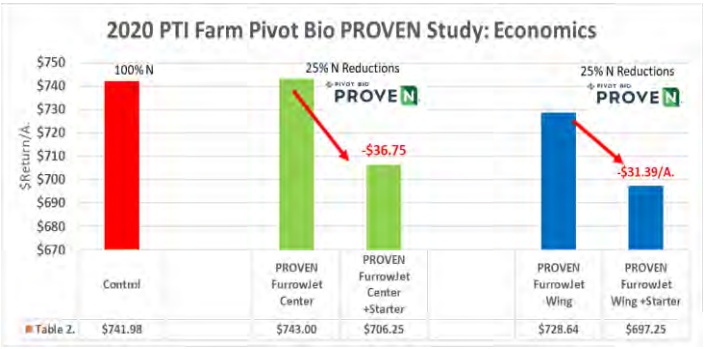
Objective: To evaluate the yield and economics of in-furrow **placement** of Pivot Bio's PROVEN, the first nitrogen-producing microbe for corn applied via a FurrowJet® wing or center application with and without a starter fertilizer. Pivot Bio PROVEN microbes are applied in-furrow during planting. Microbes in PROVEN create a symbiotic relationship with the corn plant, produce nitrogen and deliver it directly to the roots of the corn plant. Microbes then continually feed nitrogen to the corn plant throughout the growing season. Pivot Bio PROVEN microbes adhere to the roots of the corn plant and supports a reliable and consistent method for delivering plant nutrition.

Figure 1. FurrowJet® At-Plant Application

This study specifically evaluates the efficacy of PROVEN when tank-mixed with a starter fertilizer. Since biological products are living organisms, it is our desire to evaluate the affects of salt in starter fertilizer wreaking havoc with biological activity.

Results: Tank-mixing 10 Gal/A. of 10-34-0 starter (10-34-0 is a 70% polyphosphate formulation of nitrogen and phosphorus) resulted in significant performance loss of PROVEN. When 10-34-0 was added to PROVEN FurrowJet® Center applications, yield was reduced by 5% (-9.8 Bu/A.). FurrowJet® wing applications of PROVEN were reduced by -4% (-8.4 Bu/A.). These yield losses equated to economic deficits of **-$31.39** to **-$36.75/A.** respectively.



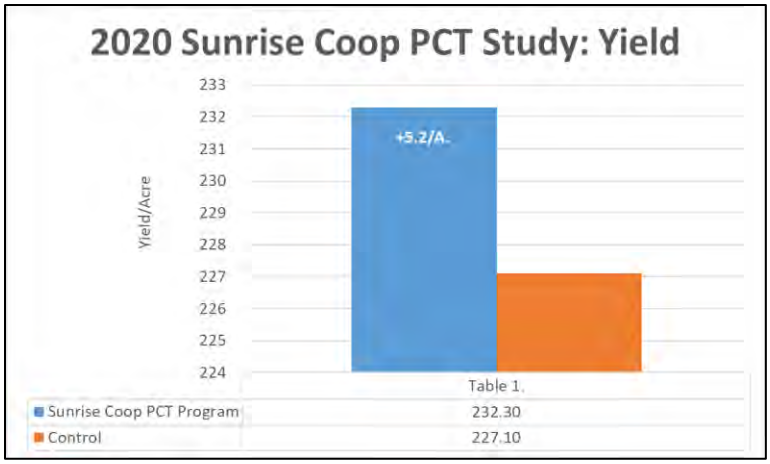


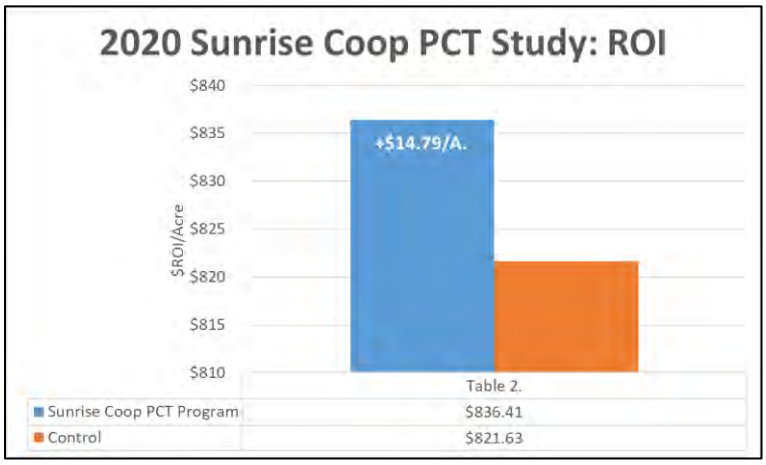
If these losses are true, this may require the separation of PROVEN and a starter fertilizer in an at-plant in-furrow application. 2021 testing will focus on PROVEN staying in FurrowJet® Center applications, while starter fertilizer stays in possibly a Conceal® system type application further away from the biological product in-furrow.

Planting Date: 5/27 Hybrid: DKC 59-82 Population: 36K Row Width: 30" Rotation: CAB Corn Price: $3.75 UAN 32%: $0.45/# PROVEN: $13/A.

Sunrise® Coop PCT Nutrition Study

Objective: To evaluate the yield and economic net return of PCT nutrition products in FurrowJet® center at-plant applications.





PCT | Sunrise®
Local grow how.

PCT | Sunrise
StandUp®
Premium P Corn Starter w/ MIC

Nitrogen	6%
Phosphorus	24%
Potassium	6%
Boron	0.0125%
Manganese	0.025%
Zinc	0.25%

BioBuild®
C-Green Amino

PCT | Sunrise® BioBuild® C-Green Amino+ II is a seaweed extract fortified with organic acids in combination with N-amino acids + a soil penetrating agent to help any plant mitigate stress. It can be used in multiple crops as in-furrow/2x2 starter, transplant water solution or as a foliar application along with crop protection products, fertilizer, or other biological products. It is recommended to apply just prior to a stress event or immediately following the event for best activity and faster recovery.

BioBuild® SUN-5

BioBuild® BioComplete II

PCT | Sunrise® BioBuild® BioComplete II is a blend of over two dozen various strains of beneficial microbes that enhance plant health and vigor. This product is designed to increase flower production, healthier and more vigorous root systems along with phosphate solubilization and nitrogen fixation.

Figure 1. FurrowJet At-Plant Application

Results: Tables 1-2. illustrate PCT Nutrition products produced yield gains of +5.2 Bu/A with positive net returns of +$6.70/A. to +$17.62/A.

Planting Date: 5/25 *Hybrid: Pioneer 1108Q* *Population: 36K* *Row Width: 30"* *Rotation: CAB* *Corn Price: $3.75*

Fertilizer Pricing: Sun5 $12.54/Gal *BioComplete: $73.39/Gal* *CGreenAmino: $44.41/Gal* *StandupP: $5.75/Gal* *$30 Fert.Reallocation*

10-34-0 FurrowJet® Study

Objective: To evaluate the yield and net return of 10-34-0 liquid starter fertilizer. Seven different rates were used in a tri-band FurrowJet® system application at planting. 10-34-0 is a 70% polyphosphate formulation of nitrogen and phosphorus.

Results: 10 Gal. rates of 10-34-0 resulted in both agronomic and economic optimum rate with yield gains of +9.5 Bu/A. resulting in positive net returns of +$36.63/A.

Figure 1: FurrowJet® 3-Way In-Furrow Band

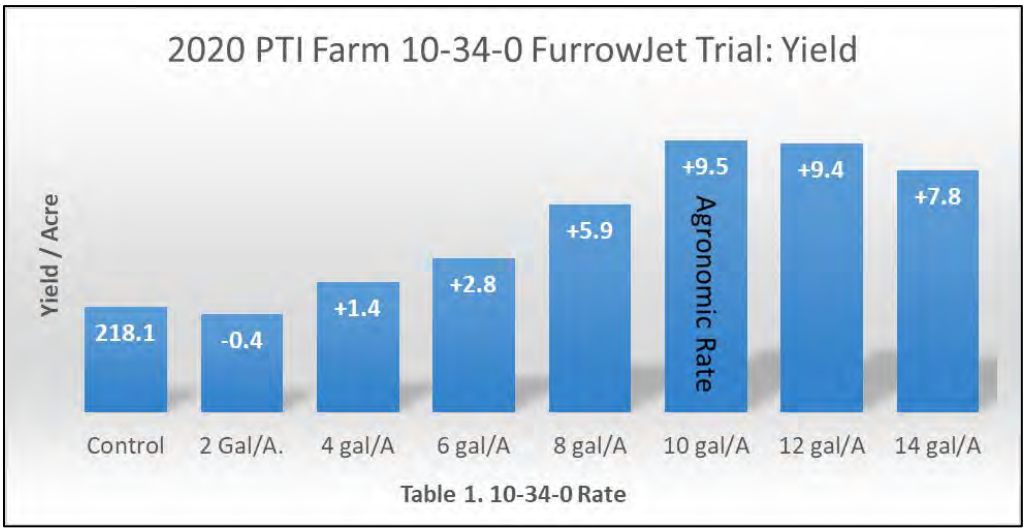


Table 1. 10-34-0 Rate

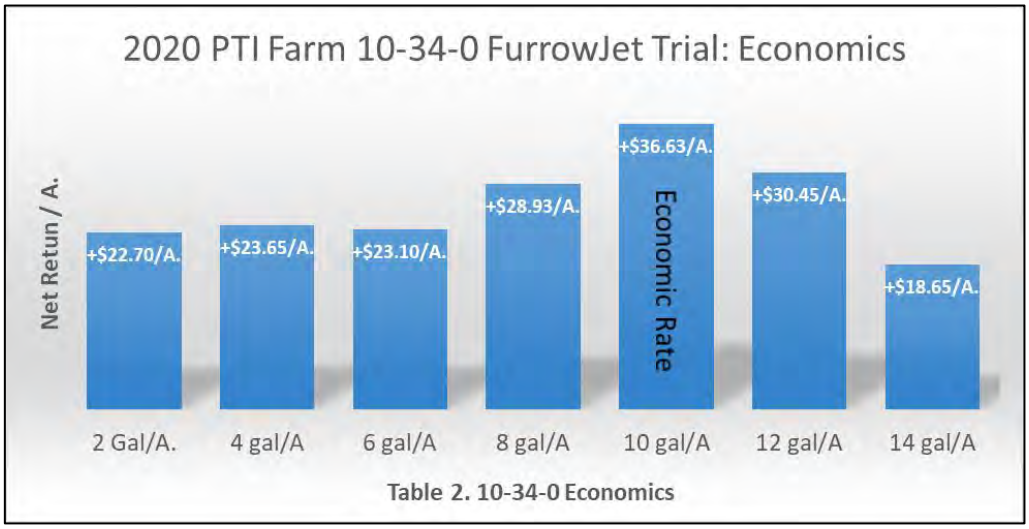


Table 2. 10-34-0 Economics

Planting Date: 5/17 Hybrid: DKC 63-91 Population: 36K Row Width: 30" Rotation: CAB Corn Price: $3.75 Fertilizer Pricing: 10-34-0 $2.58/Gal $30 Fert. Reallocation

Phosphorus Placement Study

Figure 1: FurrowJet® 3-Way In-Furrow Band

Objective: This study evaluates phosphorus placement efficiency when applied in and out of the furrow at planting. Phosphorus is immobile in the soil meaning, it does not move. Diffusion to the root has been studied to move only about 1/8 of an inch per year, which could lead to relatively small amounts of phosphorus in soil within that distance of a root. Thus, roots must grow through the soil to get the phosphorus the plant needs.

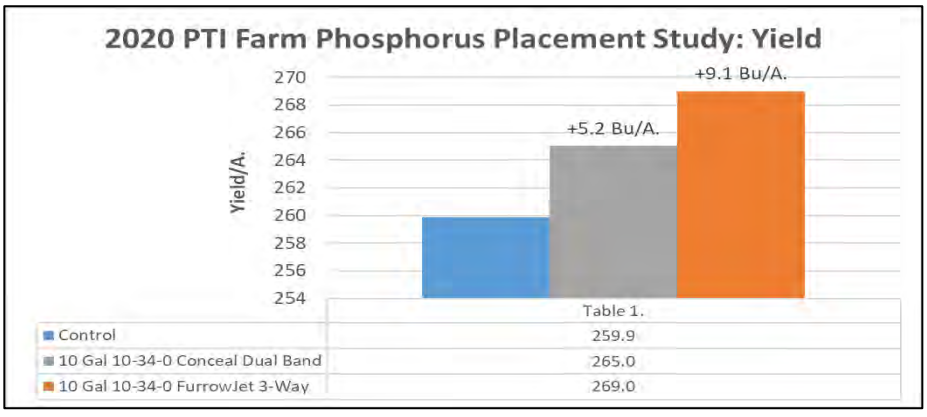
This study evaluates yield and economics of phosphorus placement efficiency when 10-34-0 is applied in both FurrowJet® system in-furrow as well as dual band Conceal® system out of furrow applications.

FurrowJet® system is a planter fertilizer attachment (Figure 1.) that enables placement of not only an in-furrow starter fertilizer, but also a dual-band of fertilizer 3/4" on each side of the seed.

Conceal® system is a unique planter attachment that allows growers to place nutrients in a high concentration dual or single band positioned 3” away from the seed trench in depths near 1.5” (Figure 2).

Figure 2. Dual Band Conceal® Out of Furrow Bands

Results: Table 1. illustrates 2020 yield data where 10-34-0 applications provided overall yield gains of +5.2 to +9.1 Bu/A. However, in-furrow applications provided additional gains +3.9 Bu/A. over Conceal® system applications, which represents a +76% increase in efficiency. Using $3.75/Bu. corn, this equates to a +$14.77/A. advantage for phosphorus applied closer to the seed in-furrow.



Planting Date: 4/27 *Hybrid: DKC 63-91* *Population: 36K* *Row Width: 30”* *Rotation: CAB* *Corn Price: $3.75* *10-34-0: $500/T*

L-CBF 7-21-3 MKP FurrowJet® Study

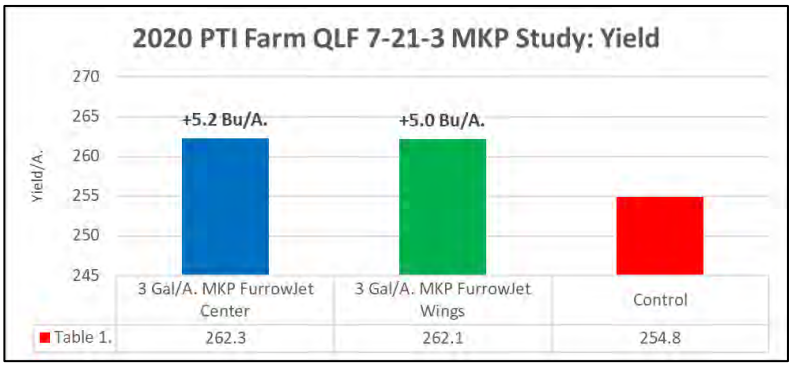
Objective: To evaluate yield and net return of QLF Agronomy's Liquid Carbon-Based Fertilizer (L-CBF) starter 7-21-3 MKP applied through FurrowJet® system (Center vs Wings).

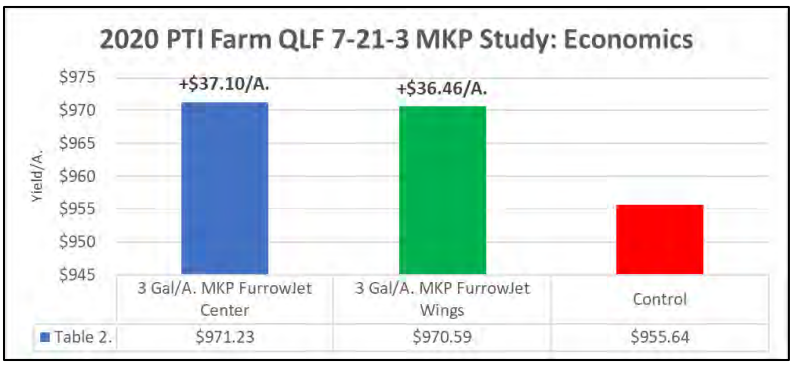
L-CBF 7-21-3 MKP is liquid starter blend derived from premium orthophosphate MKP (monopotassium phosphate) for plant available phosphorus, available carbon from sugar cane molasses as an energy source for soil microbes, and enhanced biological function with an added fermentation yeast extract.

Results: Table 1. illustrates that 3 Gal/A of L-CBF 7-21-3 MKP tank mixed with 2 Gal/A of additional water for coverage resulted in over +5 Bu/A for both Center or Wings with minimal variance between either.

Table 2. reveals positive economic gains with pop-up fertilizer blend L-CBF 7-21-3 MKP applied through the FurrowJet® system at over $36 /Acre.

Figure 1. FurrowJet® Center and Wing Application





Planting Date: 4/27 Hybrid: Pioneer 1197AM Population: 36K Row Width: 30" Rotation: CAB Corn Price: $3.75 7-21-3: $12.36/A. Rate: 3 Gal/A.

$30 Fert Reallocation

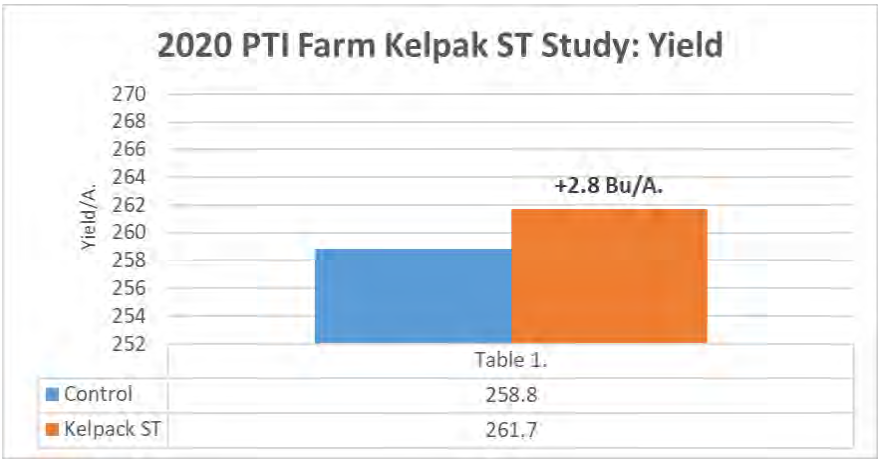
Kelpak® Seed Treatment Study

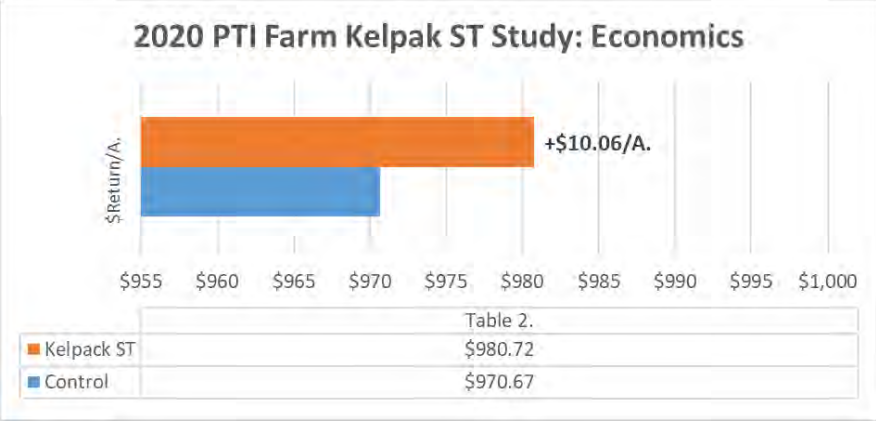
Objective: To evaluate the yield and economic impact of a liquid seaweed concentrate called Kelpak applied as a seed treatment.

Kelpak is manufactured from the kelp species *Ecklonia maxima*, which grows only in the clean, cold waters off the Atlantic Coast of southern Africa.

Kelpak is a highly concentrated liquid seaweed extract, making it a cost-effective tool. It is approved in the USA by USDA's National Organic Program (NOP) for use as an input in organic farming.

Results: Table 1. illustrates that 8oz/100# seed of Kelpak ST resulted in +2.8 Bu/A. yield gains as a seed treatment, while Table 2 reveals positive economic gains of +$10.06/A.





kelpak

Planting Date: 4/27 Hybrid: Pioneer 1197AM Population: 36K Row Width: 30" Rotation: CAB Corn Price: $3.75 Kelpak: $40/Gal. Rate:4oz/100#.

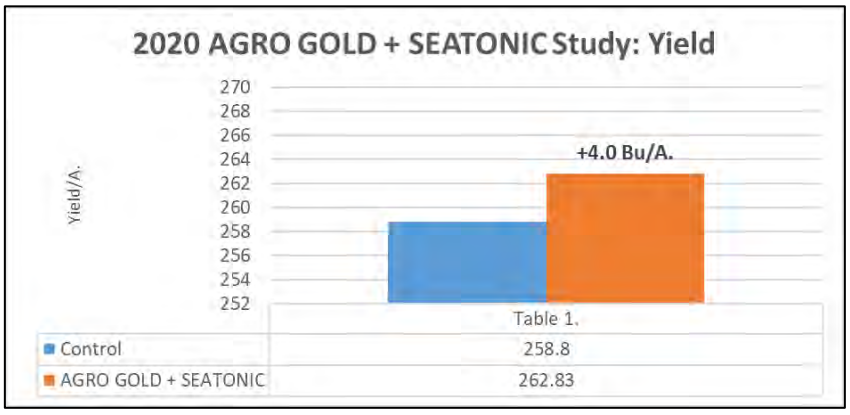
AGRO GOLD™ + SEATONIC™ FurrowJet® Study

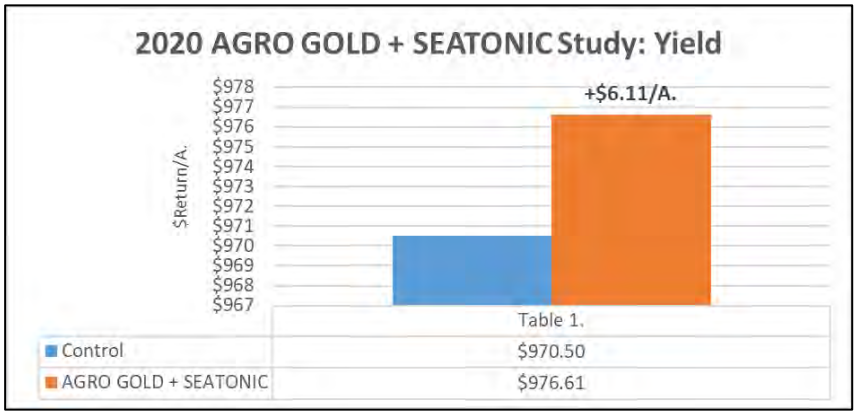
Objective: To evaluate the yield and economic impact of a tank-mix of AGRO GOLD and SEATONIC applied in FurrowJet® center applications only.

SEATONIC™ is a formulation made of an organic concentrated water-soluble liquid extract from cold water seaweed (Ascophyllum nodosum).

AGRO GOLD™ is a biological amendment containing soil enhancing bacteria recommended for all vegetable crops, small fruits, berries, citrus, banana, tobacco, alfalfa and all row (field) crops including but not limited to, cotton, sorghum, corn, wheat, sugarcane and soybeans.

Results: This year at the PTI farm the use of AgroGold + SEATONIC in a FurowJet center application proved yield gains of +4.0 Bu/A. with positive economics returns of +$6.11/A.





Planting Date: 4/27 Hybrid: Pioneer 1197AM Population: 36K Row Width: 30" Rotation: CAB Corn Price: $3.75 AGRO GOLD + SEATONIC: $9/A.

L-CBF Boost 4-0-3-2S Conceal® Study

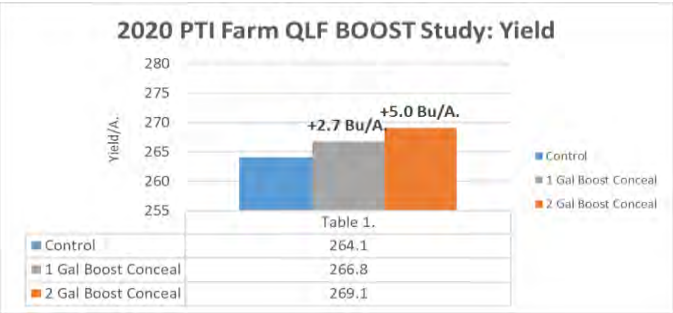
Objective: To evaluate yield and net return of QLF Agronomy's Liquid Carbon-Based Fertilizer (L-CBF) BOOST 4-0-3-2S added to 26 Gal/A of UAN 32% applied through Conceal® system (Figure1).

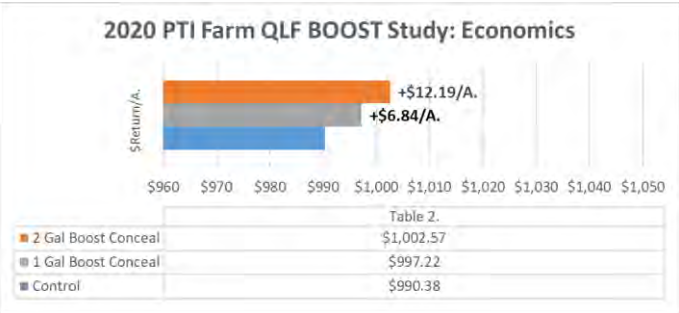
BOOST is a concentrated source of available carbon in a low pH chemistry package, L-CBF BOOST 4-0-3-2S enhances soil biology creating more plant available nutrients. Derived from sugar cane molasses (30% sugar) with an added fermentation yeast extract for enhanced biological function, and paired with non-protein nitrogen, sulfate sulfur, and strong acids, L-CBF BOOST 4-0-3-2S is not only an added energy source for soil microbes, but also a safer approach to improving fertilizer performance.

Results: Table 1. illustrates a 2-gal rate proved to be the better agronomic and economic optimum than 1-gal rate. L-CBF BOOST 4-0-3-2S enhanced more Nitrogen Use Efficiency of UAN 32% at the higher inclusion and coverage.

Table 2. net return calculations proved profitable with both rates. Demonstrated yield increases and profits reflect efficiencies gained with BOOST inclusion, insuring a better recovery of UAN 32% investment delivered through the Conceal® system dual banded placement and timing.

Figure 1. Conceal® placement 3" away from seed furrow and 1.5" deep





QLF® Agronomy

Planting Date: 4/27 *Hybrid: Pioneer 1197AM* *Population: 36K* *Row Width: 30"* *Rotation: CAB* *Corn Price: $3.75* *Boost: $3.28/Gal.*

L-CBF Amino 15-0-1 Foliar Study

Objective: To evaluate yield and net return of QLF Agronomy's Liquid Carbon-Based Fertilizer (L-CBF) Amino 15-0-1 applied foliar at the VT growth stage.

Amino 15-0-1 is a balanced source of foliar nitrogen with available carbon in a low pH chemistry package. L-CBF Amino 15-0-1 has 10% sugar. For every gallon a full pound of sugar is delivered in a microscopic form, raw and undegraded, further enhancing the adjuvant characteristics of this liquid fertilizer blend.

Derived from sugar cane molasses with an added fermentation yeast extract for enhanced biological function, and paired with high quality Urea solution and L-Amino Acid forms of nitrogen, L-CBF Amino 15-0-1 is a safer and more efficient approach to foliar nitrogen applications and plant protein formation.

Results: Table 1. illustrates a positive +10.3 Bu/A response generated by a 5 Gal/A application rate of L-CBF Amino 15-0-1 on tasseled corn. Table 2. shows this application during reproductive stages resulted in over $17/A net return.

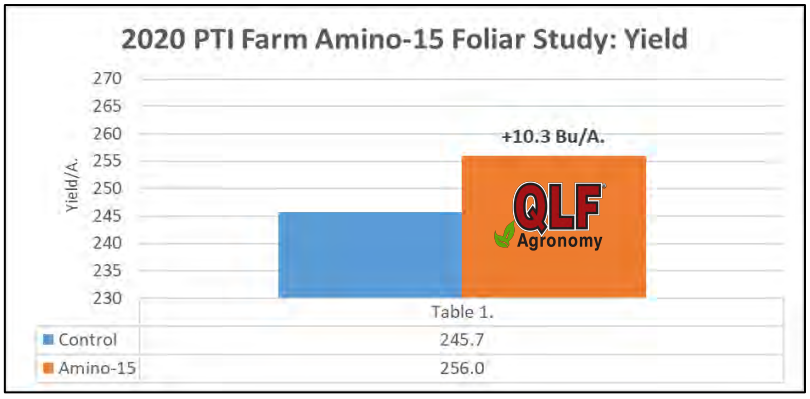


Table 1.	
Control	245.7
Amino-15	256.0

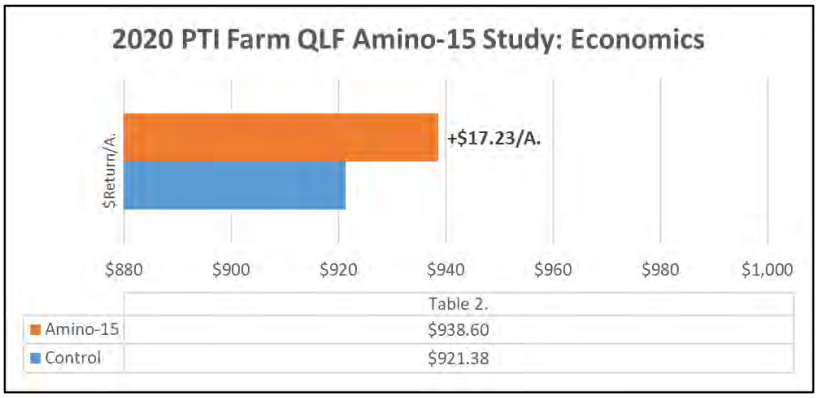


Table 2.	
Amino-15	$938.60
Control	$921.38

Planting Date: 4/27 Hybrid: Pioneer 1197AM Population: 36K Row Width: 30" Rotation: CAB Corn Price: $3.75 Amino-15: $3.08/Gal. Rate:8oz/100#.

Manticor™ LFR® FurrowJet® Study

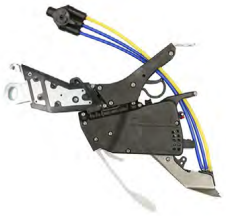
Objective: This FurrowJet® system application trial evaluates the yield and net return of Manticor LFR. This fungicide/insecticide is an in-furrow product for protection against early season corn diseases and below-ground insect pests, like corn rootworm, in a liquid-fertilizer-ready (LFR) formulation.

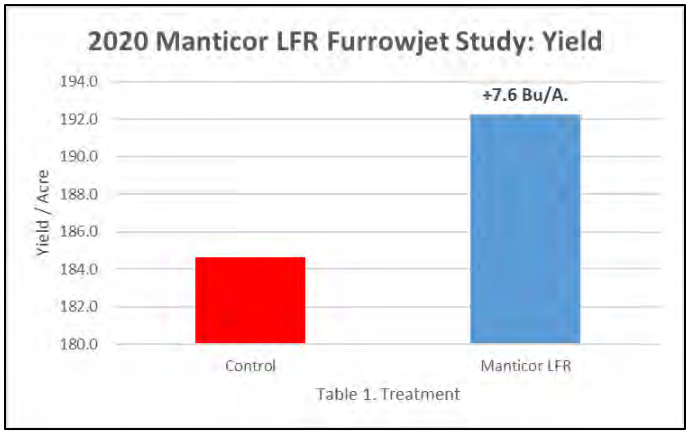
Manticor LFR combines Headline® a strobilurin fungicide (0.67lbs/gal Pyraclostrobin) and Capture LFR, a pyrethroid insecticide (1.33lbs/Gal Bifenthrin) (Figure 1). When applied in-furrow on corn, Manticor LFR in-furrow fungicide and insecticide provides control of seedling fungal diseases, such as Rhizoctonia solani, and soil insect pests, such as corn rootworm larvae, wireworm, grubs, seedcorn maggot, cutworm and others that can damage corn seeds and seedlings.

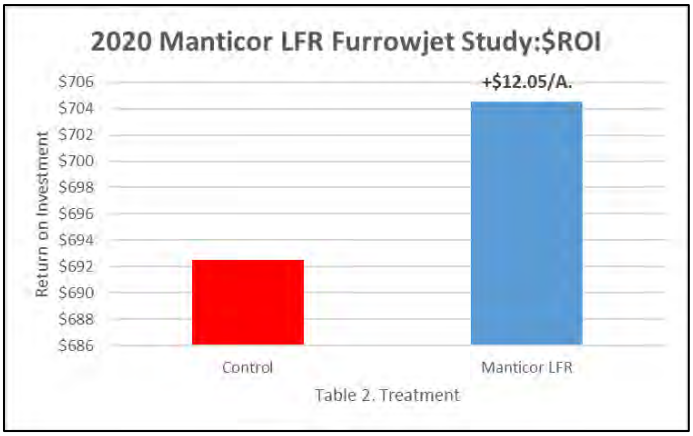
Figure 1

Active Ingredients:

Bifenthrin*	14.4%
Pyraclostrobin: (carbamic acid, [2-[[[1-(4-chlorophenyl)-1*H*-pyrazol-3-yl]oxy]methyl]phenyl]methoxy-, methyl ester)	7.2%
Other Ingredients:	78.4%
Total:	100.0%







Results: Manticor LFR FurrowJet® system treatments resulted in positive yield gains of +7.6 Bu/A. with a positive net return on investment of +$12.05/A. (Tables 1-2).

Planting Date: 4/22 Hybrid: AgriGold 641-54VT2RI Population: 36K Row Width: 30" Rotation: CAB Corn Price: $3.75 Manticor LFR: $220/Ga

Precision Planting®

2020 PTI Results

Xanthion® FurrowJet® Study

Objective: This FurrowJet® system application trial evaluates the yield and net return of Xanthion in-furrow fungicide. Xanthion protects against damaging corn seedling and root diseases, including Rhizoctonia, Fusarium, and Pythium.

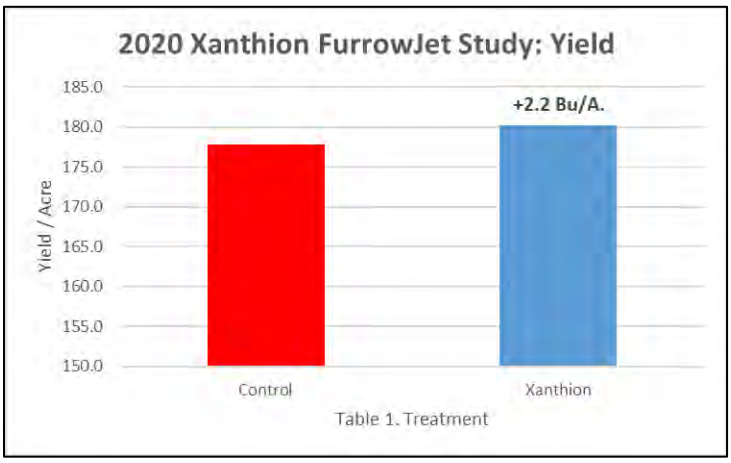
Xanthion is a combination of a chemical fungicide and a biofungicide, containing the same active ingredients as in Headline (Figure 1).

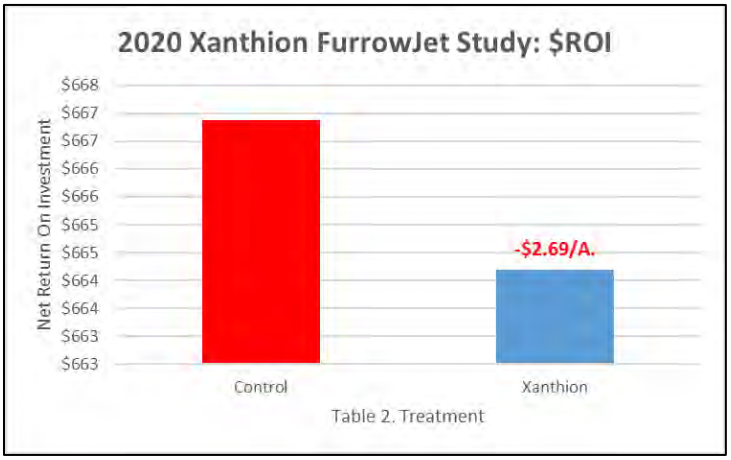
Figure 1.

Xanthion®

Active Ingredient*: (Component A)
Bacillus amyloliquefaciens, strain MBI 600** 6.12%
Other Ingredients: 93.88%
Total: 100.00%
*Contains not less than 2.2 x 10^{10} viable spores per mL
**Formerly named *Bacillus subtilis* strain MBI 600

Active Ingredient*: (Component B)
pyraclostrobin: (carbamic acid, [2-[[[1-(4-chlorophenyl)-1*H*-pyrazol-3-yl]oxy]methyl]phenyl]methoxy-, methyl ester). 23.60%
Other Ingredients:** 76.40%
Total: 100.00%
*Equivalent to 2.09 pounds of pyraclostrobin per gallon
**Contains petroleum distillates





Results: Xanthion FurrowJet® system treatments offered yield advantages of +2.2 Bu/A., however failed to prove a positive return on investment at **-$2.69/A.** (Tables 1-2.)

Planting Date: 4/22 Hybrid: Champion 61A19 Population: 36K Row Width: 30" Rotation: CAB Corn Price: $3.75 Xanthion: $11.44/A Rate: 7.2oz/A.

Loveland Products RISER® FurrowJet® Study

Objective: This tri-band FurrowJet® system application trial evaluates the yield and net return of RISER, a 7-17-3 low salt, seed safe, pop-up in-furrow starter fertilizer containing Acetate® Technology.

Figure 1.

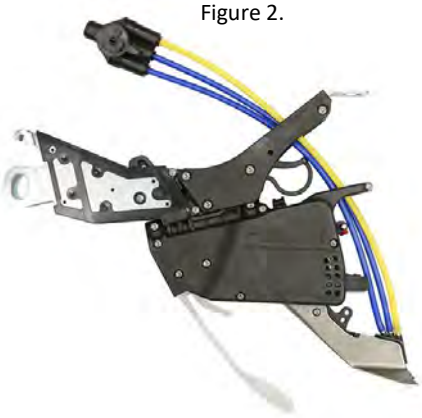
GUARANTEED ANALYSIS

Total Nitrogen	7.00%
6.0% Ammoniacal Nitrogen	
0.3% Nitrate Nitrogen	
0.7% Urea Nitrogen	
Available Phosphate (P_2O_5)	17.00%
Soluble Potash (K_2O)	3.00%
Copper (Cu)	0.07%
0.07% Chelated Copper (Cu)	
Iron (Fe)	0.20%
0.20% Chelated Iron (Fe)	
Manganese (Mn)	0.06%
0.06% Chelated Manganese (Mn)	
Zinc (Zn)	0.95%
0.95% Chelated Zinc (Zn)	

RISER® 7-17-3+MICROS

Derived from: Urea Ammonium Nitrate, Ammonium Polyphosphate, Potassium Acetate, Zinc Oxide, Anhydrous Ammonia, Copper EDTA, Iron HEDTA, Manganese EDTA, and Zinc EDTA.
EDTA is ethylenediaminetetraacetic acid. HEDTA is hydroxyethylethylenediaminetriacetic acid.

Figure 2.



Results: RiSER treatments resulted in positive yield gains of +6.0 Bu/A. with a positive net return on investment of +$8.92/A.

Nutrien Ag Solutions

ACETATE

Loveland PRODUCTS

Planting Date: 5/10 Hybrid: AgriGold 641-54VT2RIB Population: 36K Row Width: 30" Rotation: CAB Corn Price: $3.75 RiseR: $6/Gal.

Ethos® XB FurrowJet® Study

Objective: This FurrowJet® system (Figure 2.) application trial evaluates the yield and net return of Ethos XB, an insecticide/fungicide that combines the active ingredient of Capture LFR insecticide with a broad-spectrum biofungicide. This combination defends against insect pest such as corn rootworms, wireworms, grubs, seed corn maggots, cutworms and common stalk borers. This also defends against diseases such as Fusarium, Pythium, Rhizoctonia and Phytophthora.

Figure 1.

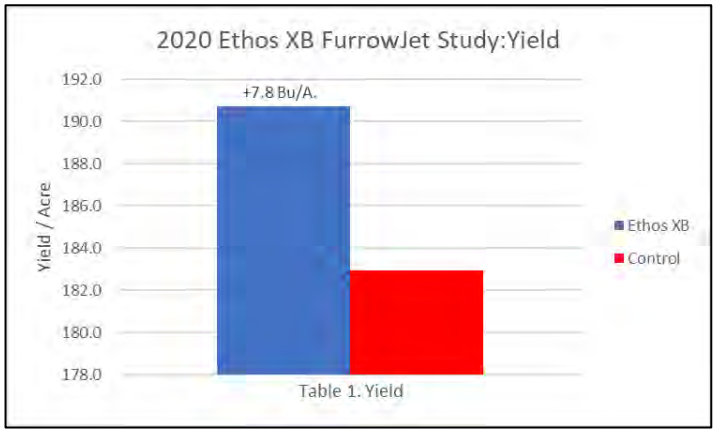
ACTIVE INGREDIENTS:	By Wt.
Bifenthrin *	15.67%
Bacillus amyloliquefaciens strain D747 **	5.00%
Other Ingredients	79.33%
Total:	100.00%

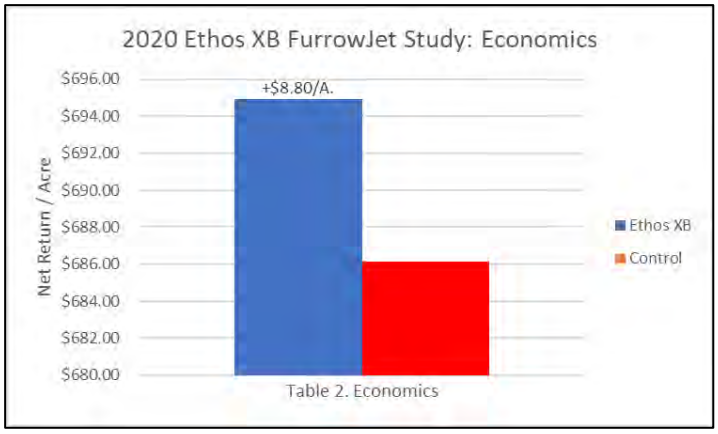
*Cis isomers 97% minimum, trans isomers 3% maximum
** Contains a minimum of 1x 10^{10} colony-forming units (cfu) per milliliter of product.
This product contains 1.5 lbs bifenthrin per gallon.

Figure 2.

The biofungicide in Ethos XB insecticide/fungicide forms a protective barrier on root surfaces and builds over time as spores germinate and colonize roots and root hairs.

Results: Ethos XB treatments applied through FurrowJet® system offered positive yield gains of +7.8Bu/A. which resulted in a return on investment of +$8.80/A. (Tables 1-2).





Planting Date: 4/27 Hybrid: Champion 61A19 Population: 36K Row Width: 30" Rotation: CAB Corn Price: $3.75 Ethos XB: $306/Gal Rate: 8.5oz/A

Capture® LFR® In-Furrow Study

Objective: This in-furrow application trial applied via Keeton® firmers (Figure 2) evaluates yield and economics of Capture® LFR®, an in-furrow liquid insecticide containing the active ingredient Bifenthrin (Figure 1.) in a liquid fertilizer ready (LFR) formulation.

Figure 1.

EPA Reg. No. 279-3302	**EPA Est. 279-NY-1**
Active Ingredient:	**By Wt.**
Bifenthrin*:	17.15%
Other Ingredients:	82.85%
	100.0%

*Cis isomers 97% minimum, trans isomers 3% maximum.

This product contains 1.5 pounds active ingredient per gallon.

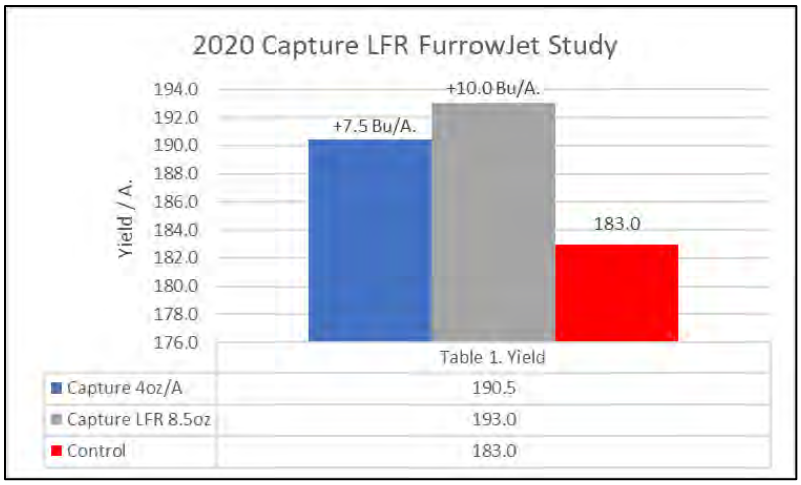


Table 1. Yield

Capture 4oz/A	190.5
Capture LFR 8.5oz	193.0
Control	183.0

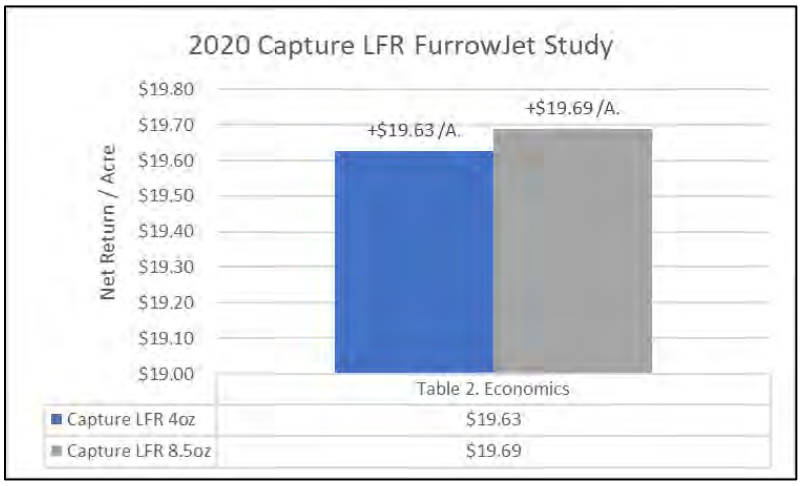


Table 2. Economics

Capture LFR 4oz	$19.63
Capture LFR 8.5oz	$19.69

Capture LFR controls seed and seedling pests such as wireworm, corn rootworm, cutworm, grubs, armyworm, seed corn maggot and common stalk borer.

Figure 2.

Results: Both rates of Capture LFR treatments performed similarly in terms of yield gains, which consisted of +7.5 to +10.0 Bu/A. The higher 8.5oz rate of Capture LFR did offer just enough yield gain over the lower 4oz rate to offset the additional cost of product within $0.06/A.

Planting Date: 4/27 Hybrid: Champion 61A19 Population: 36K Row Width: 30" Rotation: CAB Corn Price: $3.75 Capture LFR: $272/Gal

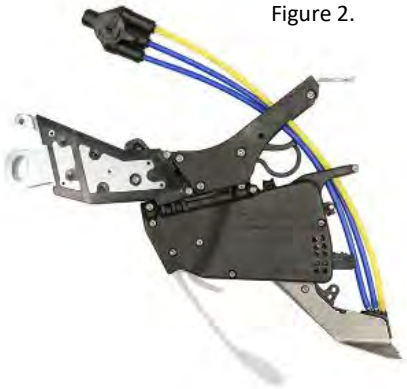
Temitry™ LFR® In-Furrow Study

Objective: To evaluate the yield and economic return of Temitry LFR applied via FurrowJet® system (Figure 2). This fungicide/insecticide is an in-furrow product for protection against early season corn diseases and below-ground insect pests, like corn rootworm, in a liquid-fertilizer-ready (LFR) formulation.

Figure 1.

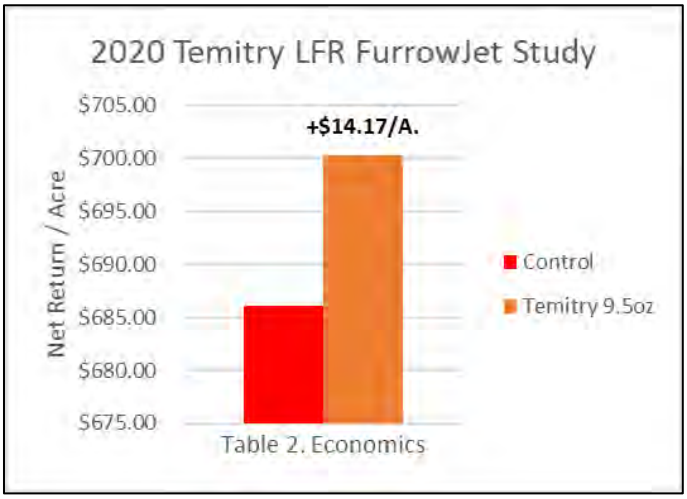
ACTIVE INGREDIENTS:	By Wt.
Bifenthrin*	14.4%
Pyraclostrobin: (carbamic acid, [2-[[[1-(4-chlorophenyl)-1H-pyrazol-3-yl]oxy]methyl] phenyl]methoxy-, methyl ester)	7.2%
Other Ingredients	78.4%
Total:	100.0%

Figure 2.



Temitry LFR combines Headline®, a strobilurin fungicide (0.67#/gal Pyraclostrobin), and Capture® LFR®, a pyrethroid insecticide (1.33#/gal Bifenthrin) (Figure 1). When applied in-furrow on corn, Temitry LFR in-furrow fungicide and insecticide provides control of seedling fungal diseases, such as Rhizoctonia solani, and soil insect pests, such as corn rootworm larvae, wireworm, grubs, seedcorn maggot, cutworm and others that can damage corn seeds and seedlings.

Results: Temitry LFR treatments resulted in average yield gains of +8.1 Bu/A. and resulted in a positive return on investment of +$14.17/A. (Tables 1-2).



Planting Date: 4/27 Hybrid: Champion 61A19 Population: 36K Row Width: 30" Rotation: CAB Corn Price: $3.75 Temitry LFR: $220/Gal

Xyway™LFR® FurrowJet® Study

Objective: To evaluate the yield and economic return of Xyway LFR, a new fungicide with the active ingredient Flutriafol (Figure 1). Xyway3D fungicide is a revolutionary in-furrow fungicide formulation that provides season-long disease protection from the inside out, root to tassel and stalk to leaf. This study evaluates Xyway LFR in a tri-band application via FurrowJet® system (Figure 2).

FMC has a pending EPA registration for the Xyway LFR fungicide formulation and is anticipated in time for the 2021 season.

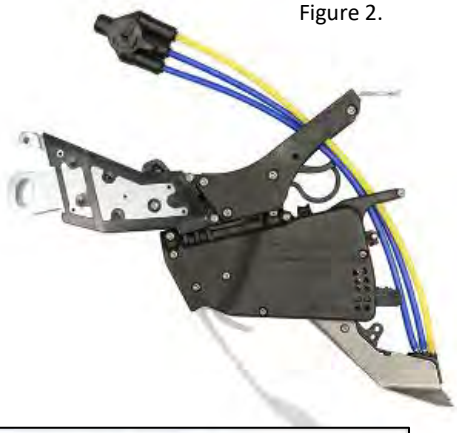
Results: Table 1. Illustrates flutriafol treatments resulted in average yield gains of +6.2 Bu/A. Since pending state registration, no pricing is available at time of publication. However, if pricing consisted of $15/A., XYWAY LFR treatments would have resulted in a positive economic return of +$8.17/A.

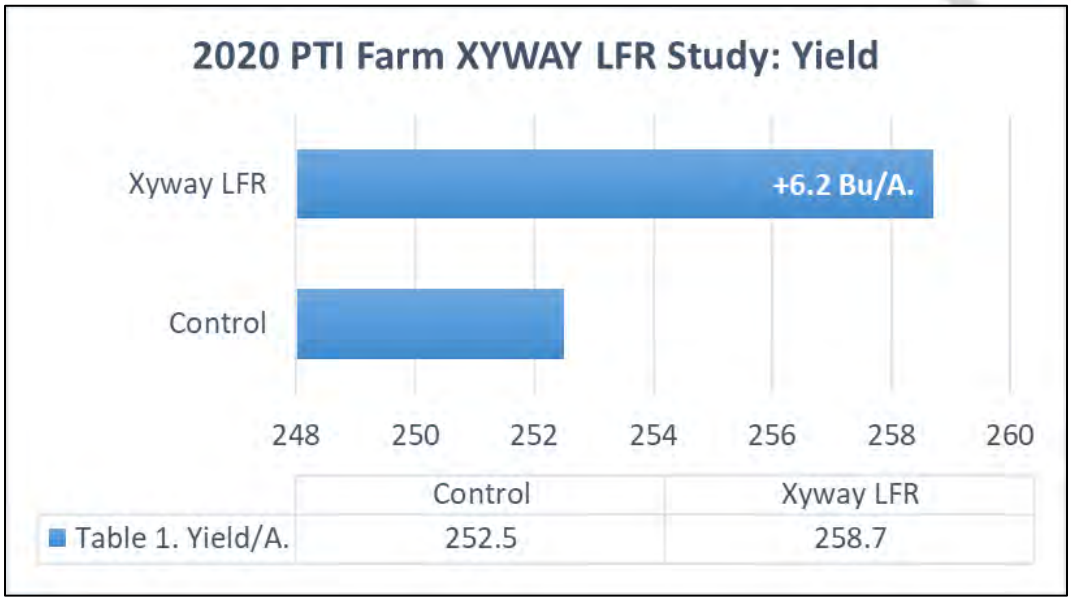
Figure 1.

EPA Reg. No. 279-9638	EPA Est. No. 279-DE-001
Active Ingredient:	**By Wt.**
Flutriafol	26.4%
Other Ingredients:	73.6%
TOTAL:	**100.0%**

Contains 2.5 pounds per gallon of the active ingredient flutriafol. Suspension Concentrate.

Figure 2.





Planting Date: 4/27 Hybrid: Champion 61A19 Population: 36K Row Width: 30" Rotation: CAB Corn Price: $3.75 XYWAY LFR: No Pricing

SabrEx™/Excellorate™ FurrowJet® Study

Objective: This FurrowJet® system application trial evaluates the yield and net return of SabrEx and Excellorate from Advanced Biological Marketing.

ABM® ADVANCED BIOLOGICAL MARKETING

Figure 1. Exellorate™

Excellorate is a 2-2-1 liquid blend of glucoheptonate carbohydrates, essential plant nutrients, beneficial enzymes and naturally occurring plant and soil stimulants. It represents a next generation of technology, complex carbohydrates, essential growth factors and is formulated to supplement biological activity (Figure 1).

Guaranteed Analysis:

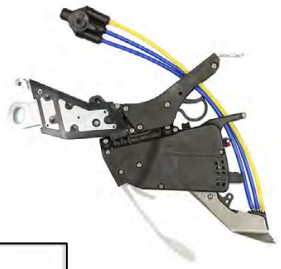
Total Nitrogen (N)	2.0%
Available Phosphate (P_2O_5)	2.0%
Soluble Potash (K_2O)	1.0%
Boron (B)	0.05%
Cobalt (Co)	0.002%
Copper (Cu)	0.14%
Iron (Fe)	0.10%
Manganese (Mn)	0.10%
Molybdenum (Mo)	0.002%
Zinc (Zn)	0.05%

Figure 2. SabrEx™ Root Inoculant

SabrEx is a formulation of two biological Trichoderma fungi strains. Trichoderma colonizes with the plants root system and feeds from the starches and sugars produced by the plant, while exuding beneficial enzymes and proteins for the host plants use. As a result, the plant produces a larger root system improving its nitrogen and water use efficiency (Figure 2).

CONTAINS NON-PLANT FOOD INGREDIENTS
Guaranteed Analysis :
Active Ingredients: 0.10% - (Total microbial count $8x10^7$ cfu/ml *Trichoderma harzianum* $4 x 10^7$ cfu/ml and *Trichoderma atroviride* $4 x 10^7$ cfu/ml
Inert Ingredients: 79.9%-water, 20.0%-proprietary liquid

Results: Tables 1. illustrates SabrEx Corn IF treatments resulted in yield gains of +1.7 Bu/A., which equated to a return on investment of +$0.39/A. Individual Excellorate treatments offered gains of +1.0 Bu/A., with a negative return on investment of **-$0.73/A.**



Tank-mixing both products offered yield increases of +2.9 Bu/A., while just capturing positive net returns of +$0.76/A.

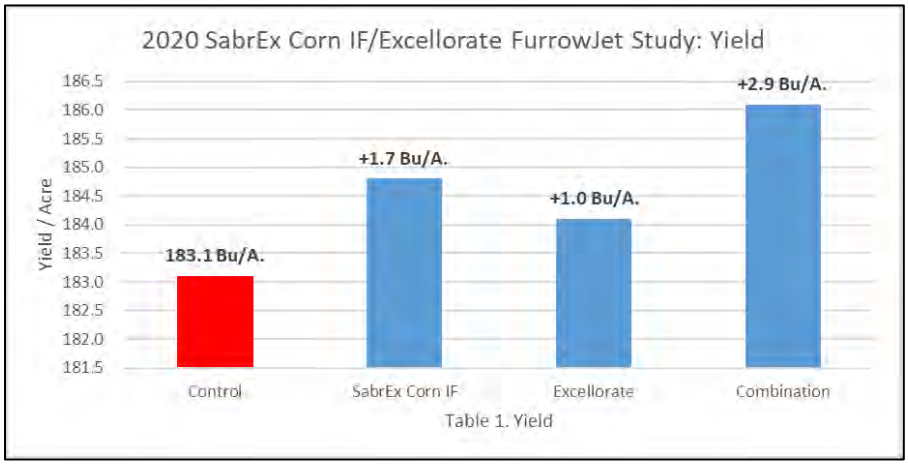


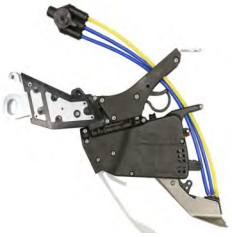
Table 1. Yield

Planting Date: 4/27 *Hybrid: Champion 61A19* *Population: 36K* *Row Width: 30"* *Rotation: CAB* *Corn Price: $3.75*

SabrEx: $5.85/A *Excellorate: $1.10/oz* *Rate: SabrEx: 1oz/A.* *Excellorate: 4oz/A.*

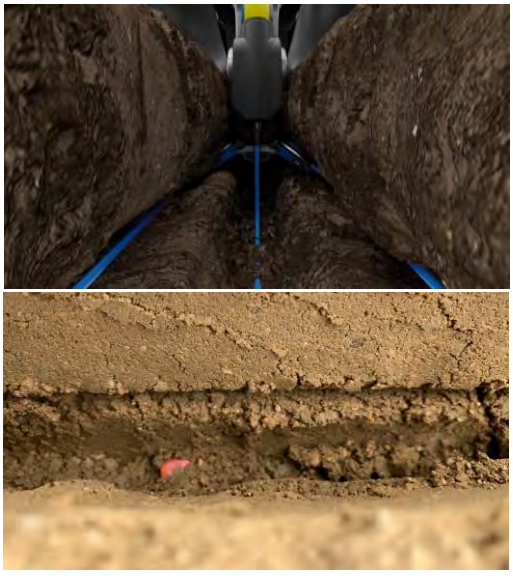
FurrowJet® Side-Wall Study

Figure 1. FurrowJet®



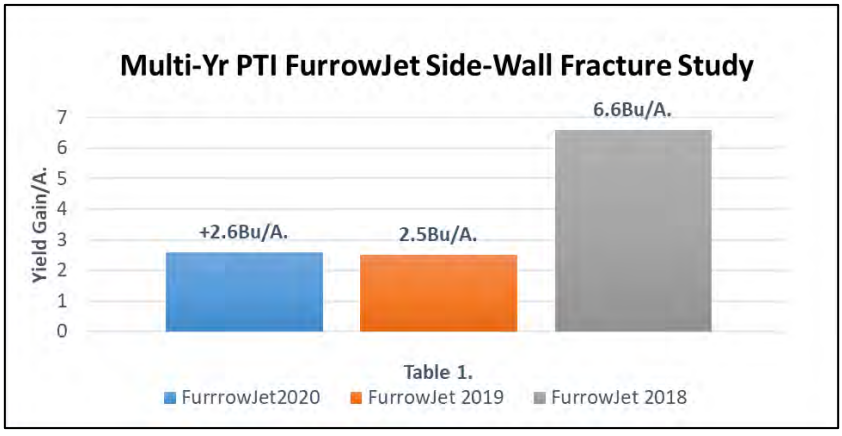
Objective: FurrowJet® system is a planter fertilizer attachment (Figure 1.) that enables placement of not only an in-furrow starter fertilizer, but also a dual-band of fertilizer 3/4" on each side of the seed (Figure 2). To achieve this dual-band placement, the wings on FurrowJet® system angle downward to cut into the sidewall and place fertilizer alongside the seed in a dual-band. By doing this, lifting and fracturing can occur that potentially could remove soil smearing or compaction created by disc openers. Additionally, closing wheel systems following FurrowJet® wings have a better opportunity to close the seed trench, remove air pockets, and allow for good seed-to-soil contact.

Figures 2-3: FurrowJet® Dual-Band Wings Fracturing Side-Walls



This study evaluates FurrowJet® dual-band wings offering the ability to cut, lift and remove side-wall compaction in the seed furrow. For this study, no liquid fertilizer was applied.

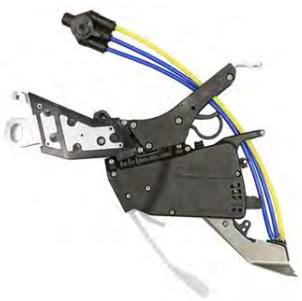
Results: Table 1. illustrates the side-wall fracture advantages of FurrowJet® system in the 2018, 2019 and 2020 growing seasons. While 2018 offered +6.6 Bu/A. advantages, 2019 and 2020 proved significantly less at only +2.5 to +2.6 Bu/A. As mentioned in the objective, FurrowJet® systems do have the ability to assist in closing the furrow due to easier side-wall collapse. In 2019 and 2020 our plot planter was fitted with the FurrowForce® system, a new robust automatic sensing and control closing wheel system. It is our belief that this system closed the gap on FurrowJet® system advantages due to superior closing activity.



Planting Date: June 11 *Hybrid: AgriGold 641-54* *Population: 36K* *Row Width: 30"* *Rotation: CAC* *Corn Price: $3.75*

Corn Summary of 2020 FurrowJet® Applications

Study	Classification	Yield/A.	$ROI	Page #
Conventional Till High Yield NetaFim DripTape Irrigated Corn	Starter Fertilizer	58.8	$ 78.19	41
April 5th Corn Plant Date w/Starter	Starter Fertilizer	23.8	$ 56.60	12
Nachurs imPulse FurrowJet Tri-Band 5Gal	Starter Fertilizer	11.2	$ 55.50	66
Nachurs imPulse FurrowJet Center 4Gal	Starter Fertilizer	7.6	$ 45.30	64
Corn Marco QuickGrow LTE 5 Gal	Starter Fertilizer	8.2	$ 43.25	58
Nachurs imPulse FurrowJet Wings 6Gal	Starter Fertilizer	8.8	$ 43.20	65
Strip Till High Yield Netafim DripTape Irrigated FurrowJet Tri-Band & Conceal: Cor	Starter Fertilizer	29.5	$ 40.76	45
May 14th Corn Plant Date w/Starter	Starter Fertilizer	19.2	$ 39.42	12
QLF 7-21-3 MKP FurrowJet Center	Starter Fertilizer + Carbon Based Sugar	5.2	$ 37.10	74
April 11th Corn Plant Date w/Starter	Starter Fertlizer	18.5	$ 36.85	12
10 Gal. 10-34-0	Starter Fertlizer	9.5	$ 36.63	72
QLF 7-21-3 MKP + Boost FurrowJet Wings	Starter Fertlizer + Carbon Based Sugar	5.0	$ 36.46	74
Nachurs Start2Finish	Starter Fertlizer	13.1	$ 31.80	67
Andersons 5oz RGS + 3Gal ATS	Starter Fertlizer	9	$ 20.32	61
Capture LFR 8.5oz	Insecticide	10.0	$ 19.69	83
Capture 4oz	Insecticide	7.5	$ 19.63	83
AgroLiquid Starter Fertility Program	Starter Fertlizer	14.6	$ 18.95	63
Sunrise Coop PCT FJC	Starter Fertlizer + Biological	5.2	$ 14.79	71
10 Gal 10-34-0 FJ vs Conceal	Starter Fertlizer	3.9	$ 14.77	73
Temitry LFR	Fungicide + Insecticide	8.1	$ 14.17	84
Pivot Bio PROVEN 25% N Reduction Center vs Wings	Biological	3.8	$ 12.32	69
QLF Boost 2gal + Marco QuickGrow LTE 5Gal	Carbon Based Sugar	5.0	$ 12.19	59
Manticor LFR	Fungicide + Insecticide	7.6	$ 12.05	79
Strip Till High Yield Netafim DripTape Irrigated FurrowJet Wings: Corn	Starter Fertlizer	10.0	$ 11.71	45
AgroLiquid accesS 2 Gal	Starter Fertlizer	5.0	$ 9.75	62
Corn FurrowJet Side Wall Cut	Mechanical	2.6	$ 9.75	88
Riser	Starter Fertlizer	6.0	$ 8.92	81
Ethos XB	Starter Fertlizer	7.8	$ 8.80	82
QLF Boost 1gal + Marco QuickGrow LTE 5Gal	Carbon Based Sugar	3.2	$ 8.72	59
April 23rd Corn Plant Date w/Starter	Starter Fertlizer	11	$ 8.65	12
Xyway LFR	Starter Fertlizer	6.2	$ 8.17	85
Strip Till High Yield Netafim DripTape Irrigated FurrowJet Center: Corn	Starter Fertlizer	5.25	$ 7.41	45
QLF AgroGold RC FJC	Starter Fertlizer	4.0	$ 6.11	76
AgroLiquid accesS 1 Gal	Starter Fertlizer	2.8	$ 6.00	62
Andersons 5Gal Season Pass 6-18-6 + Microcarb + 1pt BioPass FJC	Starter Fertlizer	2.6	$ 3.89	61
Pivot Bio PROVEN w/25% N Reduction FJC	Biological	-1.7	$ 1.02	68
Combo of SabrEx/Excelorate	Starter Fertlizer + Micronutrient + Biological	2.9	$ 0.76	86
SabrEx Corn IF	Biological	1.7	$ 0.39	86
5Gal Marco LTE + 1qt BioMarc	Micronutrient	2.0	$ (0.50)	57
Excellorate	Starter Fertlizer + Micronutrient	1.0	$ (0.73)	86
AgroLiquid accesS 3 Gal	Starter Fertlizer	3.4	$ (0.75)	62
Andersons 5Gal Season Pass 6-18-6 + Microcarb + 1pt BioPass FJW	Starter Fertlizer	1.3	$ (1.02)	61
Xanthion	BioFungicide	2.2	$ (2.69)	80
Pivot Bio PROVEN 100%N	Biological	2.6	$ (3.28)	68
May 23rd Corn Plant Date w/Starter	Starter Fertlizer	6.0	$ (10.03)	12
AgroLiquid accesS 4 Gal	Starter Fertlizer	1.3	$ (19.50)	62
Pivio Bio PROVEN Wing + Starter	Biological + Starter Fertlizer	-8.4	$ (31.39)	70
Pivio Bio PROVEN Center + Starter	Biological + Starter Fertlizer	-9.8	$ (36.75)	70
Averages		7.58	$ 15.28	



Force® 6.5G vDrive® Insecticide Study

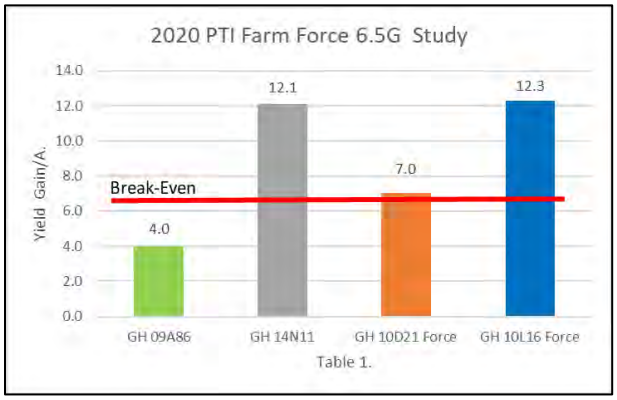
Objective: This trial evaluates the yield and net return of Force 6.5G soil applied insecticide. Force 6.5G soil-applied corn insecticide is a higher-load (2lbs/A.) granular formulation for control of corn rootworm and other soil-dwelling insect pests. This formulation was developed by Syngenta to better meet the changing needs of today's corn growers who are looking for both superior performance and increased at-plant efficiency. Four Golden Harvest corn hybrids were tested in this study to evaluate the yield and net return at a full rate of Force 6.5G.

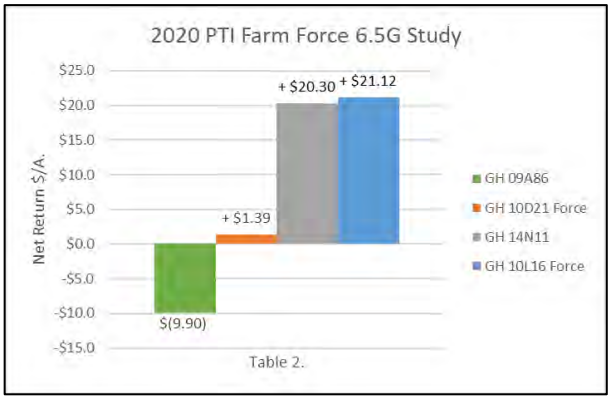
Figure 1. Force® 6.5G Label

Results: Table 1. reports Force 6.5G applications resulted in average yield gains of +8.9 Bu/A., ranging from +4.0 Bu/A. to +12.3Bu/A. over the four corn hybrids tested. Yield response needed for break-even was +6.7 Bu/A.

Figure 2. vDrive® Insecticide

Table 2. illustrates that three of the four corn hybrids (GH10D21, GH14N11, GH10L16) proved economic gains from using Force 6.5G. GH14N11 and GH10L16 proved highest returns at +$20.30/A. to +$21.12/A. GH10D21 just broke even at +$1.39/A., while GH09A86 proved economic losses at **-$9.90/A.**

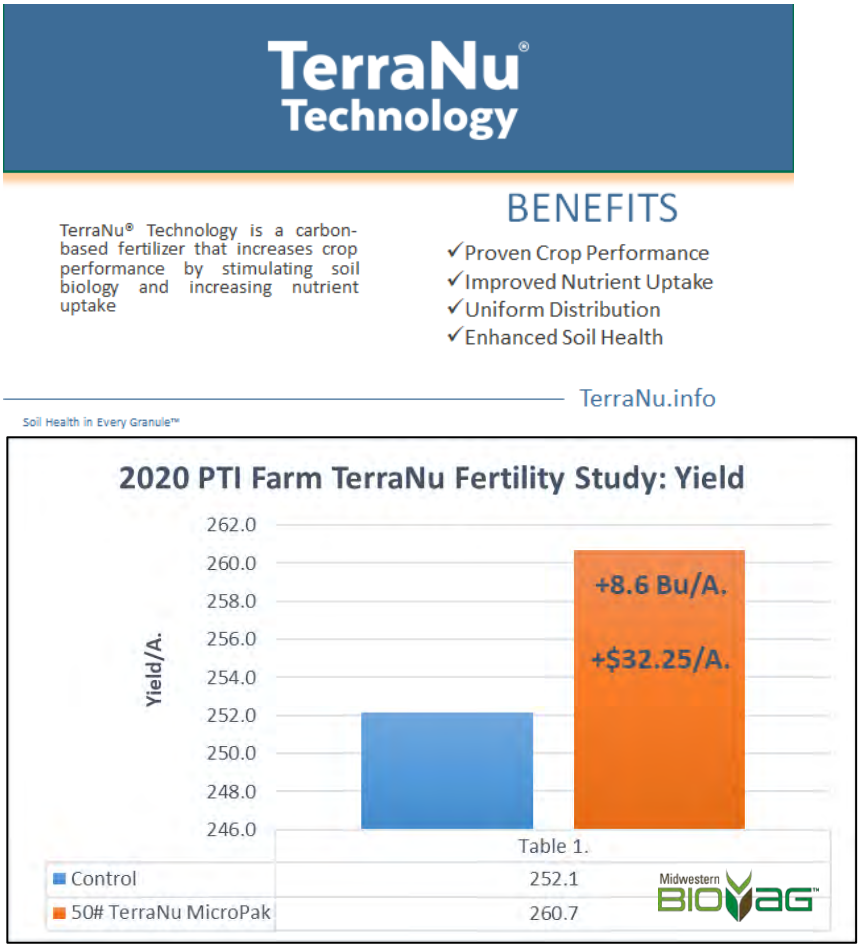




Planting Date: May 15 Hybrid: Varied Population: 36K Row Width: 30" Rotation: CAC Corn Price: $3.75 Force 6.5G: $25/A.

TerraNu® Micro-Pak Study

Objective: To evaluate the yield and economics of TerraNu Micro-Pak carbon-based fertilizer. TerraNu is granulated dairy manure digestate with an analysis of 3-3-3-7S with Mg, Ca, B, Cu, Fe, Mn, and Zn.



Results: Table 1. illustrates that 3 Gal/A. of QLF 7-21-3 MKP with Boost resulted in positive yield gains of +8.6 Bu/A. Using a cost of $30/A. for 50lbs/A., TerraNu posted positive net returns of +$32.11/A.

Planting Date: 4/27 *Hybrid: DKC 61-74* *Population: 36K* *Row Width: 30”* *Rotation: CAC* *Corn Price: $3.75*

$30 Fert. Reallocation *TerraNu 50#= $30/A.*

Precision Planting®

2020 PTI Results

Calcium Products SO4™ Study:

Objective: This trial evaluates the yield response and economics of pelletized calcium sulfate (SO4) applied fall broadcast and as banded spring strip-till. Sulfur is an essential component of plant growth with key processes relying on chlorophyll formation and protein production. Sulfur is considered the fourth major nutrient behind N, P, and K.

CALCIUM PRODUCTS™

SO4™ PELLETIZED GYPSUM

SO4 from Calcium Products is a 21% Calcium (non-pH neutralizing) and 17% Sulfur dry pelletized fertilizer, mined and manufactured in NW Iowa. It is finely ground and pelletized to achieve a balance of solubility and pellet strength.

Releases Sulfur to Match Plant Needs

SO4 supplies a balanced initial sulfur release and a steady supply throughout the growing season. AMS releases sulfur too quickly, and elemental sulfur releases sulfur too slowly, neither meeting the crop's complete needs.

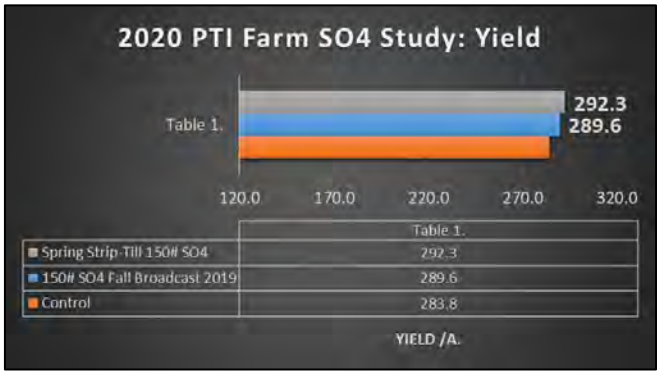
Spreads Easily

SO4's consistent pellet size allows it to be blended and applied with other dry fertilizers, which means it doesn't require a separate application. It can be applied pre-plant in the spring, in-season via top dress or post-harvest in the fall.

Will Not Acidify Soil

SO4 is pH neutral, meaning it will not acidify the soil like other sulfur sources. Proper soil pH maximizes a plant's utilization of nutrients promoting good plant health and optimizing yield.

Historically, much of the sulfur need was satisfied with atmospheric deposition as result of coal burning industries. However, amendments to the Clean Air Act in 1990 targeted sulfur emissions, resulting in less than ½ of the amount of sulfur today compared to 30 years ago.



Results: Fall 2019 **broadcast** treatments of SO4 resulted in average yield gains of +5.8 Bu/A., however offered negative returns of **-$0.24/A.** after cost of product and application. (Tables 1-2). Spring strip-till **banding** treatments of S04 resulted in average yield gains of +8.5 Bu/A., with positive economic returns of $10/A.

Spring strip-till **banding** of S04 resulted in higher efficiency and pushed yield gains an additional +2.7 Bu/A. over broadcast applications and posted positive net economic returns of +$10.24/A.

Planting Date: 5/11 Hybrid: Champion 61A19 Population: 36K Row Width: 30" Rotation: CAC Corn Price: $3.75

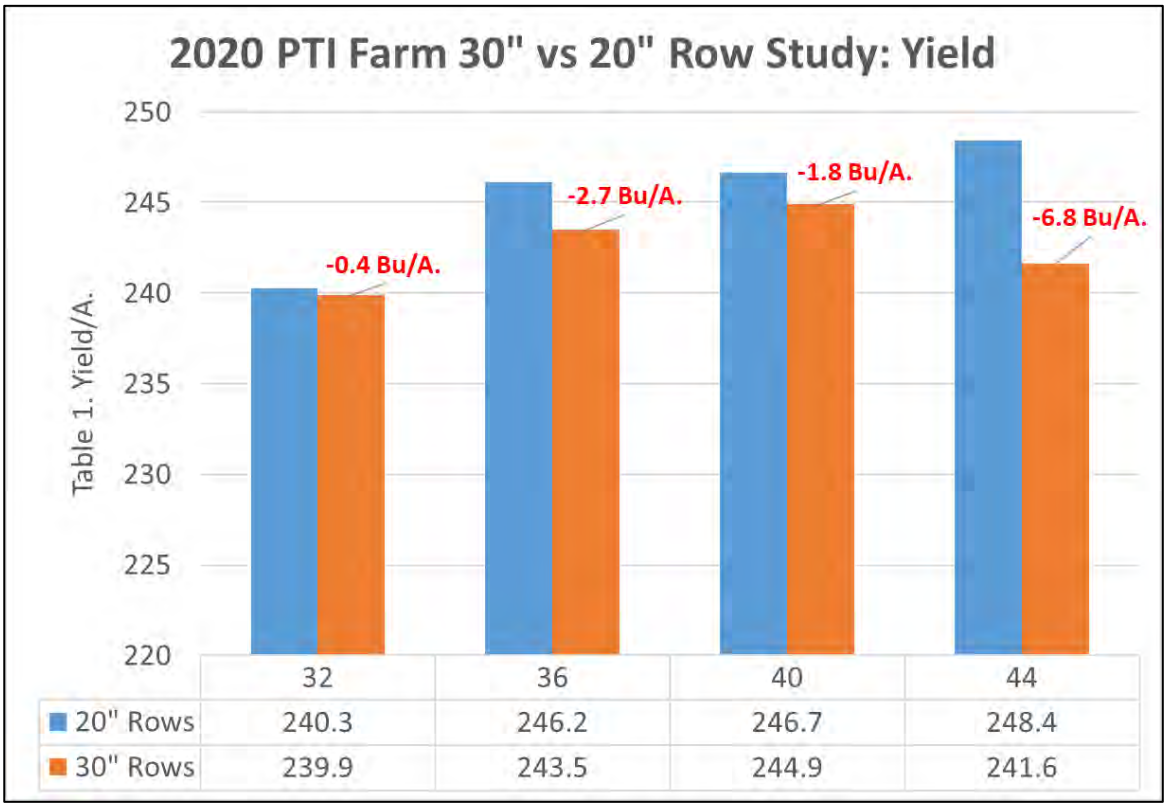
SO4: $240/Ton + $4/A Application

30” vs 20” Corn Study

Objective: This trial evaluates the industry wide standard of 30” row corn, to a 20” narrower system at four seeding rates of 32K, 36K, 40K, and 44K. Four hybrids consisting of Dekalb 63-91, AgriGold 639-70, Golden Harvest 10D21, and Pioneer 1185 are used in this study to help identify differences in plant type response.

Results: Table 1. illustrates that 20” row corn out-yielded every individual 30” row entry, by a range of only 0.4 to 6.8 Bu/A. Between the 32K to 36K seeding rates, there was less than a 3Bu/A. spread.

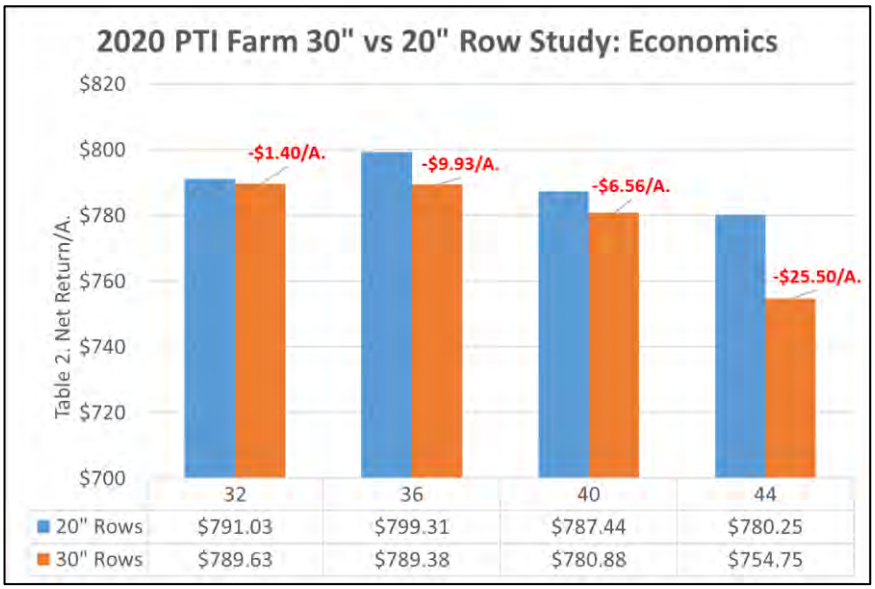
30” rows achieved **agronomic yield** at the 40K seeding rate. 20” rows failed to determine agronomic yield because every seeding rate through 44K offered higher yields.



	32	36	40	44
20" Rows	240.3	246.2	246.7	248.4
30" Rows	239.9	243.5	244.9	241.6

30” vs 20” Corn Study Continued

Table 2. illustrates that 20” rows also out-performed all individual 30” row entries in regard to economics. After cost of seed at each seeding rate, 30” rows resulted in lower economic returns ranging from **-$1.40** to **-$25.50/A.**



20” rows may not have proved agronomic yield in Table 1., but it did however reach **economic optimum** yield at seeding rates of 36K. This would indicate that higher seeding rates above 44K would more than likely of resulted in higher economic losses.

At the PTI Farm, we have thousands of growers that come each summer to have a conversation about agronomics. One question we talk about often is corn row width. Many farms today that are on 30” corn rows, say they switched from wide 38” or 36” wide rows back in the early 70’s. If this is the case, growers have been implementing 30” row corn systems for nearly 50 years. The question now is, has 50 years been long enough doing the same thing over and over or is time for a change to another system that could offer higher yields and profitability? The challenge at the PTI Farm with 20” narrow corns rows has been the lack of large economic profitability. In other words, will an increase of +$1.40 to +$9.93/A. at 32K to 40K seeding rates cause a farmer to run to their local equipment dealer and convert their planters, harvest equipment, tractor tires, and side-dress equipment/management? This is why the adoption rate of narrow corn rows has been slow.

Until the seed industry produces “short and showy” fixed ear, leaf architecture appropriate, and higher yielding hybrids suited for narrow rows, the narrow row system may likely continue to be slow to adopt. Conversely, farm operations that could be a nice fit for narrow rows are:

1. Producers on marginal ground where plant-to-plant competition could be important to conserve water and nutrients.
2. Growers who want to plant at higher seeding rates (above 40K) in the effort to “unlock” yield. At these higher pops, 30” rows are not appropriate.
3. Growers who want one planter that will also plant soybeans or another crop that prefers to be in narrow rows as well.

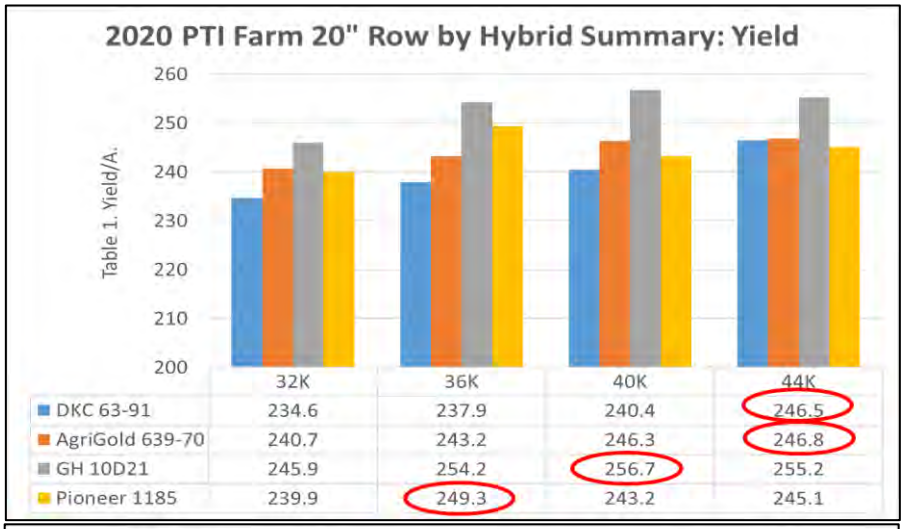
Planting Date: 6/10 Hybrid: Varied Population: 32K-44K Row Width: 20-30” Rotation: CAB Corn Price: $3.75 Seed Price: $275/Bag

20” Row Corn Seeding Rate Study

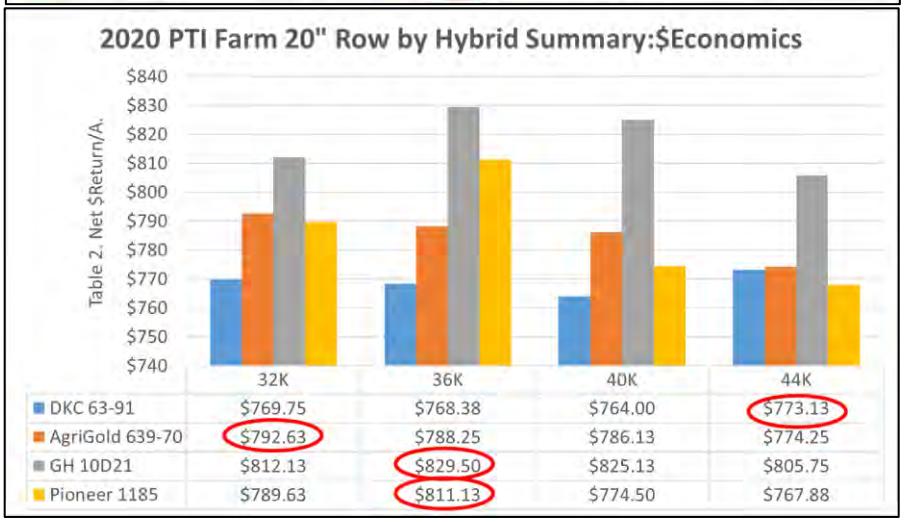
Objective: This trial evaluates four seeding rates of 32K, 36K, 40K, and 44K in a 20” narrow row corn environment. Four hybrids consisting of Dekalb 63-91, AgriGold 639-70, Golden Harvest 10D21, and Pioneer 1185 are used in this study to help identify differences in plant type response.

Results:

1. Dekalb 63-91 achieved agronomic yield at the highest 44K seeding rate. Yields varied by 11.9 Bu/A. across all seeding rates with 32K the lowest yield. Economic seeding rate occurred at 44K.
2. AgriGold 639-70 achieved agronomic yield at the highest 44K seeding rate. Yields varied by 6.1 Bu/A. across all seeding rates with 32K the lowest yield. Economic seeding rate occurred at 32K, due to the low variance in yield across all pops.
3. Golden Harvest 10D21 achieved agronomic yield at the 40K seeding rate. Yields varied 10.8 Bu/A. across all seeding rates with 32K the lowest yield. Economic seeding rate occurred at 36K.



	32K	36K	40K	44K
DKC 63-91	234.6	237.9	240.4	246.5
AgriGold 639-70	240.7	243.2	246.3	246.8
GH 10D21	245.9	254.2	256.7	255.2
Pioneer 1185	239.9	249.3	243.2	245.1



	32K	36K	40K	44K
DKC 63-91	$769.75	$768.38	$764.00	$773.13
AgriGold 639-70	$792.63	$788.25	$786.13	$774.25
GH 10D21	$812.13	$829.50	$825.13	$805.75
Pioneer 1185	$789.63	$811.13	$774.50	$767.88

4. Pioneer 1185 achieved agronomic yield at the 36K seeding rate. Yields varied by 9.4 Bu/A. across all seeding rates with 32K being the lowest yield. Economic seeding rate occurred at 36K.

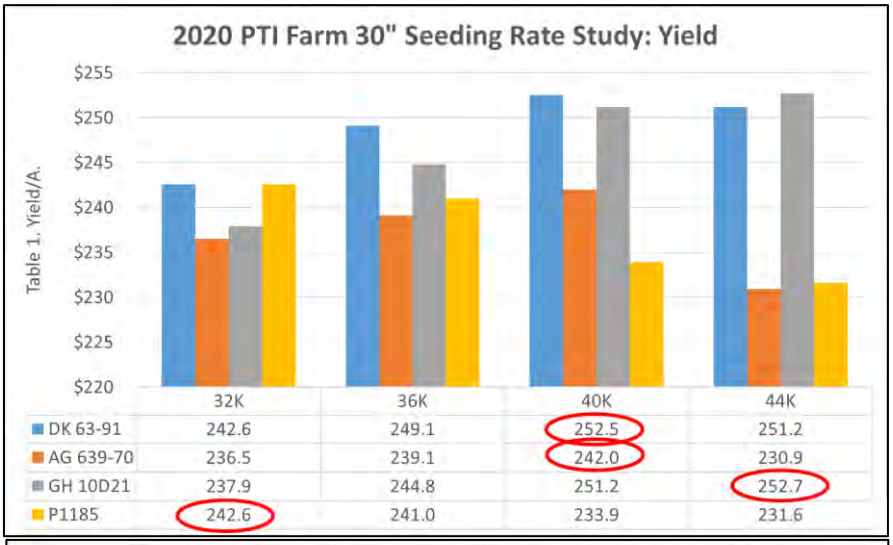
Planting Date: 5/17 *Hybrid: Varied* *Population: 32K-44K* *Row Width: 20-30”* *Rotation: CAB* *Corn Price: $3.75* *Seed Price: $275/Bag*

30” Row Corn Seeding Rate Study

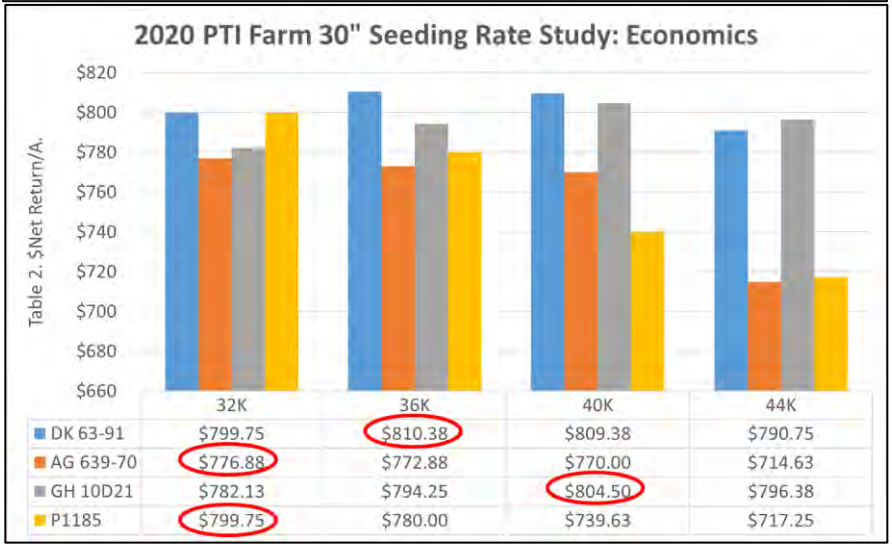
Objective: This trial evaluates four seeding rates of 32K, 36K, 40K, and 44K in a 30” narrow corn environment. Four hybrids consisting of Dekalb 63-91, AgriGold 639-70, Golden Harvest 10D21, and Pioneer 1185 are used in this study to help identify differences in plant type response.

Results:

1. Dekalb 63-91 achieved agronomic yield at the 40K seeding rate. Yields varied by 9.9 Bu/A. across all seeding rates with 32K the lowest yield. Economic seeding rate occurred at 44K.
2. AgriGold 639-70 achieved agronomic yield at the 40K seeding rate. Yields varied by 11.1 Bu/A. across all seeding rates with 44K being the lowest yield. Economic seeding rate occurred at 40K but pushing to 44K resulted in the lowest economics for this hybrid.
3. Golden Harvest 10D21 achieved agronomic yield at the 44K seeding rate. Yields varied 14.8 Bu/A. across all seeding rates with 32K the lowest yield. Economic seeding rate occurred at 40K.



	32K	36K	40K	44K
DK 63-91	242.6	249.1	252.5	251.2
AG 639-70	236.5	239.1	242.0	230.9
GH 10D21	237.9	244.8	251.2	252.7
P1185	242.6	241.0	233.9	231.6



	32K	36K	40K	44K
DK 63-91	$799.75	$810.38	$809.38	$790.75
AG 639-70	$776.88	$772.88	$770.00	$714.63
GH 10D21	$782.13	$794.25	$804.50	$796.38
P1185	$799.75	$780.00	$739.63	$717.25

4. Pioneer 1185 achieved agronomic yield at the lowest 32K seeding rate. Yields varied by 11.0 Bu/A. across all seeding rates with 44K the lowest yield. Economic seeding rate occurred at 32K.

Planting Date: 5/17 Hybrid: Varied Population: 32K-44K Row Width: 20-30” Rotation: CAB Corn Price: $3.75 Seed Price: $275/Bag

Precision Planting®

2020 PTI Results

20” Solar Corridor Study

Objective: This trial’s intention is to evaluate any yield or economic advantage in planting 20” row corn in a “solar corridor twin” method at seeding rates of 32K to 44K. A solar corridor is designed as 40” wide rows surrounded by two 20” rows. The theory behind this trial is to increase the distribution of sunlight so that all corn leaves or chloroplasts (regardless of their vertical disposition on the corn plant) receive full access to sunlight the entire growing season. If one of the basic principles of corn yield is maximizing sunlight, could a solar corridor ultimately contribute to increased yield?

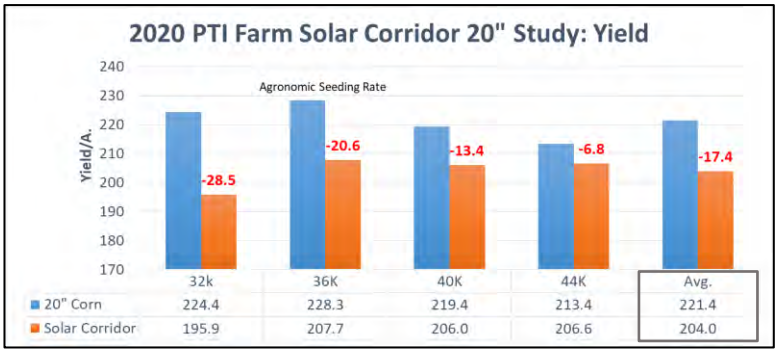
Results and Highlights:

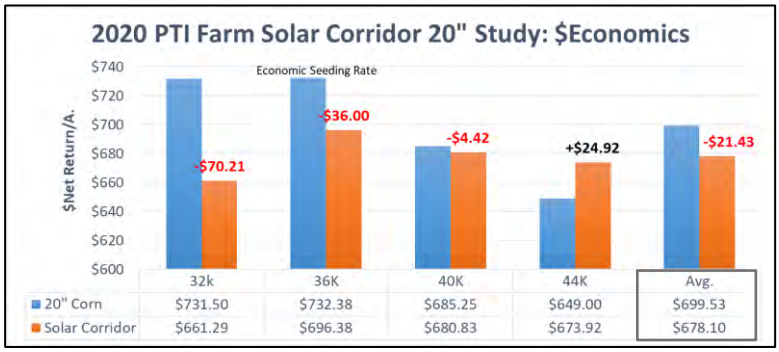
40” solar corridor rows resulted in average yield losses of **-17.4 Bu/A.**, as well as economic losses of **-$21.43/A.** compared to traditional 20” rows over all seeding rates.

Both systems achieved agronomic and economic seeding rates at 36K.

40” solar corridor rows out-performed the traditional 20” rows **ONLY** at the high 44K seeding rate, where the solar corridor gained +$24.92/A. This was mainly due to 20” rows decreasing in yield with increased seeding rates, while solar corridor 40” rows held stable, only varying 1.7 Bu/A. up to the 44K seeding rate.

2019 data resulted in yield losses of **-9.7 Bu./A**., however economic gains of +$5.92/A. for the unconventional system.





We look forward to year #3 of testing in 2021 to help evaluate and understand this agronomic system.

Corn pH Acidity Study

Objective: To evaluate the long-term yield and economic impact of acidic soil pH in corn.

When the PTI farm was acquired in the fall of 2017, a soil test revealed some major issues with soil pH on a particular area of the east side of the farm. Soil test results indicated average pH values of 5.1, with lows of 4.7 pH. This acidic area offered an opportunity to evaluate the yield response of acidic soils compared to corrected basic or neutral pH soils. Three ton of Ag Lime was applied in 2017 and another 2.5 Ton in 2018. However, plots were left without Ag Lime applied, to compare yield and economics.

What is soil pH? The term pH stands for the potential (p) of hydrogen ions (H+) in water and indicates a measure of the relative acidity or alkalinity of the soil solution. Soil pH is calculated on a 14-point scale, where a value of 7.0 is considered neutral or basic (Figure 2). Lower values on the pH scale indicate increasing H+ ions and acidity, while higher values represent increasing hydroxyl ions (OH-) and alkalinity. pH is expressed on a logarithmic scale, each change of 1 pH unit represents a 10-fold increase in soil acidity or alkalinity.

Figure 1. 2017 Soil Test pH

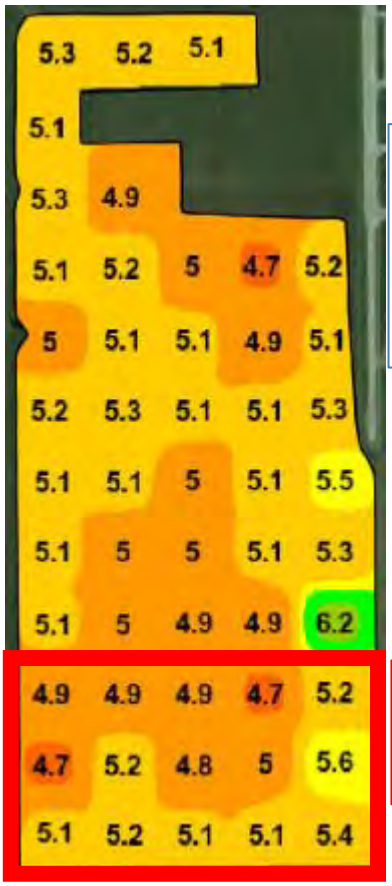
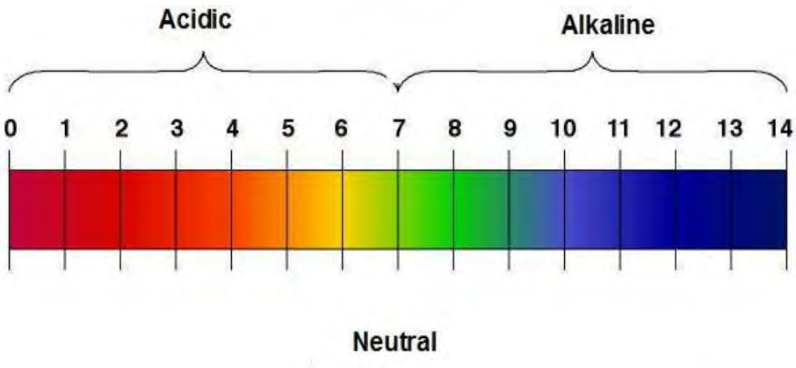
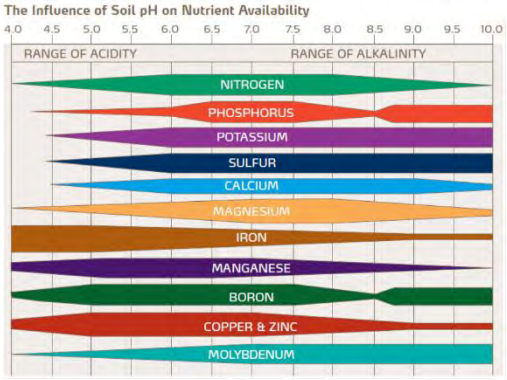


Figure 2. Soil pH Scale





Corn pH Acidity Study Continued

Results: Table 1. illustrates that in our first year of this soil acidity study, there was no significant corn yield loss in acidic soils near 5.1 pH. 2018 yield data revealed only a **-1.3 Bu/A.** yield loss in a corn rotation. A year ago, in 2019, yield performance was once again somewhat minimal with yield losses at only **-3.5 Bu/A.** from low pH soils. Table 2. reveals these two years accounted for economic losses of **-$55.60** and **-$36.96/A.**, respectively. 2020 yield data finally proved yield gains of +11.7 Bu/A. from applications of Ag lime with economic gains of +$43.78/A. This indicates a trend of possible higher long-term yields with improved pH levels in corn. Due to severely low pH levels (5.1), time may have been a factor needed to help revitalize soils and to offer yield gains.

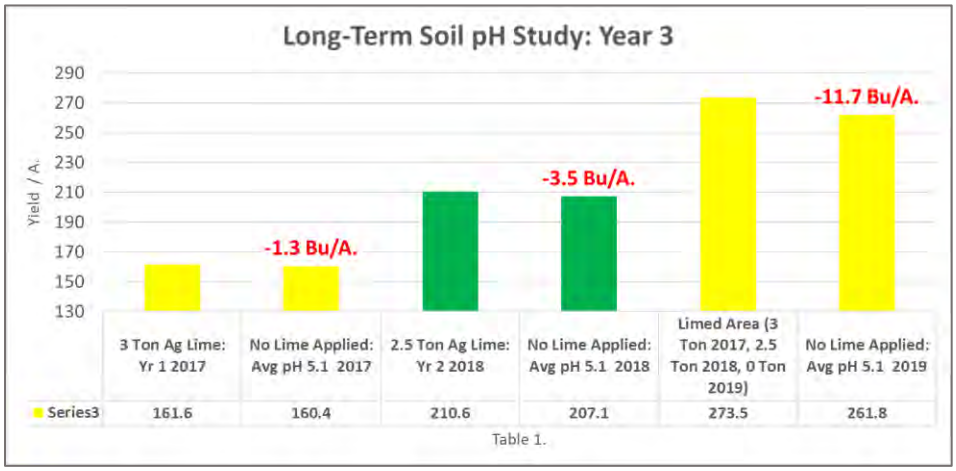


Table 1.

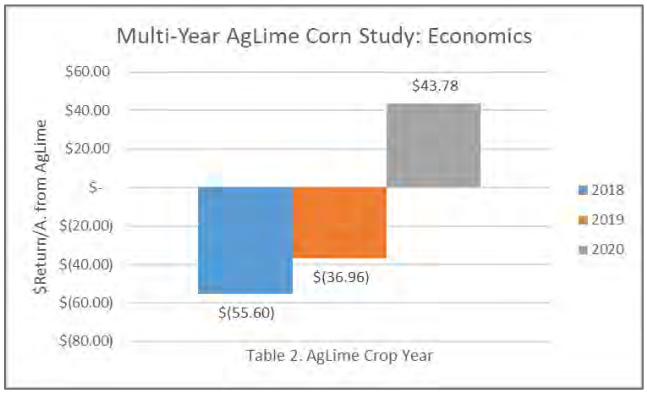


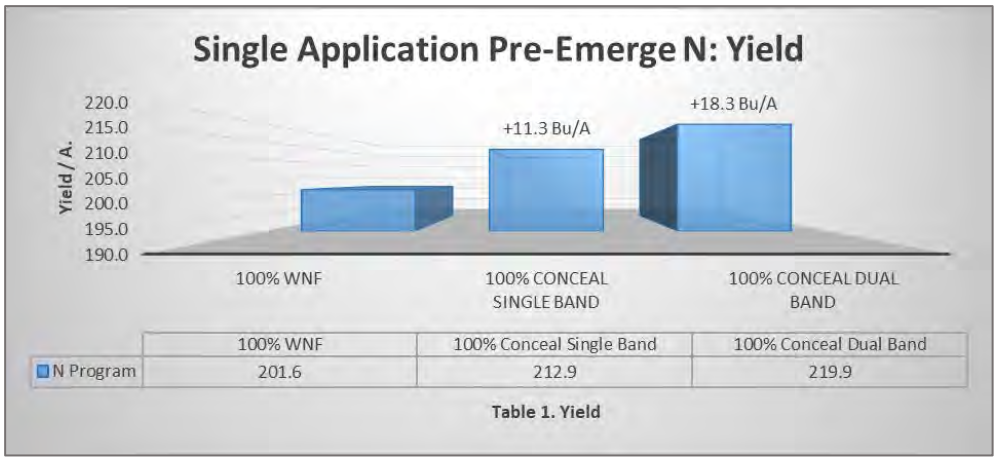
Table 2. AgLime Crop Year

Although corn losses have been minimal in an acidic environment until this year, soybeans have seen much larger losses. Be sure to check out the 2020 Soybean pH Soil Acidity Study to see these results. Being designed as a long-term multi-year study, we will continue this trial over the years to come monitoring yield, nutrient deficiencies, or other stress factors.

Planting Date: June 8 *Hybrid: DKC 61-41* *Population: 36K* *Row Width: 30”* *Rotation: CAB* *Prices: Corn $3.75*

Conceal® vs. WNF 100% Single Application Pre-Emerge Nitrogen Study

Objective: To compare 100% single applications of surface applied broadcast Weed-N-Feed (WNF) 32% UAN treatments to Conceal® system single and dual band at-plant nitrogen applications. Conceal® system is a unique planter attachment that allows growers to place nitrogen in a high concentration dual or single band positioned 3" away from the seed trench (Figure 2.) in depths near 1.5". Conceal® system uses existing planter space, utilizing a backswept knife located with-in the center of the planter's gauge wheels (Figure 1). As nitrogen is applied, it is sealed within the soil profile by the gauge wheels, preventing potential volatilization losses that is typically problematic with surface type nitrogen applications.



	100% WNF	100% Conceal Single Band	100% Conceal Dual Band
N Program	201.6	212.9	219.9

Table 1. Yield

Results: Table 1. illustrates that Conceal® system dual band applications of nitrogen out-yielded traditional 100% WNF by +18.3 Bu/A., while Conceal® system single band treatments out-performed the same by +11.3 Bu/A. Both Conceal® system applications offered a +6% to +9% yield advantage over the WNF treatment.

In summary, planter applied nitrogen offered an average yield advantage of +14.8 Bu/A. over a WNF application. Planter applied nitrogen equated to additional revenue gains over WNF applications by +$42.35/A. and +$68.63/A. respectively.

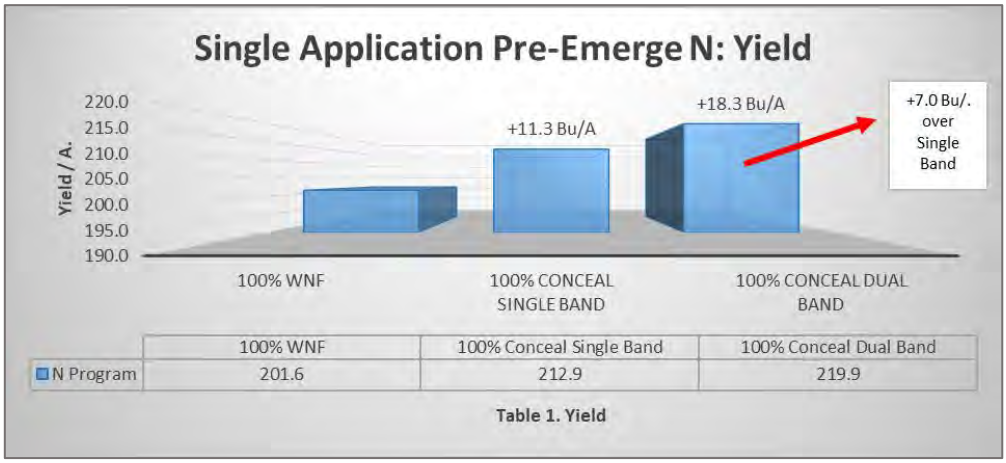
Figure 1. Conceal® Knife Design within Gauge Wheel

Figure 2. Conceal® Dual Placement 3" from Seed Trench

Planting Date: 5/11 *Hybrid: GH 10D21* *Population: 36K* *Row Width: 30"* *Rotation: CAB* *Corn Price: $3.75*

Single Band vs. Dual Band Conceal® Nitrogen Study

Objective: To compare dual band versus single band applications of nitrogen in an at-plant scenario using Conceal® system. Both treatments consist of 50% of 225lbs total nitrogen at planting and the remaining 50% in a V6 side-dress, all using UAN 32%.



	100% WNF	100% Conceal Single Band	100% Conceal Dual Band
N Program	201.6	212.9	219.9

Table 1. Yield

Conceal® system is a unique planter attachment that allows growers to place nitrogen in a high concentration dual or single band positioned 3" away from the seed trench (Figure 1.) in depths near 1.5". If corn is planted at 2" depth, Conceal®system fertilizer placement is 3X-0.5X1 in single bands and 3X-0.5X2 in dual bands.

Conceal® system uses existing planter space, utilizing a backswept knife located within the center of the planter's gauge wheels (Figure 1). As nitrogen is applied, it is sealed within the soil profile, preventing potential volatilization losses typically seen with surface type nitrogen applications.

Results: Table 1. illustrates that Conceal® system dual band applications of nitrogen out-yielded single band applications by +7.0 Bu/A. These yield gains consequently equated to additional net returns of +$26.25/A. (Table 2.).

Figure 1. Conceal® Single or Dual Placement 3" from Seed Trench, 1.5" in Depth

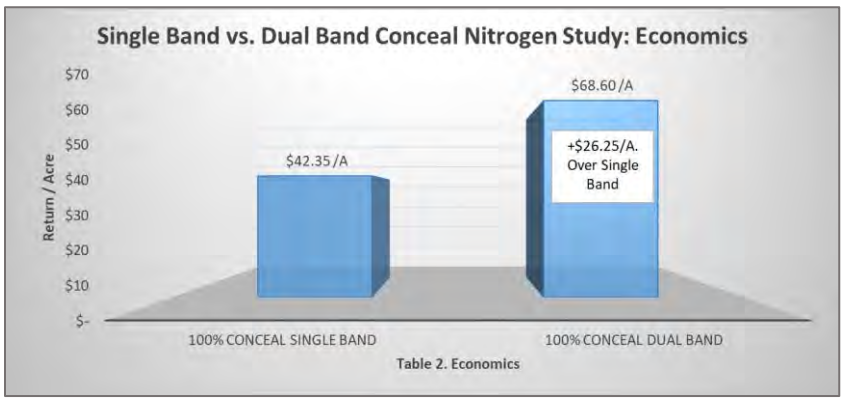


Table 2. Economics

Planting Date: 5/11 *Hybrid: GH 10D21* *Population: 36K* *Row Width: 30"* *Rotation: CAB* *Corn Price: $3.75*

Conceal® Nitrogen Rate/Placement Study

Objective: This corn study evaluates the performance of nine different nitrogen rate and placement programs. These nine programs consist of single one and done nitrogen programs, 2-way split applications, and even 3-way split programs. All treatments are applied using 32% UAN liquid nitrogen. As a baseline, the 50% WNF + 50% V6 Side-Dress (Treatment #4) is facilitated as the control for this trial.

1. 100% Weed-N-Feed (WNF): 180# N applied as Surface applied 32% UAN
2. 100% Conceal® Single Band: 180# N applied with Conceal® Single N band 1.5" Deep
3. 100% Conceal® Dual Band: 180# N applied with Conceal® Dual N bands 1.5" Deep

Single Applications

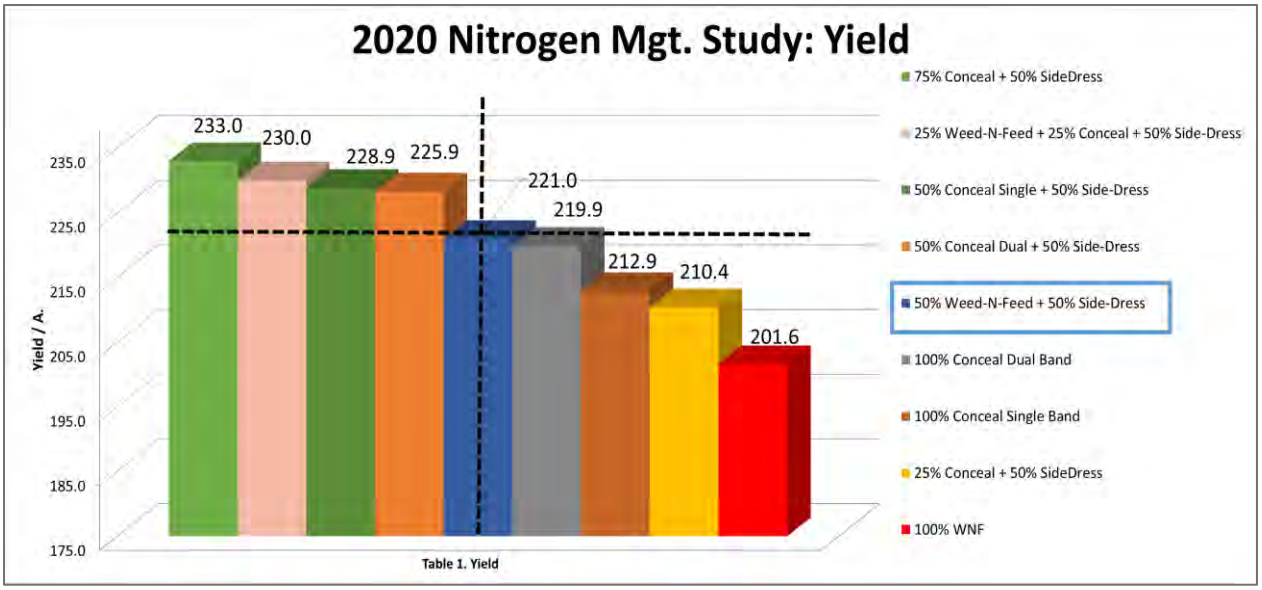
4. **50% WNF+50% Side-Dress: 90# N WNF+ 90# N V6 side-dress: "Control"**
5. 50% Conceal® Single Band+50% Side-Dress: 90#N Conceal® Dual Bands + 90# N V6 Side-Dress
6. 50% Conceal® Dual Band+50% Side-Dress: 90#N Conceal® Dual Bands + 90# N V6 Side-Dress
7. 25% Conceal® Dual Band+50% Side-Dress: 45# N Conceal® Dual Bands + 90# V6 Side-Dress (25% Under-Application)
8. 75% Conceal® Dual Band+50% Side-Dress: 135# N Conceal® Dual Bands + 90# N V6 Side-Dress (25% Over-Application)

Dual Split Applications

9. 25% Conceal®+25%WNF+50% Side-Dress: 45# N WNF + 45# N Conceal® dual bands + 90# V6 Side-Dress

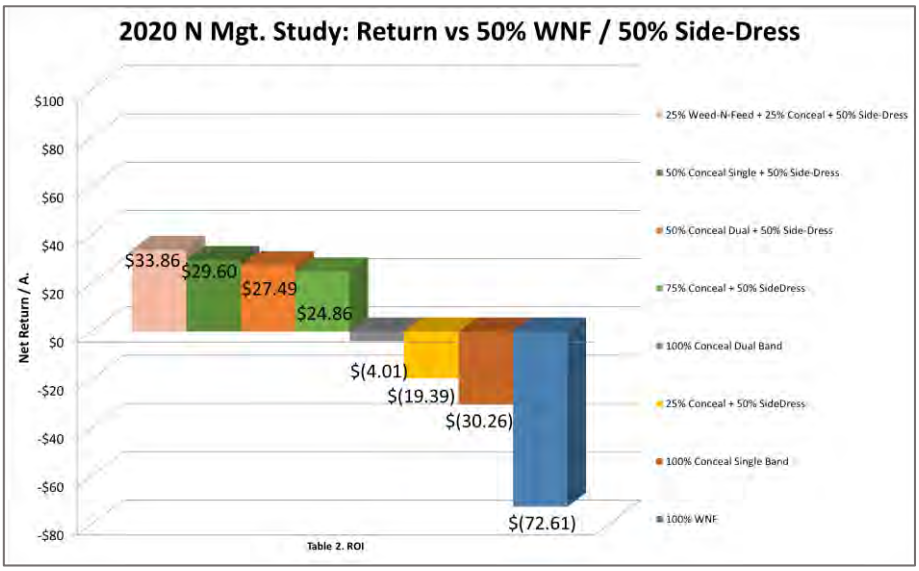
Triple Split Applications

Results: Table 1. illustrates the overall yield results of all nine nitrogen programs. All three single applications of nitrogen (Treatments 1-3), along with the -25% reduced rate treatment, proved the lowest performances in the study. Dual nitrogen programs (Programs 4-8) out-yielded single N programs (1-3) by +12.3 Bu/A. Triple N programs (Program 9) out-yielded singles by +18.5 Bu/A. and beat dual programs by +6.2 Bu/A.



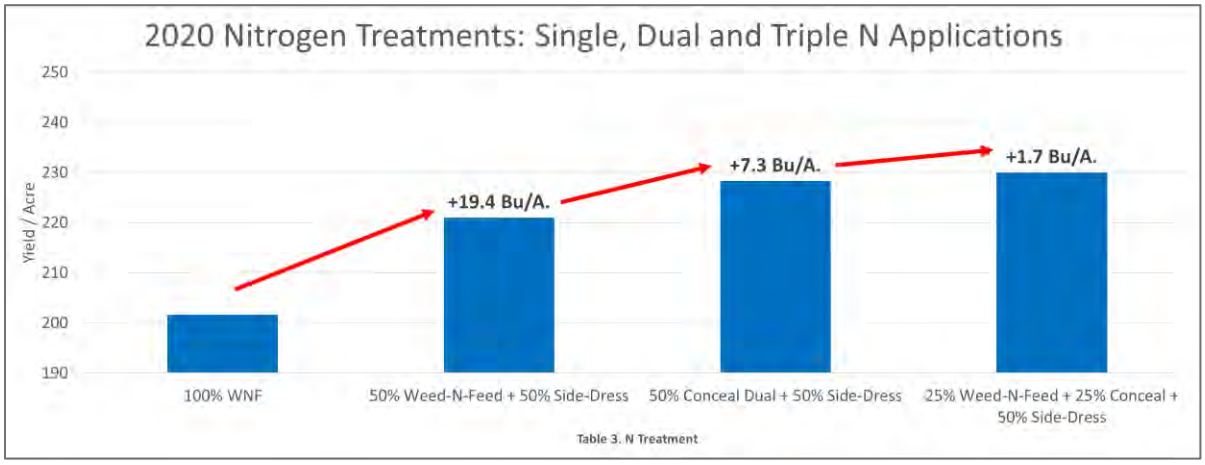
Nitrogen Management Rate/Placement Study Continued

Table 2. continues the story by calculating net return after cost of nitrogen. The top nitrogen program for 2020 was the triple split application program (Treatment #9) that resulted in +$33.86/A. over the control. Single application programs resulted in losses of **-$4.01** to **-$72.61/A.** compared to the control, with the 100% WNF treatment suffering the largest losses of the group.



To help understand the efficiency of the applications, we also evaluated adjusting the nitrogen rate by +25% and -25%. Adding 25% more nitrogen was the overall highest yielding treatment in the study at 233.0 Bu/A. but resulted in the second highest net return of +$29.60/A. after the cost of N. Lowering the nitrogen rate by 25% turned out to be detrimental as yields suffered **-10.6Bu/A.** with returns offset by **-$19.39/A.** compared to the control. Please note this 25% reduced rate of N, albeit a dual split application of 25% planter applied N and a 50% side-dress, still offered +$53.22/A. above the single application 100% WNF rate of N.

Table 3. helps clarify the yield advantages of split applications of nitrogen. In the past we learned that a split application program such as the control in this study (50% WNF followed by 50% side-dress) offered yield advantages compared to one and done WNF programs. This year was no different, with gains of +19.4 Bu/A. in this scenario. The interesting part of this study tells us that if planter applied nitrogen is utilized as part of the split nitrogen program, yields can be increased another +7.3 Bu/A. One step further would-be triple application, where it resulted in additional gains of another +1.7 Bu/A.



Nitrogen Management Rate/Placement Study Continued

Table 4. illustrates multi-year data from 2017-2020 and the net return associated with each nitrogen program used over the past four growing seasons. Conceal® system at-plant nitrogen programs occupy the top three spots of the nine total programs, netting additional returns of +$34.71 to +$49.57/A. above the control. The triple application of 25% WNF + 25% Conceal® system dual band + 50% Side-dress took top honors at +$49.57/A. over the control treatment.

Multi-year single applications reveal net losses of **-$4.01** to **-$58.26/A.**, with 100% WNF treatments suffering the lowest returns.

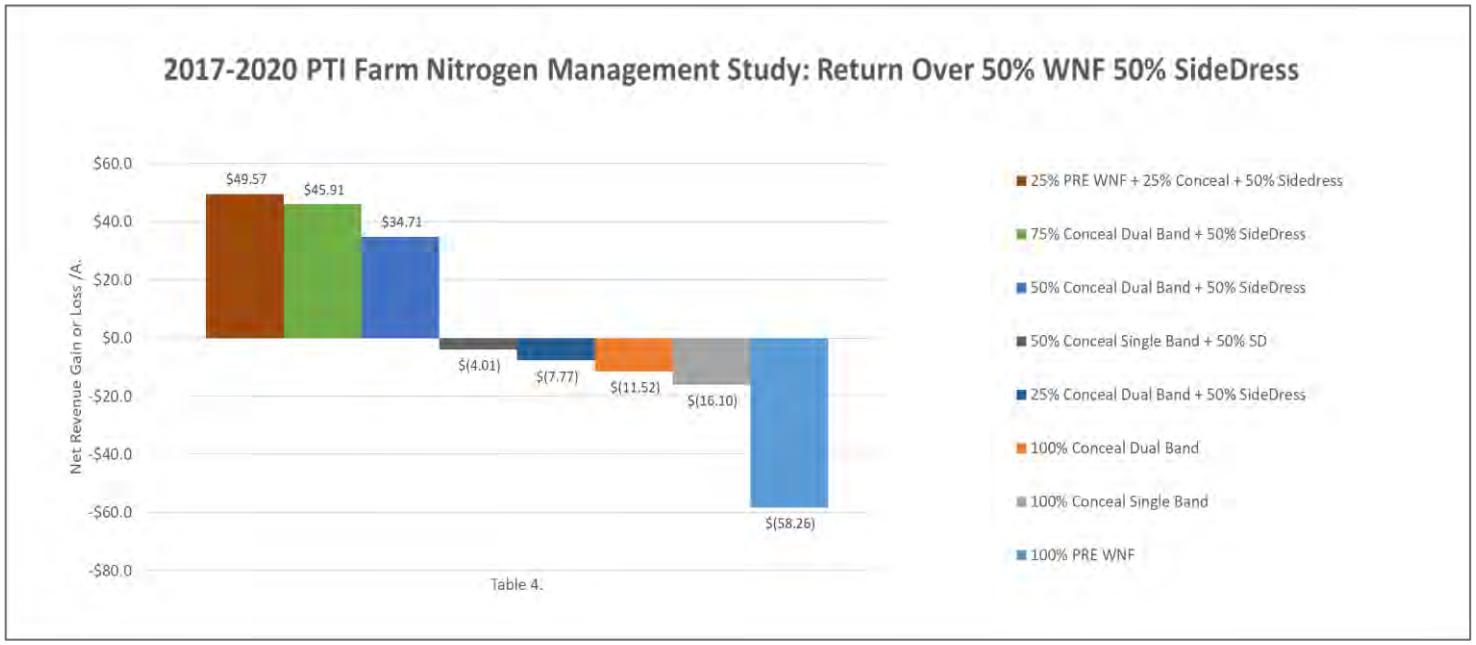


Figure 1. Weed-N-Feed Application (WNF)

Figure 2. Conceal® 3" Dual Band Nitrogen

Figure 3. V6 Side-Dress Application

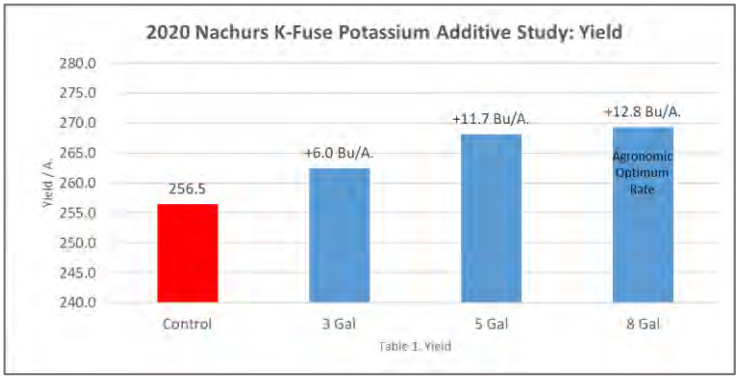
Planting Date: 5/17 *Hybrid: GH 10D21* *Population: 36K* *Row Width: 30"* *Rotation: CAB* *Corn Price: $3.75*

Conceal® K-Fuse® Potassium Study

Objective: To evaluate the yield and economics of Nachurs K-Fuse powered by Bio-K® (Figure 1.), a potassium/sulfur product designed to be blended with UAN fertilizer and applied on the planter or at side-dress. For this study we applied three, five, and eight gallons of K-Fuse at planting in a dual band Conceal® system application tank-mixed with 27 Gal/A. of UAN 32%. (Figure 2.).

Results: Table 1. illustrates K-Fuse applications reached agronomic optimum yield at the highest 8 Gal/A. rate. Yield response ranged from +6.0 Bu/A. to +12.8 Bu/A.

As for economics, all rates of K-Fuse provided positive economic returns of +$8.66, +$20.94 and +$11.60/A, however Table 2. depicts 5 Gal/A. establishing the economic optimum rate in this study with net returns of +$20.94/A.



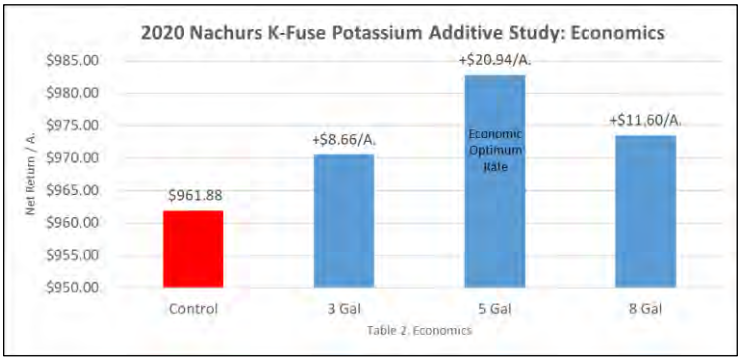


Figure 1. Nachurs K-Fuse® Potassium Additive

nitrogen potassium sulfur

Higher crop yields, along with applications of potassium that haven't kept up with the crop removal pace, have left many acres in decline of available potassium. Similar decreases can be found with Sulfur since dry fertilizer manufacturing practices as well as Clean Air measures have limited or removed incidental sulfur from being part of the residual nutrient supply.

NACHURS K-fuse, by addition of potassium and sulfur to high nitrogen fertility programs will address known deficiencies as well as improve nitrogen use efficiency. **NACHURS K-fuse** is designed to be blended with various fertilizer products to provide additional potassium and sulfur needed to promote high yielding crops. Primarily, **NACHURS K-fuse** should be blended with UAN solutions for sidedress and/or fertigation application to provide two very critical elements: potassium and sulfur. It can also be mixed with APP and UAN for 2x2 and/or strip-till application to provide a more balanced nutrient program. **NACHURS K-fuse** contains a proprietary additive which is designed to be blended with various fertilizer products to provide additional potassium and sulfur needed to promote high yielding crops. Up to 32% more potassium and 93% more sulfur can be applied per acre versus potassium thiosulfate when blended with UAN.

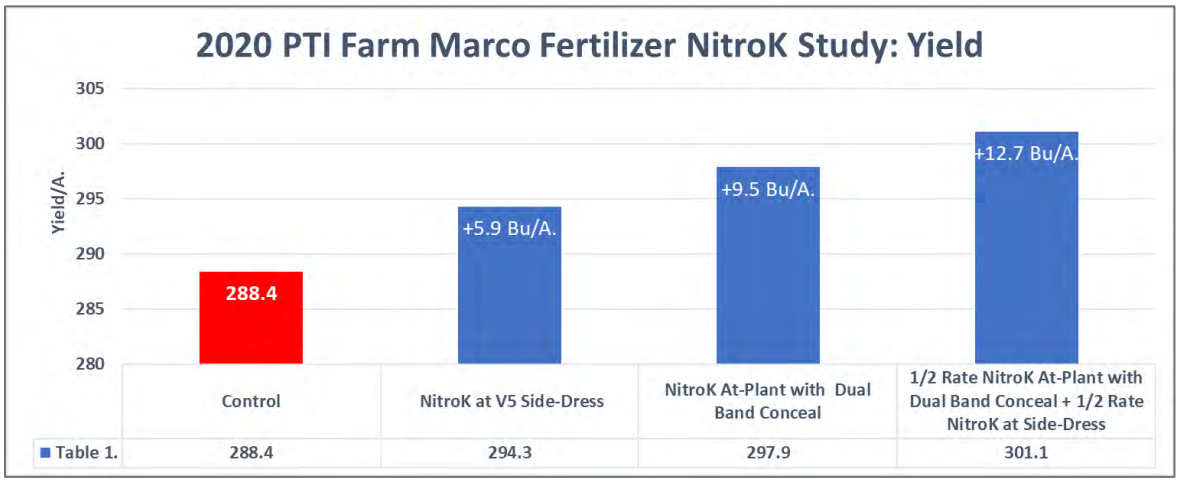
POWERED BY bio-K®

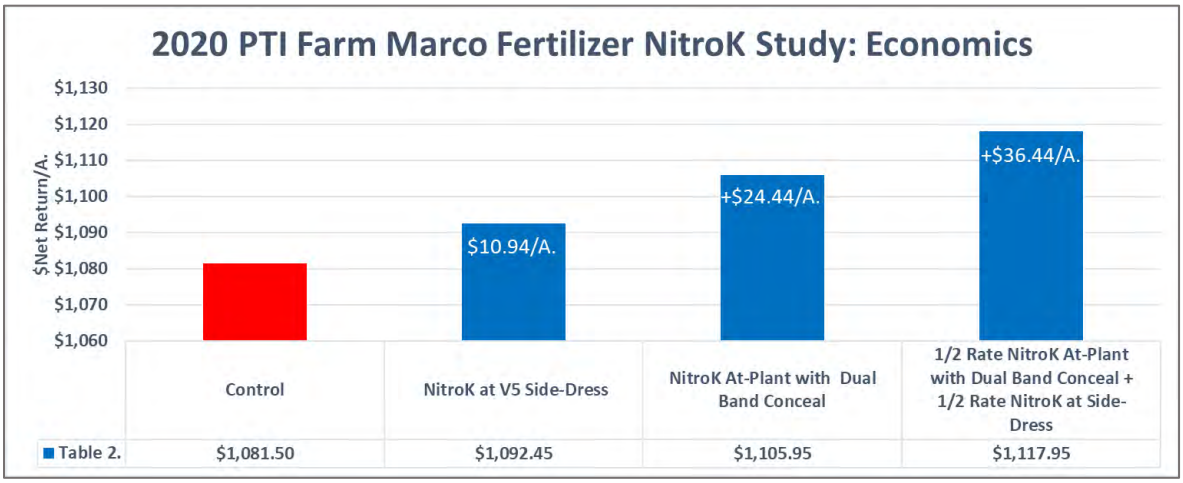
Figure 2. Conceal® Dual Placement 3" from Seed Furrow, 1.5" in Depth

Planting Date: May 11 *Hybrid: DKC 65-95* *Population: 36K* *Row Width: 30"* *Rotation: CAB* *Corn Price: $3.75* *K-Fuse: $4.55/Gal*

Marco Nitro K Conceal® Study

Objective: To evaluate the yield and net return of Marco Fertilizer's NitroK, a 22-0-4-4S liquid fertilizer as a nutritional aid in providing season long availability of nitrogen, potassium, and sulfur. In this study, NitroK is applied at a 60# N rate as a 32% UAN tank-mix partner in a V5 side-dress, as well as an at-plant dual band Conceal® system application.





Results: Table 1. illustrates all NitroK applications provided yield benefit, however 50% split applications of NitroK in both at-plant dual band Conceal® system, along with a 50% side-dress application proved highest yield advantages of +12.7 Bu/A. with economic returns of +$36.44/A. (Table 2). Applying NitroK as an at-plant dual band treatment offered a 61% yield improvement over later V5 side-dressing, totaling +$13.50/A.

Planting Date: 4/27 Hybrid: DKC 61-41 Population: 36K Row Width: 30" Rotation: CAB Corn Price: $3.75 Fertilizer Pricing: NitroK:$11.18/A. UAN: $0.45/#

Dribble vs Conceal® Nitrogen Study

Objective: To evaluate and compare yield and economic impact of at-plant applications of nitrogen placed in both dual band dribble and Conceal® system at-plant treatments. Dual Band dribble applications are made by liquid lines dribbling the fertilizer right behind the closing system.

Figure 1. dribble tubes on planter

Figure 2. Dual band dribble immediately after planting

Conceal® system is a unique planter attachment that allows growers to place nitrogen in a high concentration dual or single band positioned 3” away from the seed trench (Figure 3.) at depths near 1.5”. Conceal® system uses existing planter space, utilizing a backswept knife located with-in the center of the planter’s gauge wheels. As nitrogen is applied, it is sealed within the soil profile by the gauge wheels, preventing potential volatilization losses that are typically problematic with surface type nitrogen applications.

Figure 3. Conceal® 3” away, 1.5” deep from the seed trench

Figure 3. Conceal® 3” away, 1.5” deep from the seed trench

Dribble vs Conceal® Nitrogen Study Continued

Results: This year at the PTI farm, dual band Conceal® system proved yield gains of +12.2 Bu./A over dribble applications of nitrogen with economic gains of +$36.64/A. thus increasing the need for nitrogen incorporation.

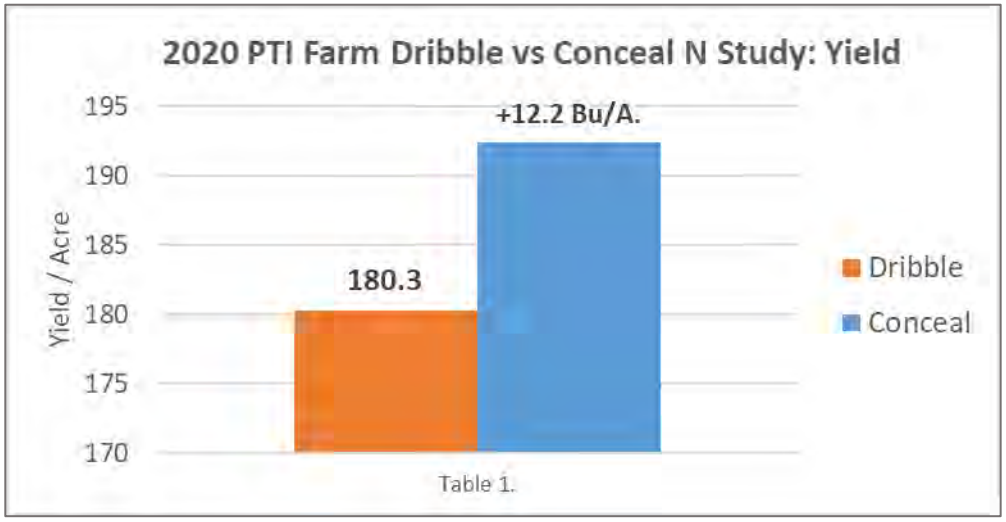


Table 1.

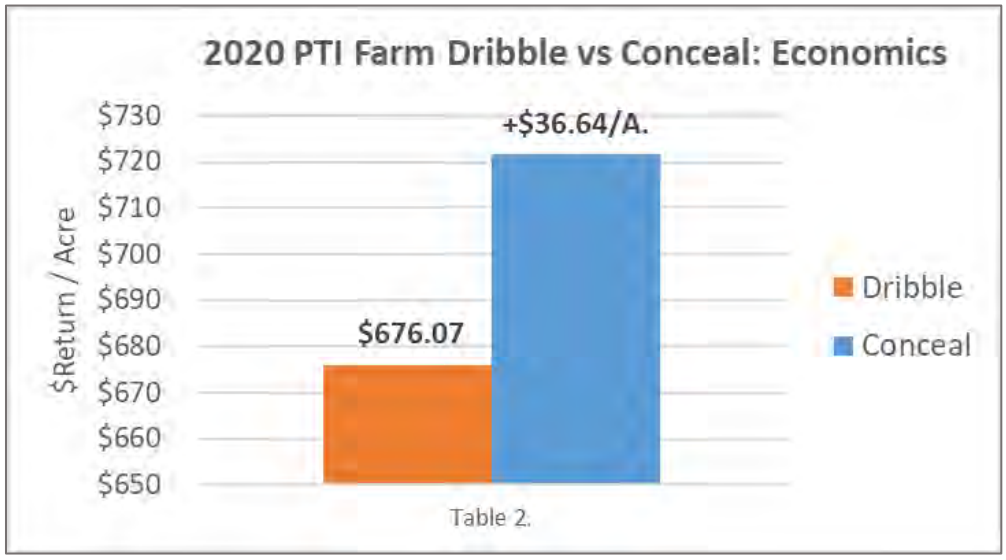


Table 2.

Planting Date: 5/11 *Hybrid: DKC 65-95* *Population: 36K* *Row Width: 30"* *Rotation: CAC* *Corn Price: $3.75*

Nitrogen Sealer Study

Objective: To evaluate the yield and economic impact of implementing nitrogen sealers when side-dressing corn with liquid nitrogen (N). Nitrogen sealers from Nitrogen Sealing Systems in Catlin, IL are a pair of coulters that attach to a side dress unit behind the knife or high-pressure injection nozzle (Figure 1-2). Sealers are designed to lift and redirect soil over top of the injection point of nitrogen, collapsing and sealing the trench, protecting nitrogen that could otherwise volatilize.

Figure 1. Nitrogen Sealers

Volatilization is a form of N loss that occurs when nitrogen is applied on the soil surface without incorporation by tillage or rainfall events. In this event, applied nitrogen converts to ammonia, a gaseous form that can easily escape into the atmosphere. In a side-dress situation, this can occur when nitrogen is applied and not sealed or covered properly. If coulter slots open up or become exposed to sunlight, air, wind, and increased temperatures after application, volatilization can occur.

Figure 2. Sealed row with soil berm

Results: Tables 1-2. illustrate nitrogen sealers offering yield gains of +11.2 Bu/A., while capturing an additional $42/A. At a cost of $285/row on a 15-knife side-dress applicator, break-even would occur at 102 acres.

Table 1.

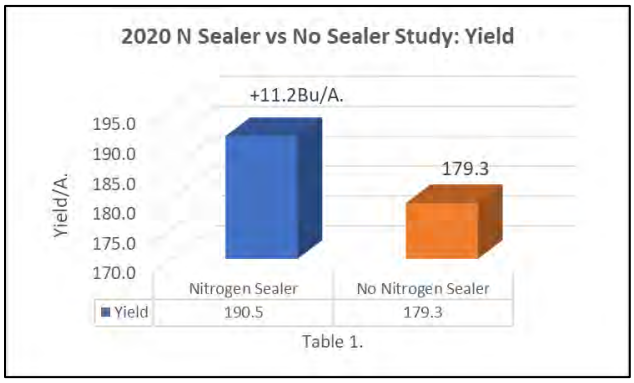
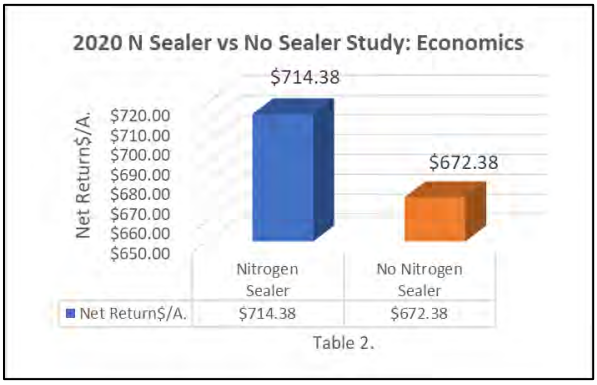


Table 2.



Planting Date: 5/1 *Hybrid: Dekalb 64-34SS* *Population: 36K* *Row Width: 30"* *Rotation: CAC* *Corn Price: $3.75*

Side-Dress Timing: V3 *Sealers from Nitrogen Sealing Systems $255/Row*

Sidedress Placement Study

Figures 1&2. Nutrimax® Dual Delivery System

Objective: To evaluate the yield and economic impact of implementing the Nutrimax Dual Delivery System from Unverferth Equipment. This innovative system combines a single-coulter down the center of each 30" row with two trailing hoses, one mounted on each side of the coulter (Figures 1&2). This system allows the operator to inject nitrogen into the soil down the middle of the row, in addition to applying on top of the soil, right next to the plant root.

The u-shaped steel coulter mounting bracket positions each tube outward for consistent application at the plant's base for optimum nitrogen uptake when moisture is available. We implemented push-to-connect ¼ turn valves, which allows the operator to apply with both the coulter and hoses at the same time, or stand-alone systems.

Results: Tables 1-2. illustrates the Nutrimax Dual Delivery System alone offered yield losses of **-3.9Bu/A.** resulting in economic losses of **-$14.63/A.** 50% center knife, and 50% Nutrimax resulted in yield and economic losses of **-1.0Bu/A.** and **-$3.75/A.** respectively.

One speculation as to the reason for these results may be the dual band Conceal® system application that was applied at planting, totaling 25% of nitrogen needs. This early banding placement could have offset any advantages to additional dual-band applications as a V6 side-dress.

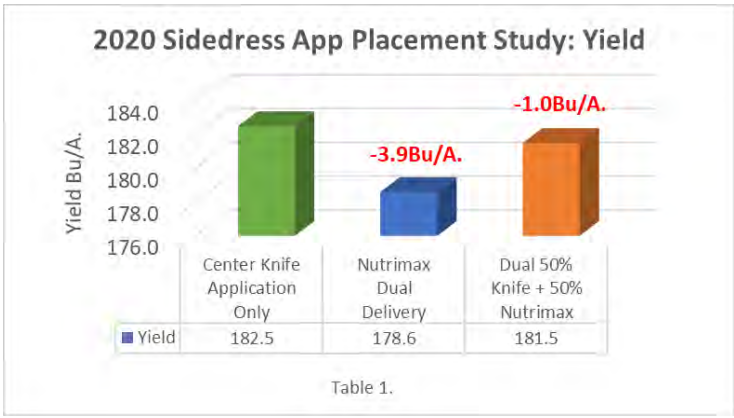


Table 1.

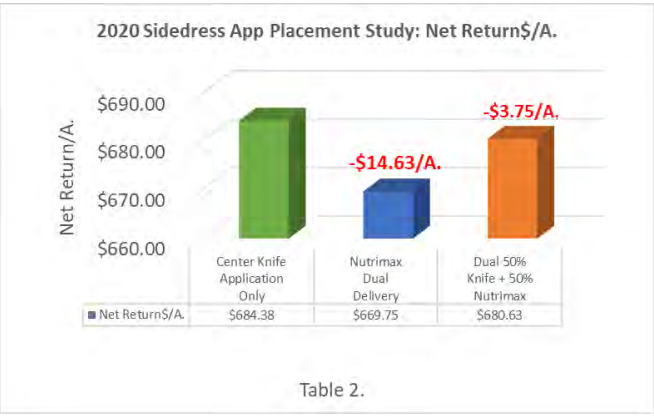


Table 2.

Planting Date: 5/1 *Hybrid: Dekalb 64-34SS* *Population: 36K* *Row Width: 30"* *Rotation: CAC* *Corn Price: $3.75*

Side-Dress Timing: V6

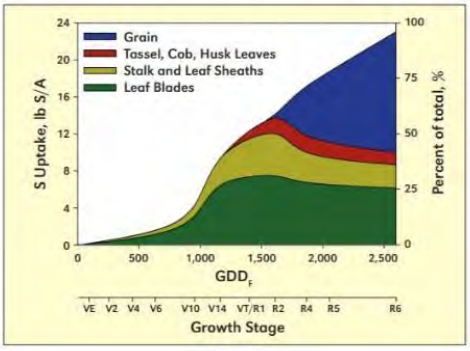
Nitrogen, Sulfur, Boron Conceal® Study

Objective: To evaluate the yield and economic impact of tank-mixing Sulfur and Boron with at-plant nitrogen applications applied via dual band Conceal® system (Figure 1). In this study 20 Gal/A. of UAN 32% nitrogen is used as a baseline control and compares adding 3 Gal/A. of ammonium thiosulfate 12-0-0-26 (ATS), as well as 1 qt. of a 5% Boron.

Figure 1. Conceal® Dual Band Application

Sulfur (S) is an essential nutrient for corn growth and is a critical nutrient to make required proteins. One bushel of corn typically requires 0.1 to 0.12lbs/Bu. S uptake occurs over the entire growing season, with relatively constant uptake from the 14-leaf stage to maturity. Unlike nitrogen, only 40% to 50% of S is taken up by flowering (see Figure 2. chart below). S is also very mobile in most soils, like nitrate, because it has a double negative charge and is repelled by the negative charge of the soil, unlike nutrients like potassium, calcium, or magnesium.

Figure 2. Sulfur Uptake Graph



Due to the Clean Air Act Amendment of 1990, major emission reductions of sulfur dioxide (SO2) were put in place to the power sector. Figure 3. shows the difference in sulfur deposition over time from 2001 to 2015 as a result of this legislation. This reduction of free S in the atmosphere has created a situation where farmers may now need to apply S-fertilizer to crops for optimum yields.

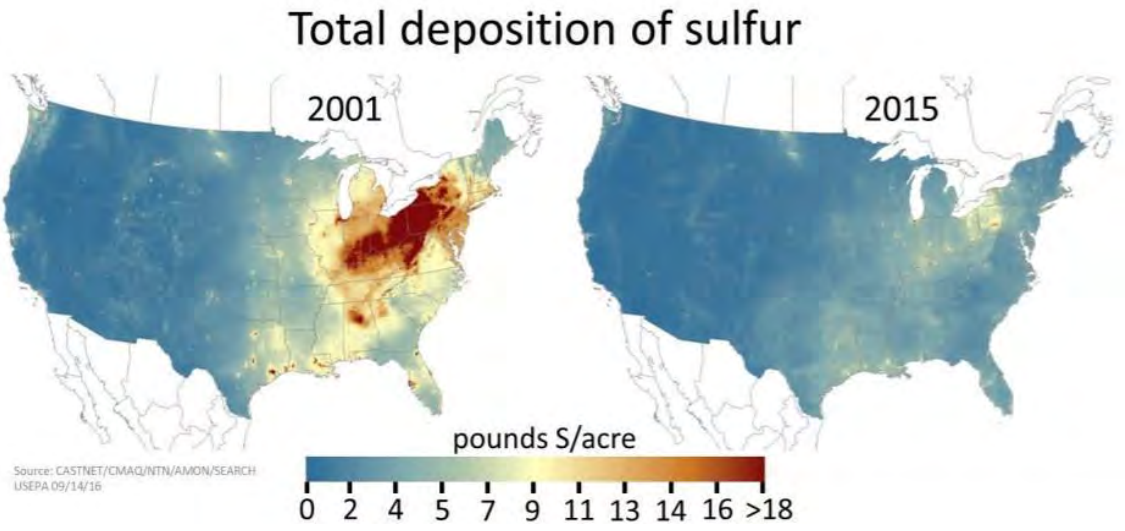
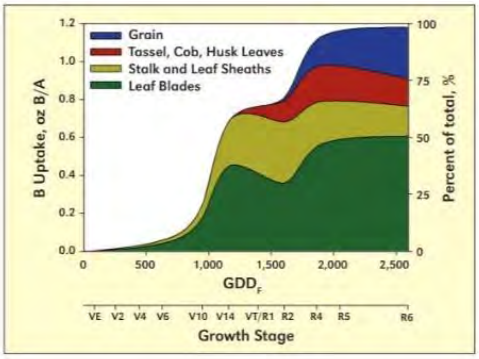


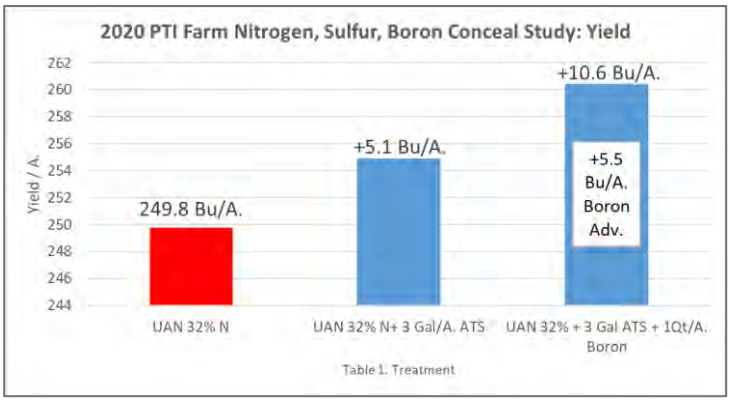
Figure 3. Sulfur Deposition Map

Nitrogen, Sulfur, Boron Conceal® Study Continued

Boron (B) is a micronutrient critical to the growth and health of all crops. It is a component of plant cell walls and reproductive structures. Boron, a water-soluble micronutrient, is especially prone to leaching. Since boron is a neutrally charged ion, it floats in ecosystems until it finds a substance to which it can bond to. During periods of heavy rain, boron is flushed out of the soil quickly. Boron serves two primary roles; one is supporting plant cell division, and the second is during the silking stage of development, in which boron helps transfer water and nutrients from the roots up through the plant. B is required in small amounts, in fact a 200 Bu/A. crop only uptakes 0.2lbs of B. Boron containing fertilizers typically should not be applied in close contact with seeds for any crop, since boron will injure germinating seeds.

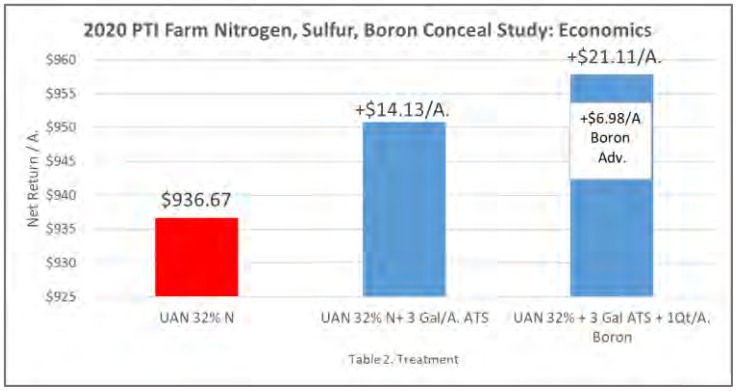
Figure 4. Boron Uptake Graph

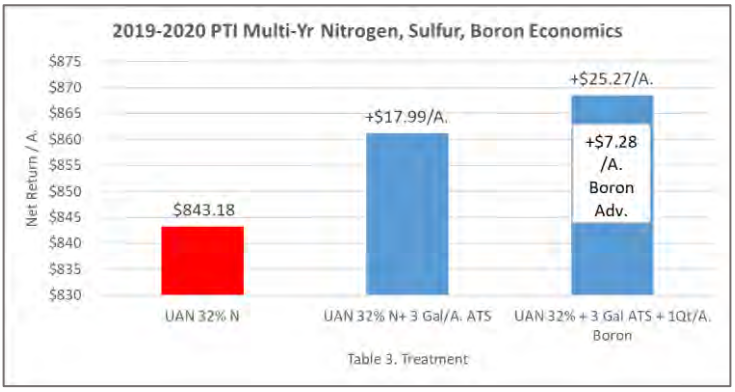




Results: Tables 1-2 illustrate that 3 Gal/A. of ATS provided yield gains of +5.1 Bu/A. with a positive return on investment of +$14.13/A. 1qt. of Boron tank-mixed with the UAN and ATS, resulted in additional yield gains of +5.5 Bu/A. with net returns of +$6.98/A.

Table 3. reveals multi-year data over 2019 and 2020 indicating average return on investment of +$17.99/A. for ATS applications, while Boron has contributed gains of +$7.28/A.



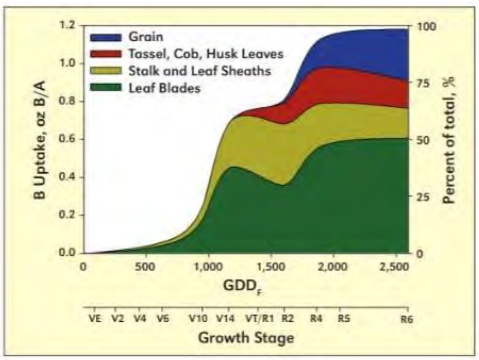


Planting Date: April 27 *Hybrid: DKC 63-91* *Population: 36K* *Row Width: 30"* *Rotation: CAB* *Corn Price: $3.75*

ATS: $1.76/Gal. *5% Boron: $4.31/pt.*

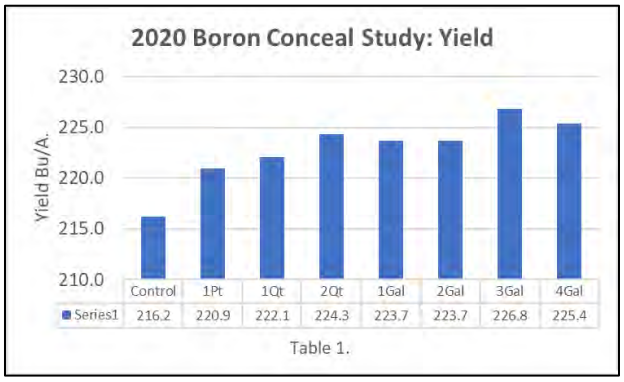
Boron Rate Study

Objective: To evaluate the yield and economic impact of tank-mixing multiple rates of Boron with at-plant nitrogen applications applied via dual band Conceal® system. Rates of 1pt, 1qt, 2qt, 1gal, 2gal, 3 gal, and 4gal of a 10% Boron product were used in this study.



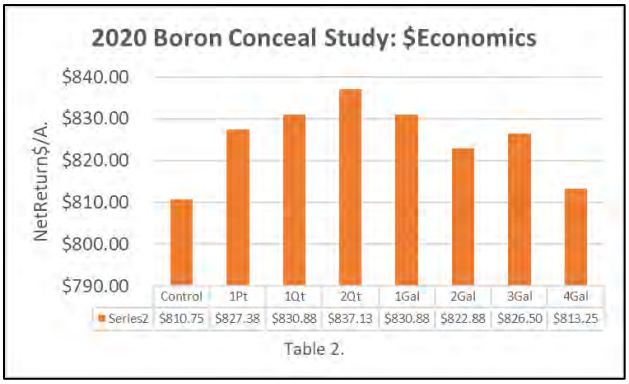
Boron (B) is a micronutrient critical to the growth and health of all crops. It is a component of plant cell walls and reproductive structures. Boron, a water-soluble micronutrient, is especially prone to leaching. Since boron is a neutrally charged ion, it floats in ecosystems until it finds a substance to which it can bond to. During periods of heavy rain, boron is flushed out of the soil quickly. Boron serves two primary roles; one is supporting plant cell division, and the second is during the silking stage of development, in which boron helps transfer water and nutrients from the roots up through the plant. B is required in small amounts, in fact a 200 Bu/A. crop only uptakes 0.2lbs of B. Boron containing fertilizers typically should not be applied in close contact with seeds for any crop, since boron will injure germinating seeds.

Results: Tables 1-2 illustrate that 3 Gal/A. of Boron provided agronomic optimum yield with gains of +10.6 Bu/A. over the control. However, 2Qts. of Boron achieved economic optimum with an increase of +$26.38/A.



	Control	1Pt	1Qt	2Qt	1Gal	2Gal	3Gal	4Gal
Series1	216.2	220.9	222.1	224.3	223.7	223.7	226.8	225.4

Table 1.



	Control	1Pt	1Qt	2Qt	1Gal	2Gal	3Gal	4Gal
Series2	$810.75	$827.38	$830.88	$837.13	$830.88	$822.88	$826.50	$813.25

Table 2.

Planting Date: April 27 *Hybrid: DKC 63-91* *Population: 36K* *Row Width: 30"* *Rotation: CAB* *Corn Price: $3.75 .* *10% Boron: $8/Gal*

Corn 2020 Summary of Conceal® Applications

Treatment	Classification	+/- Yield Gain	ROI $	Page #
Triple Split N Program over WNF	Nitrogen	28.4	$ 106.50	101-103
Conventional Till High Yield NetaFim DripTape Irrigated Corn	N, K, S, B, Carbon Based Sugar	58.8	$ 78.19	41
Strip Till High Yield Netafim DripTape Irrigated Conceal Dual Band	N, K, S, B, Carbon Based Sugar	20.25	$ 75.94	45
100% Dual Band over WNF	Nitrogen	18.3	$ 68.63	99
100% Single Band over WNF	Nitrogen	11.3	$ 42.38	99
Strip Till High Yield Netafim DripTape Irrigated FurrowJet Tri-Band & Conceal	N, K, S, B, P, Biological, Carbon Based Sugar	29.5	$ 40.76	45
Conceal Dual Band over Dribble Dual Band	Nitrogen	12.2	$ 36.64	107
Marco NitroK 50% Conceal 50% Sidress	Nitrogen	12.7	$ 36.44	105
Conceal Rate/Placement: 25% Conceal+25%WNF+50% Side-Dress	Nitrogen	9	$ 33.86	102
Nachurs Start2Finish	Potassium	13.1	$ 31.80	67
Conceal Rate/Placement: 50% Conceal Single Band+50% Side-Dress	Nitrogen	7.9	$ 29.60	102
Centuro N Stablilizer	Nitrogen	10.5	$ 28.41	53
Conceal Rate/Placement: 50% Conceal Dual Band+50% Side-Dress	Nitrogen	4.9	$ 27.49	102
Boron Rate Study 2QT 10% Boron Dual Band Conceal	Boron	8.1	$ 26.38	112
Single vs Dual Band - Dual	Nitrogen	7	$ 26.25	100
Conceal Rate/Placement: 75% Conceal Dual Band+50% Side-Dress	Nitrogen	12	$ 24.86	102
Marco NitroK Dual Band Conceal	Nitrogen, Potassium	9.5	$ 24.44	105
The Andersons Root Growth Stimulator	Biological + N + S	7.79	$ 21.66	61
K-Fuse Potassium: 5gal	Potassium	11.7	$ 20.94	104
Andersons 5oz RGS + 3Gal ATS	Biological + N + S	9	$ 20.32	61
AgroLiquid Starter Fertility Program	Nitrogen + Sulfur	14.6	$ 18.95	63
3 gal ATS Conceal Dual Band	Nitrogen + Sulfur	5.1	$ 14.13	111
QLF 2 Gal. Boost + N	Nitrogen + Carbon Based Sugar	5	$ 12.19	77
1qt 5% Boron Dual Band Conceal	Boron	5.5	$ 6.98	111
QLF Boost 1Gal Conceal	Nitrogen + Carbon Based Sugar	2.7	$ 6.84	77
Marco Safe N	Nitrogen + Sulfur	3.5	4.13	56
Averages:		13.01	$ 34.42	

Conceal® 3” away, 1.5” deep from the seed trench

Corn Leaf Orientation Study

Objective: To study corn leaf orientation within the row and understand the relationship of yield impact of corn leaves being positioned parallel or perpendicular to the row (Figures 1-2). Correct leaf orientation offers benefits of increased light interception, less sunlight to encourage weed suppression, cooler in-canopy temperatures, and moisture preservation.

Figure 1. Correct Leaf Orientation

Figure 2. Incorrect Leaf Orientation

Results: Table 1. illustrates the multi-year results of yield checks at the PTI Farm from 2018 to 2020. Individual ear weight loss associated with incorrect leaf orientation resulted in **-8.7%** yield loss. Table 2. depicts average yield losses of **-17.4** to **-21.8 Bu/A**. for each plant with wrong leaf orientation. However, occurrence factors of these incorrect oriented plants generally range from only 20% to 30% of all plant population. Therefore, actual yield losses from incorrect orientation range from **-3.5** to **-6.5 Bu/A**. depending on overall actual corn yield. Work is being done to establish solutions to help eliminate incorrect leaf orientation. Some of this work identifies seed placement in the seed furrow in order to manipulate direction of leaf placement. Early studies indicate that incorrect leaf orientation cannot be totally prevented, but trial data does suggest that by manually placing seed in certain positions in the trench can improve results by +10%. In general, seed tip directional placement has been seen to improve emergence timing, while embryo directional placement may impact leaf orientation.

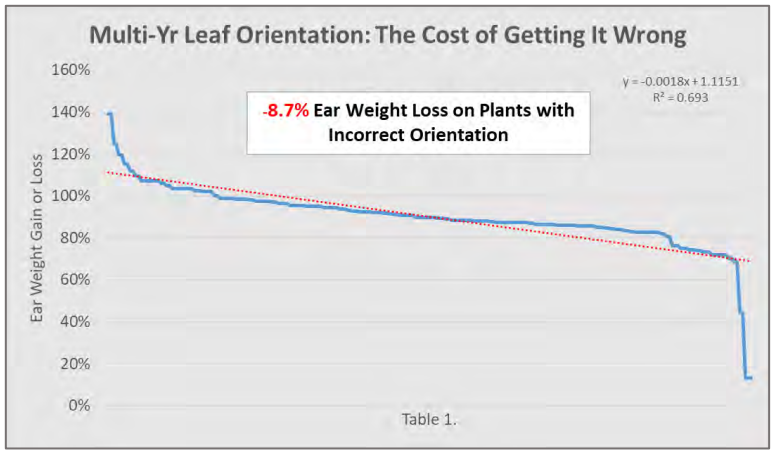


	Table 2.	Occurrence Factor Percentage		
Overall Corn Yield	Yield Loss	20% Wrong	25% Wrong	30% Wrong
200	-17.4Bu/A.	**-3.5Bu/A.**	**-4.4 Bu/A.**	**-5.2 Bu/A.**
225	-19.6Bu/A.	**-3.9 Bu/A.**	**-4.9 Bu/A.**	**-5.9 Bu/A.**
250	-21.8Bu/A.	**-4.4 Bu/A.**	**-5.4 Bu/A.**	**-6.5 Bu/A.**

Corn Strip Planting Study

Objective: This study evaluates the yield and economic advantages of planting corn and soybeans in alternate 40' strips (Figure 1.). In the past this helped to reduce erosion. The PTI team evaluated this system in 2020 to harvest more sunlight on outside rows with the intention of trying to stimulate higher corn yield. It is quite common to have higher corn yield on the outside field edges (Figure 2.), due to corn being able to harvest more sunlight. However, most often after the first few rows this yield advantage decreases due to more shading of corn biomass. This study is intended to measure any potential yield increases and the associated economics from the system.

Results: In order to understand the agronomics of this system, we split our 16-row planter into seven individual segments to include the following:

- West 2 Rows: 1-2
- West 2 Rows: 3-4
- West 2 Rows: 5-6
- Center 4 Rows: 7-10
- East 2 Rows: 11-12
- East 2 Rows: 13-14
- East 2 Rows 15-16

Figure 1. 40' Alternate Strips of Corn and Soybeans

Figure 2. Outside Edge of Field

Corn Strip Planting Study Continued

Table 1. illustrates the yield response of each planter row segment in the 40' alternate strips. Strip planting did in fact offer yield advantages by having the "sunlight corridor" to increase sunlight harvest. Compared to the center 4 planter rows, the outside halves of the planter offered average yield advantages of +16.4 to +19.0 Bu/A. (+7% to 8% increase). However, the West outside 1-2 rows and the East 15-16 rows, achieved the highest yield increases. Those rows were nearest to the sunlight corridor, with average yields ranging from +21.5 to +25.5 Bu/A. These yields resulted in a +10% to 11% increase in corn production. It is interesting to note that the West rows outperformed the East rows by +2.6 Bu. All rows were planted in a north/south fashion.

As for economics, the sunlight corridor in the very outside rows (Rows 1-2, 15-16) garnered an additional +$28.13 to +$95.63/A. in this strip cropping system. At the PTI Farm, we always talk about challenging the status quo and trying to farm smarter each and every season. This strip cropping system, even though challenging to implement with herbicide and nutrient applications, proved to create up to nearly $100/A. gains. In the future we plan to add east/west row fashion and possible interval blocks of 10' or 20' strips.

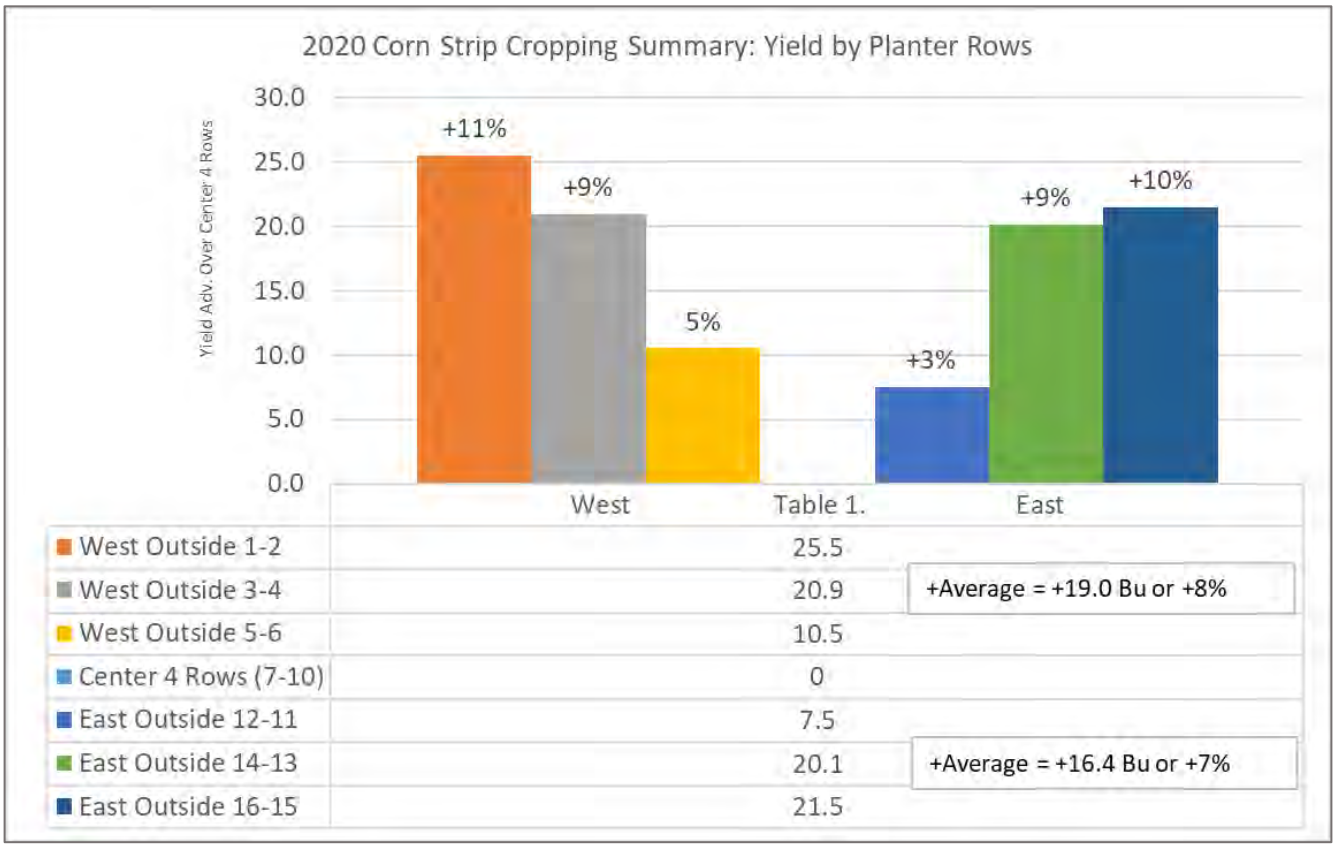


Table 1.

West Outside 1-2	25.5
West Outside 3-4	20.9
West Outside 5-6	10.5
Center 4 Rows (7-10)	0
East Outside 12-11	7.5
East Outside 14-13	20.1
East Outside 16-15	21.5

+Average = +19.0 Bu or +8%

+Average = +16.4 Bu or +7%

Precision Planting®

2020 PTI Results

Corn Veltyma™ Foliar Fungicide Study

Objective: To evaluate the yield and net return of a new fungicide introduced called Veltyma. Veltyma contains Revysol, which is a DeMethylation Inhibitor (DMI) fungicide that is part of the triazole group of fungicides initially labeled for 17 crops, including corn and soybeans. Veltyma gives excellent control of anthracnose, eye spot, gray leaf spot, northern corn leaf blight, southern corn leaf blight, common rust, southern rust, and tar spot. Veltyma has a label which expands the window of application from V10-R3 (adjuvant limitation).

Veltyma™

BASF
We create chemistry

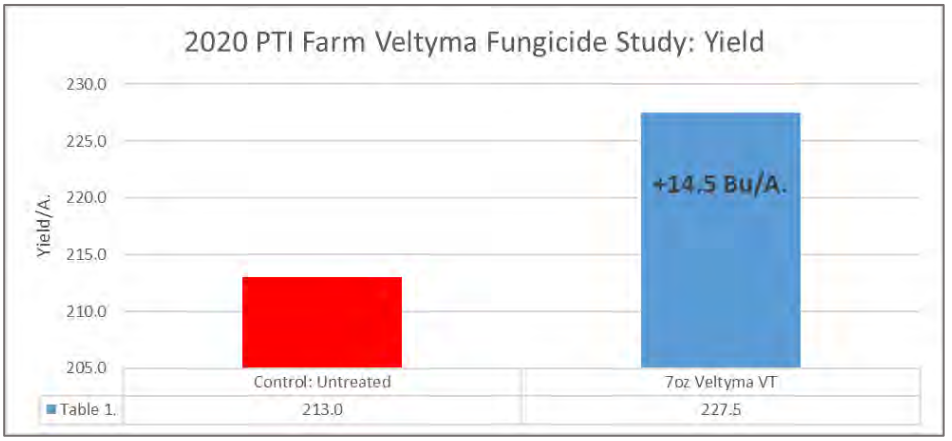
Active Ingredients*:
mefentrifluconazole: 2-[4-(4-chlorophenoxy)-2-(trifluoromethyl)phenyl]-1-(1H-1,2,4-triazole-1-yl)propan-2-ol 17.56%
pyraclostrobin: (carbamic acid, [2-[[[1-(4-chlorophenyl)-1*H*-pyrazol-3-yl]oxy]methyl]phenyl]methoxy-, methyl ester) 17.56%
Other Ingredients: 64.88%
Total: 100.00%

*Veltyma™ fungicide contains 1.67 lbs mefentrifluconazole and 1.67 lbs pyraclostrobin per gallon.

EPA Reg. No. 7969-409 **EPA Est. No.**

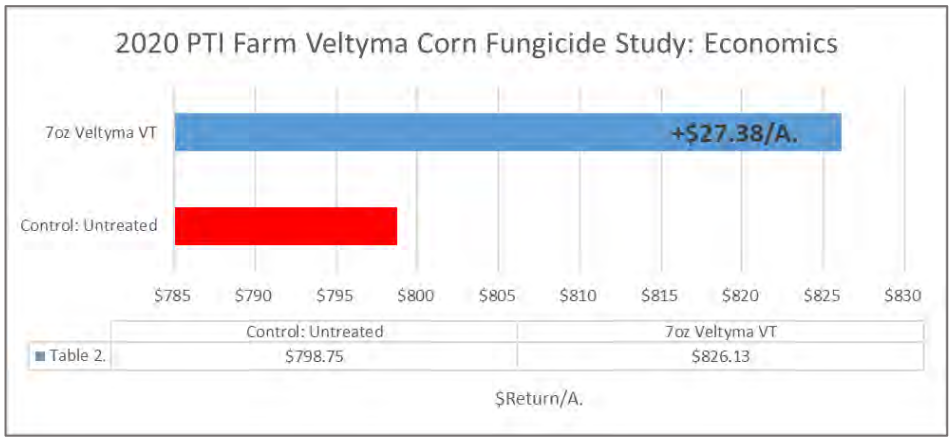
Mefentrifluconazole	Group	3	Fungicide
Pyraclostrobin	Group	11	Fungicide

Results: Tables 1 illustrates that VT foliar applications of Veltyma resulted in yield gains of +14.5 Bu/A. This plot had significant levels of tar spot, which could be a foreseeable problem in years ahead in corn.



After cost of application and fungicide, using a $3.75 corn price, Veltyma proved positive net returns of +$27.38/A. (Table 2).

Figure 1. Tar Spot in Corn



Planting Date: 4/17 *Variety: DKC 64-34* *Population: 36K* *Row Width: 30"* *Rotation:CAB* *Corn Price: $3.75*

Precision Planting®

2020 PTI Results

mSet® Multi-Genetic Planting Study

Objective: To analyze the yield and economic benefit of implementing mSet® single meter multi-genetic technology to place specific corn hybrids for individual spatial management zones.

mSet® is an upgradeable product to vSet® meters and vDrive® controller, which couples a seed selector added to the hopper to switch hybrids, and a seed pool level sensor in the meter (Figure 1). The level sensor tells the seed selector when the meter needs more seed, and it drops a dose of seed into the meter. This continually happens until it is time to switch hybrids. At hybrid change, the level sensor will let the seed pool run low, then call for a dose of the other hybrid to enter the meter just in time for the change, leading to a short transition between hybrids. The seed pool is controlled by the mSet® selector (Figure 2), providing the correct hybrid in the meter, and allowing the vSet® meter to accurately singulate those seeds. The ultimate result is the hybrid you select, planted in the area of the field you select, planted with highest accuracy of singulation. Additionally, for those who want to both; plant fast, and place hybrids by spatial zone variability, SpeedTube® system can be used in tandem with multi-genetic technology (Figure 3).

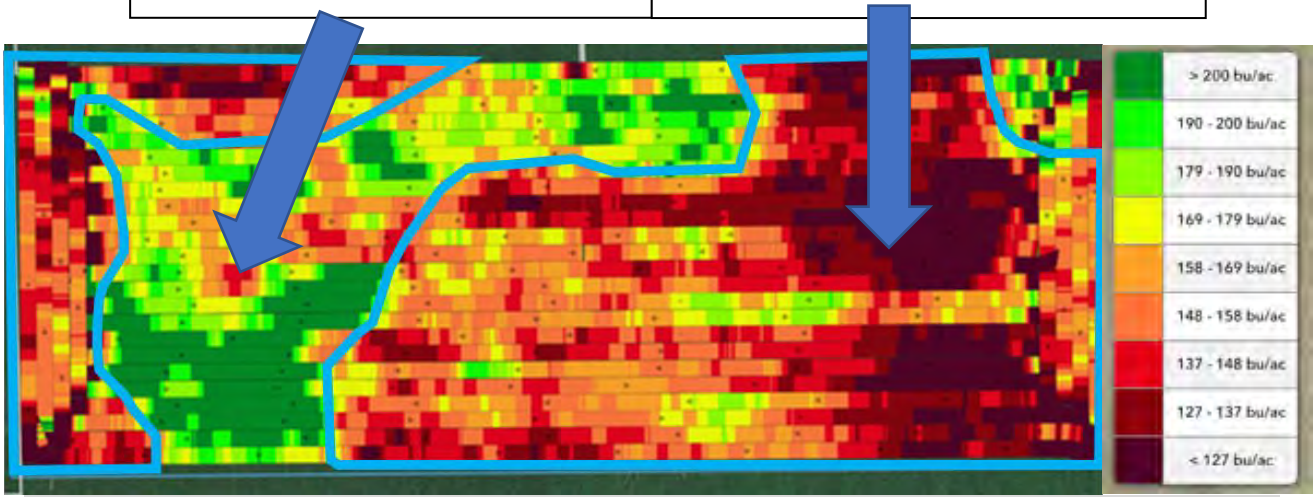
Figure 1. mSet® Box

Figure 2. mSet®

Figure 3. Speedtube®

Figure 4. Offensive and Defensive Spatial Zones

Offensive Zone: Low Ground (Wet Soils)	Defensive Zone: High Ground (Stress Soils)
Hybrid = AgriGold 641-06VT2 RIB	Hybrid = AgriGold 641-54VT2 RIB



Multi-Genetic Planting Study Continued

Results: AgriGold 641-06VT2RIB was used as our offensive corn hybrid in the lower elevation, higher OM, but potentially saturated soils. AgriGold 641-54VT2RIB was used as the defensive hybrid planted into the higher ground, lower OM, and potentially droughty soils. Each genetic package was placed into the appropriate matching spatial management zone (Figure 4). Test blocks were planted to evaluate the yield performance when hybrids were placed correctly, as well as incorrectly.

Figure 5. illustrates the 2020 multi-genetic planting results. Correct placement in the defensive zone resulted in yield gains of +9.8 Bu/A. and corresponded to an economic advantage of +$36.75/A.

Figure 5. also illustrates that the correct hybrid placement in the offensive zone resulted in yield gains of 19.6 Bu/A. with increased revenue of +$73.50/A.

Figure 5.

Figure 6. summarizes multi-genetic corn planting performance over the three-year time period of 2018-2020. During this timeframe, multi-genetic corn has offered increased yield gains of +14. Bu/A. with additional farm revenue of $48.22/A. in increase revenue.

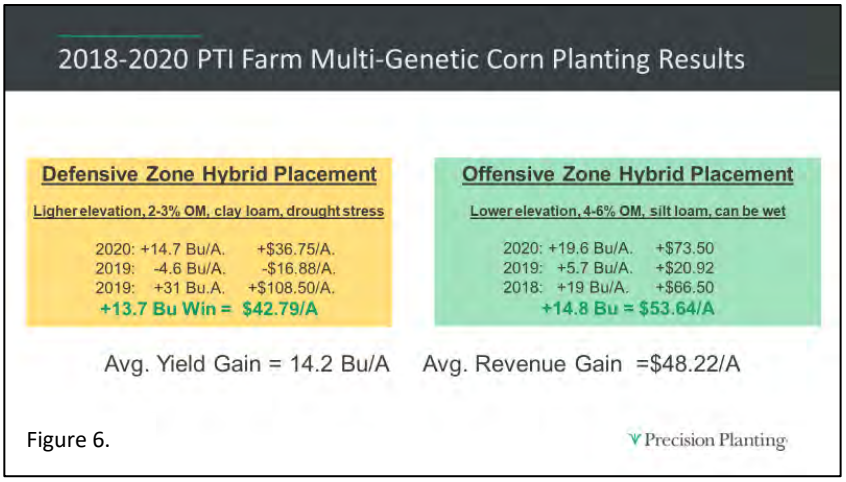


Figure 6.

Based on this data, if a grower invested $1000/row on a 16-row planter for multi-hybrid technology, these types of yield and economic gains would result in return on investment at only 332 acres.

These yield results confirm that a multi-genetic system can offer yield advantages and potentially large economic gains if used properly. For this system to work, growers and seedsman need to work together to place the appropriate genetics on the correct acre.

Strip Freshener™ Study

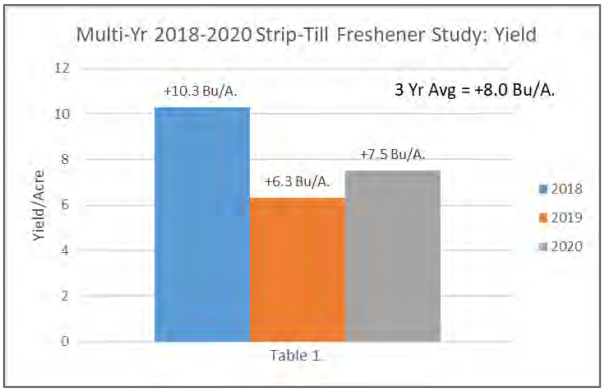
Objective: To evaluate Yetter 2984 strip freshener to facilitate consistent soil warming and bring existing strips to life. Original fall strips made in October after harvest were freshened in April before planting (Figure 1).

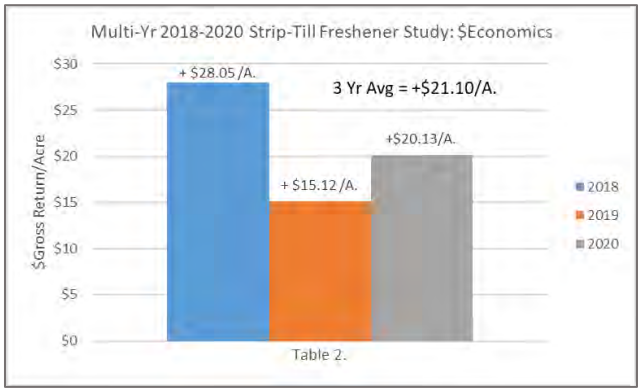
Features:

- 3-blade arrangement with rolling basket to condition strips
- Operates at 6 to 10 mph and 1 1/2" to 4" deep, depending on depth setting
- Precision Planting CleanSweep® residue managers to clean rows while building strips

Figure 1.

Results: Spring strip freshening increased yield by an average of +7.5 Bu/A. and resulted in net gains of +$20.13/A., using a custom cost of $8/A. for calculating cost of application. Tables 1-2. illustrate multi-year 2018-2020 average yield gains of +8.0 Bu/A. and net economic gains of +$21.10/A.





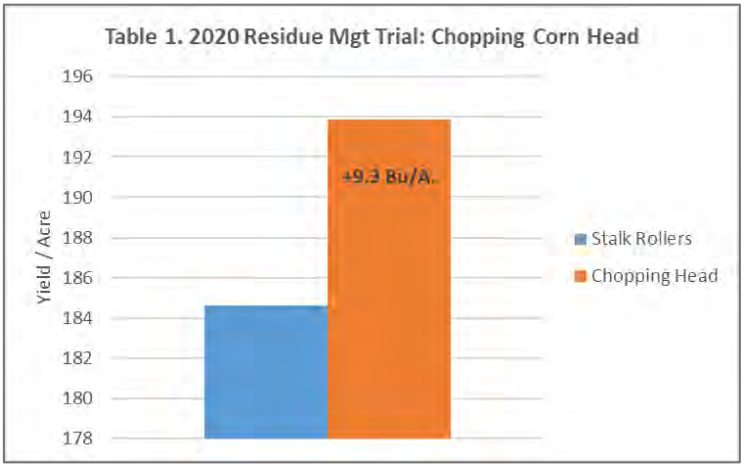
Planting Date: 4/24 *Hybrid: GH 10D21* *Population: 36K* *Row Width: 30"* *Rotation: CAC* *Corn Price: $3.75*

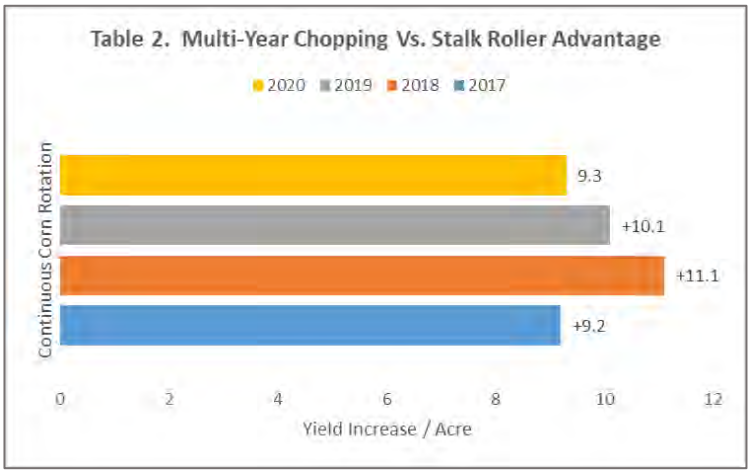
Chopping Corn Head Study

Objective: To study the yield impact of utilizing a chopping corn head in a continuous corn conventional tillage rotation. A Capello Quasar™ chopping head is used to create replicated strips of chop and non-chop residue management trials. The goal of this trial is to evaluate sizing of residue, allowing heavy stalks and residue to break down faster to advance the degradation process and in turn, reducing the carbon penalty associated with continuous corn environment.

Results: Table 1. illustrates that chopping corn residue improved corn yields by +9.3 Bu/A. and increased gross revenue by +$34.88/A. at a corn commodity price of $3.75/Bu.

Multi-year data from 2017-2020 indicates similar results with chopping advantages of +9.2, +11.1, +10.1 and +9.3 Bu/A. respectively.





Planting Date: 4/17 *Hybrid: DKC 65-95* *Population: 36K* *Row Width: 30”* *Rotation: CAC* *Corn Price: $3.75*

Precision Planting

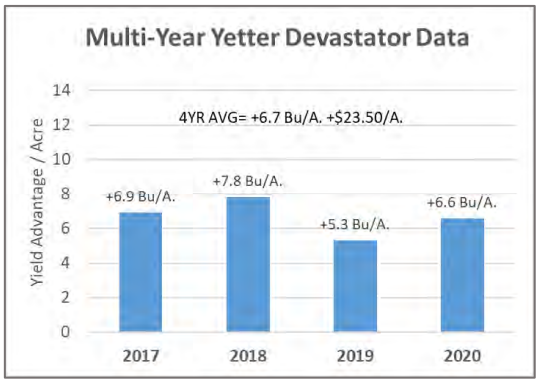
2020 PTI Results

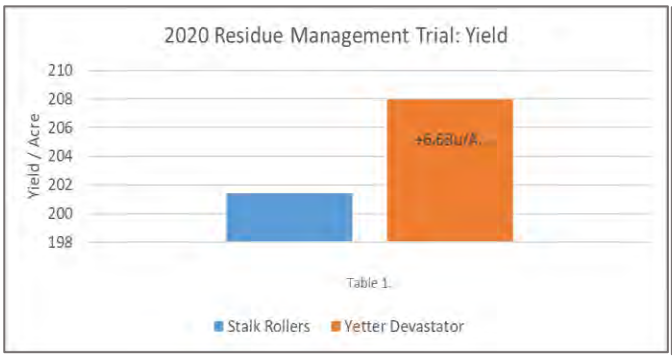
Yetter Devastator™ Study

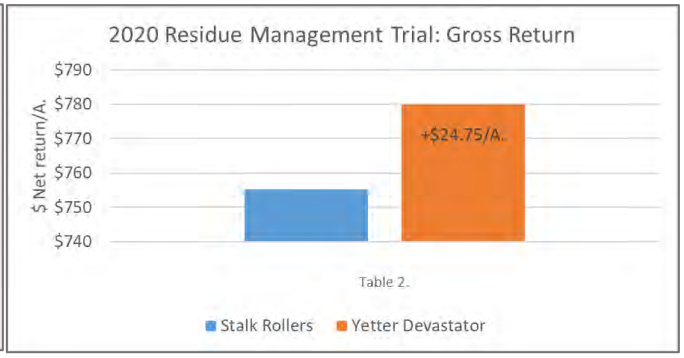
Objective: This continuous corn residue management study evaluates Yetter Manufacturing's 5000 Stalk Devastator. This corn head mounted device saves tires and tracks by knocking over and crushing stalks while leaving them attached, speeding up the cornstalk breakdown process and improving field conditions for spring planting. Features include the following:

- Prevents damage to tires, tracks, wires, and hydraulic hoses on combines, trucks, tractors, and implements
- Knocks over and crushes stalks for faster decomposition and microbial breakdown of residue
- Preserves residue cover, reducing soil erosion and keeping stalks in place in windy conditions

Results: Yetter Devastators provided +6.6 Bu/A. yield increases (Table 1.) and a return on investment of +$24.75/A. (Table 2.). Multi-year data from 2017-20 indicated consistent average yield gains of +5.3 to +7.8 Bu/A. One advantage to the Yetter Devastator is relatively quick return on investment. At a purchase price of $4371 for an eight row Devastator, based upon four-year data, break-even acres would occur at 186 total acres. With corn after corn rotations, residue management needs, considerations, and tools like this have been advantageous.







Planting Date: 5/11 *Hybrid: GH 10D21* *Population: 36K* *Row Width: 30"* *Rotation: CAC* *Corn Price: $3.75*

SCiO™ Pocket Molecular Sensor Study

Objective: This study evaluates a new quick and easy grain moisture sensor called SCiO (Figure 1.). The SCiO is a pocket sized, Bluetooth, micro-spectrometer that has the ability to measure moisture of shelled or unshelled grain. It's an in-field scouting tool that wirelessly connects to your smartphone via Bluetooth, to provide quick and accurate moisture readings.

Figure 1. SCiO™ in field scouting tool

Once the SCiO is connected, it can then be placed directly on the grain for moisture calculation. Five readings must be collected for every moisture SCiO scan.

For this agronomic experiment, we compared the SCiO to a commonly used handheld DICKEY-john Mini-GAC plus (Figure 4).

Moisture readings can be done easily in the field without lugging large equipment or even hand-shelling ears. Using your smartphone in tandem with the SCiO, a grower can add notes and save moisture readings with the app (Figure 2-3.).

Figure 2. SCiO™ smartphone app

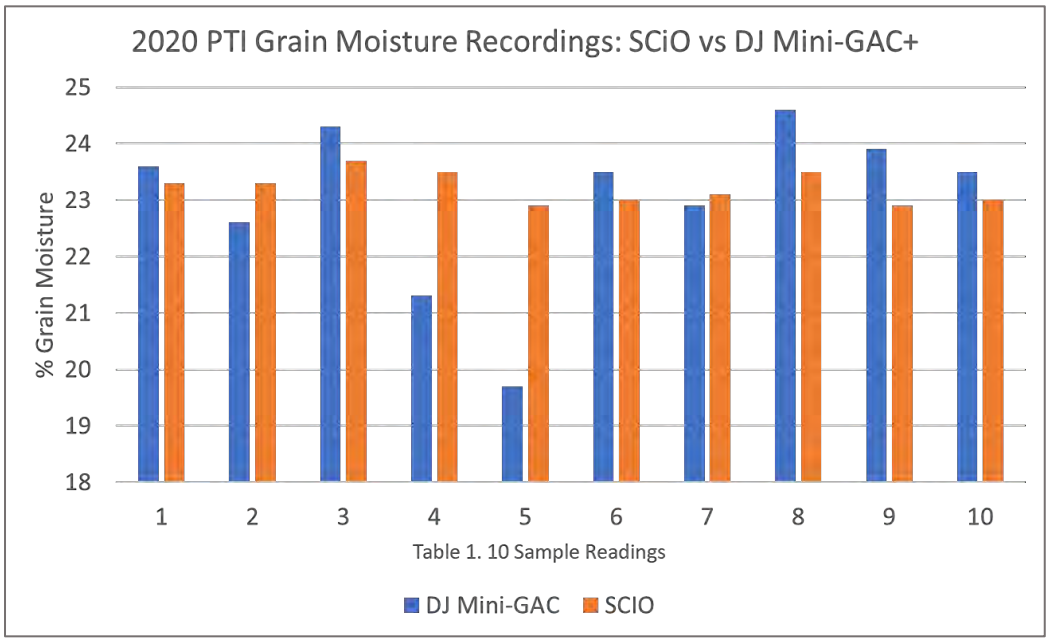
SCiO™ Pocket Molecular Sensor Study

Figure 4. DICKY-john Mini-GAC® plus

Results: This year we evaluated the SCiO and the DICKY-john Mini GAC-plus and compared the results to baseline grain moisture sample performed by a local grain terminal near PTI. This baseline was used as our control moisture sample (23.0%), we then ran 10 sample analysis tests from each moisture tester to evaluate over-all performance and accuracy.

Table 1. illustrates the moisture readings from each moisture device. Both moisture testers predicted an accurate moisture reading from the grain terminal within 0.2pts of grain moisture. The most notable difference between the two grain moisture testers was the range of all ten sample readings. The DICKY-john mini-GAC plus did accurately predict the same moisture as our baseline sample, however the range of the 10 samples was from 19.7% to 24.6% moisture (4.9% moisture range). The SCiO resulted in an average moisture that was +0.2% off from the baseline sample of 23.0% moisture. However, the ten samples tested ranged from 23.0 to 23.7 (0.7% range).

As an experimental product tested at the PTI Farm in 2019, the SCiO was an excellent tool to use in the field and looked very promising. After using the SCiO again in 2020, we had tremendous performance and accuracy. We look forward to using this tool throughout future growing seasons.



Precision Planting

2020 PTI Results

Bushel Plus (Harvest Loss Calculator) Study:

Objective: Understanding combine, and header loss can be frustrating and very time consuming but none-the-less very important. The only indication of grain loss that is most commonly provided to the combine operator is rotor, sieve, and tailing losses which can be monitored by electronics in the cab (Figure 2). However, there is no correlation to bushel or economic loss per acre. Growers have a "feel good dial" which can adjust the system to increase or decrease sensitivity of harvest loss.

Optimize Your Combine

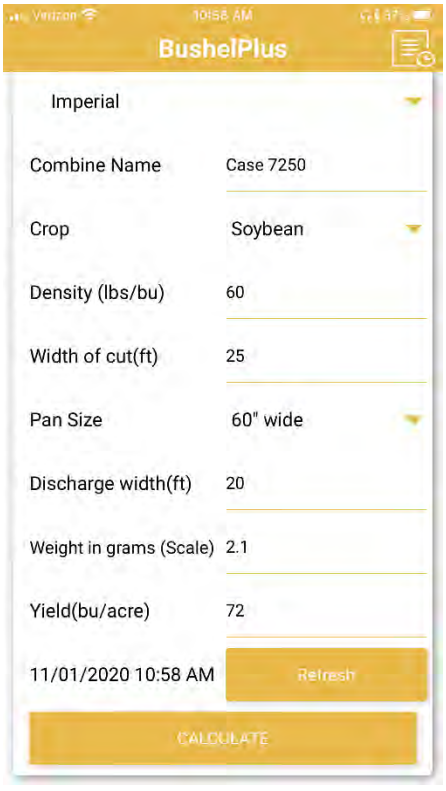
Figure 1.

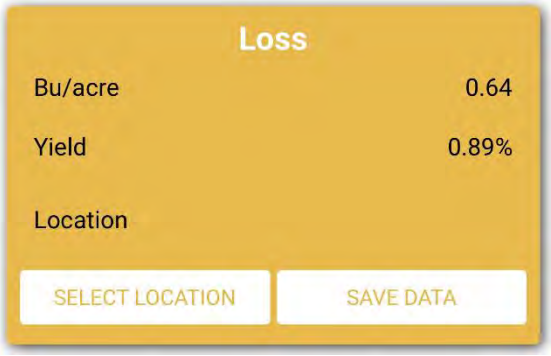
In addition, on current monitor loss systems today, header loss is not included in any grain loss calculations. This leaves a grower not fully aware of total grain losses and most importantly, where the loss is coming from.

Figure 2.

The Bushel Plus system consists of powerful, rechargeable magnets that attach a carrier unit (Figure 1.) underneath any combine. This remains mounted on the combine for testing and nested inside the carrier is an internal drop pan that can be released on the go, by a remote-control key fob while the combine is harvesting.

Figure 3.





A downloadable smartphone app provides easy quick calculation of header and machine losses in Bu/A. as well as percent loss (Figure 3.).

Bushel Plus (Harvest Loss Calculator) Study Continued:

Results: Example 1 illustrates actual combine losses calculated from Bushel Plus. In this scenario, harvest losses exceeded our goal of less than 1 Bu/A. loss. Both machine and header losses combined totaled **-3.91 Bu/A.** Bushel Plus was able to confirm the harvest loss total, where the losses were at, and in this instance informed the grower that adjustments needed to be made.

Example 1. Total Corn Harvest Loss	Harvest Plus Calculation
Machine Loss	1.0 Bu/A.
Header Loss	2.91 Bu/A.
Total Loss:	**-3.91 Bu/A.**

Example 2. illustrates actual corn header losses calculated from Bushel Plus technology. In this scenario we compare a Case 4408 non-chopping head to a Capello Quasar chopping head. Calculations indicated that the Capello head reduced harvest loss by +0.55 Bu/A. compared to the Case 4408 head. This loss saving equates to additional revenue of +$2.06/A.

Example 2. Corn Header Loss	Harvest Plus Calculation
Case 4408 Corn Non-Chop Head	3.18 Bu/A.
Capello Quasar™ Chopping Head	2.63 Bu/A.
Difference:	**+0.55 Bu/A.**

In summary, Bushel Plus was an excellent tool to use as a resource to not only understand what harvest losses consisted of, but it allowed our PTI Farm team to fine-tune our combine settings to minimize the harvest loss in the field. Most of today's combines do not inform the operator of actual Bu/A. losses to fully understand the economics of harvest loss.

Corn Tillage Study

Objective: To evaluate the yield and economic impacts of various tillage programs in a continuous corn rotation. Tillage programs include conventional till, strip-till, vertical till, and no-till.

Table 1. University of IL Machinery Cost Estimates

Tillage Practice	Category	Cost
Conventional Till	Ripper	$ 25.70
	Soil Finisher	$ 12.70
	Plant	$ 14.40
	Total:	$ 52.80
Strip Till	Strip	$ 16.70
	Plant	$ 14.40
	Burndown	$ 8.00
	Total:	$ 39.10
Vertical Till	Vertical	$ 11.70
	Burndown	$ 8.00
	Plant	$ 17.20
	Total:	$ 36.90
No Till	Burndown	$ 8.00
	Plant	$ 17.20
	Total:	$ 25.20

Figure 4. No-Till

Figure 1. Sunflower® 4630 Disc Ripper

Figure 2. Sunflower® 6833 Vertical Tillage Tool

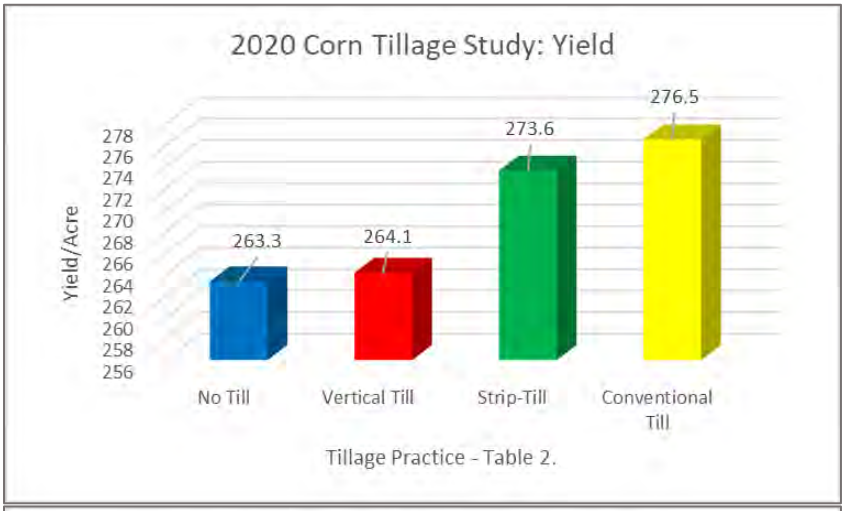
Figure 3. Figure 2. Kuhn® Krause Gladiator

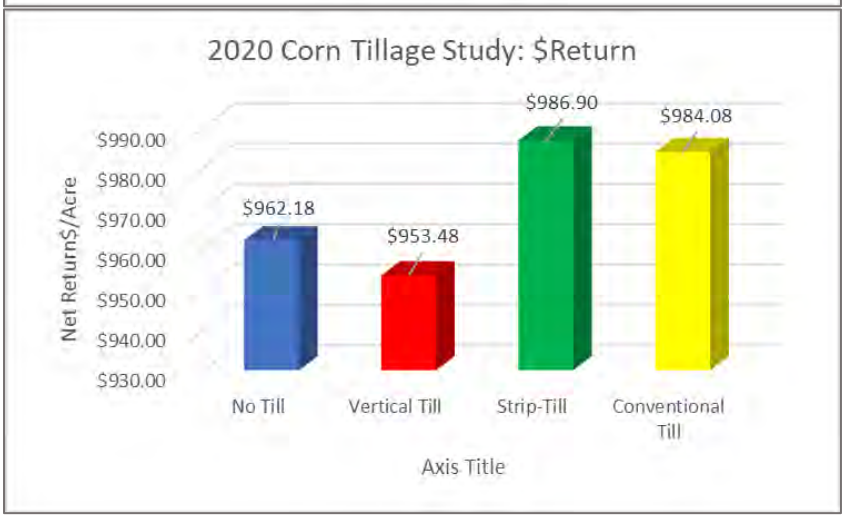
Corn Tillage Study Continued

Results: To understand both yield and economics, the University of Illinois Machinery Cost Estimate Summary is used to calculate individual cost of each tillage program (Table 1). For reduced tillage programs, an $8/A. burn-down is also included.

Table 2. illustrates overall yield for each tillage segment. Yields varied only 13.2 Bu/A. between all tillage programs with conventional tillage offering highest yields at 276.5 Bu/A.

After applying all appropriate costs to each individual tillage segment, Table 3. depicts the economics of each system. Although conventional tillage performed the best this year agronomically, it fell short of being the economic optimum tillage type. Strip-till was economically the best this year with increases of +$2.82/A. over conventional tillage, +$24.72/A. over no-till, and +$33.42/A. over vertical till.





Planting Date: 5/5 *Hybrid: DKC 65-95* *Population: 36K* *Row Width: 30”* *Rotation: CAC* *Corn Price: $3.75*

Precision Planting®

2020 PTI Results

In-Line Ripper Study

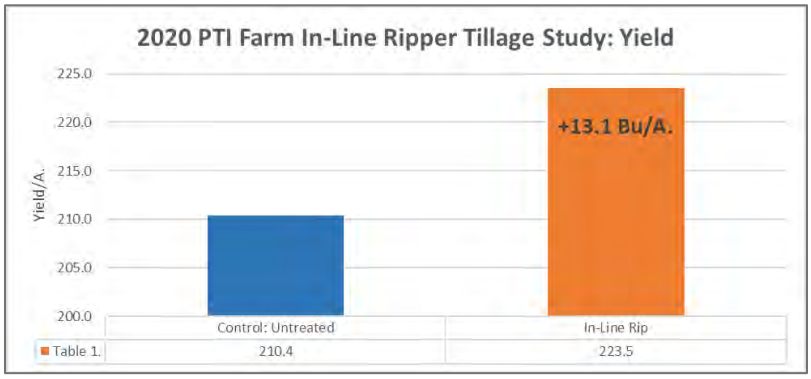
Objective: To evaluate the yield and economic impacts of in-line ripping using a Sunflower® 4710 ripper.

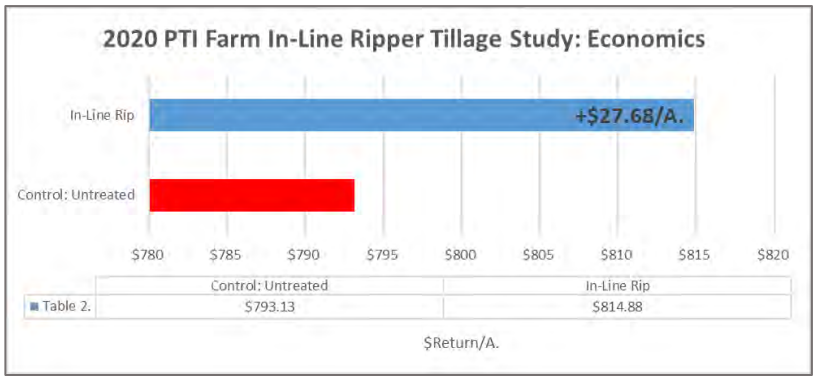
The Sunflower® 4700 Series ripper provides deep tillage designed to penetrate heavily compacted soils, shatter soil compaction, while leaving the surface residue virtually undisturbed.

Results: In-line ripping resulted in +13.1 Bu/A. yield gains. Using the Iowa State University 2020 Custom Rate Study, an equipment cost of $21.45/A. was used for in-line ripping. Using this expense, in-line ripping in this study resulted in economic gains of +$27.68/A.

This study was added to our testing as a result of the last three years offering heavy rains and saturated soils that stayed wet and compacted. It was our hope that in-line ripping would help lift, fracture and remove soil density layers.

Figure 1. 4710 Sunflower® In-Line Ripper





2020 Iowa Farm Custom Rate Survey

FM 1698 Revised March 2020

IOWA STATE UNIVERSITY
Extension and Outreach

Tillage	Charge
Chopping cornstalks, / acre	$12.40
Moldboard plowing, / acre	18.20
Chisel plowing, / acre	17.95
Disk/chiseling, / acre	20.15
Vertical tillage, / acre	18.75
Strip tillage, / acre	20.30
- extra charge, dry bulk fertilizer, banded, no materials, / acre	13.30
- extra charge, liquid fertilizer, knifed, no materials, / acre	12.60
- extra charge, anhydrous fertilizer, no materials, / acre	6.20
Subsoiling (8 to 15 inches deep), / acre	21.45
V-ripping (over 15 inches deep), / acre	22.20
V-ripping with tandem disk, / acre	22.60
Disking, tandem, / acre	15.50
Disking, heavy or offset, / acre	18.75
Harrowing or dragging, / acre	10.55
Soil finishing, / acre	15.70
Field cultivating, / acre	16.10
Rock picking, / acre	17.10
Cultivating, conventional, / acre	13.00

SUNFLOWER AGCO Your Agriculture Company

Planting Date: 5/5 *Hybrid: GH 09A86* *Population: 34K* *Row Width: 30”* *Rotation: CAC* *Corn Price: $3.75*

Broadcast vs Banding Dry Fertilizer Study

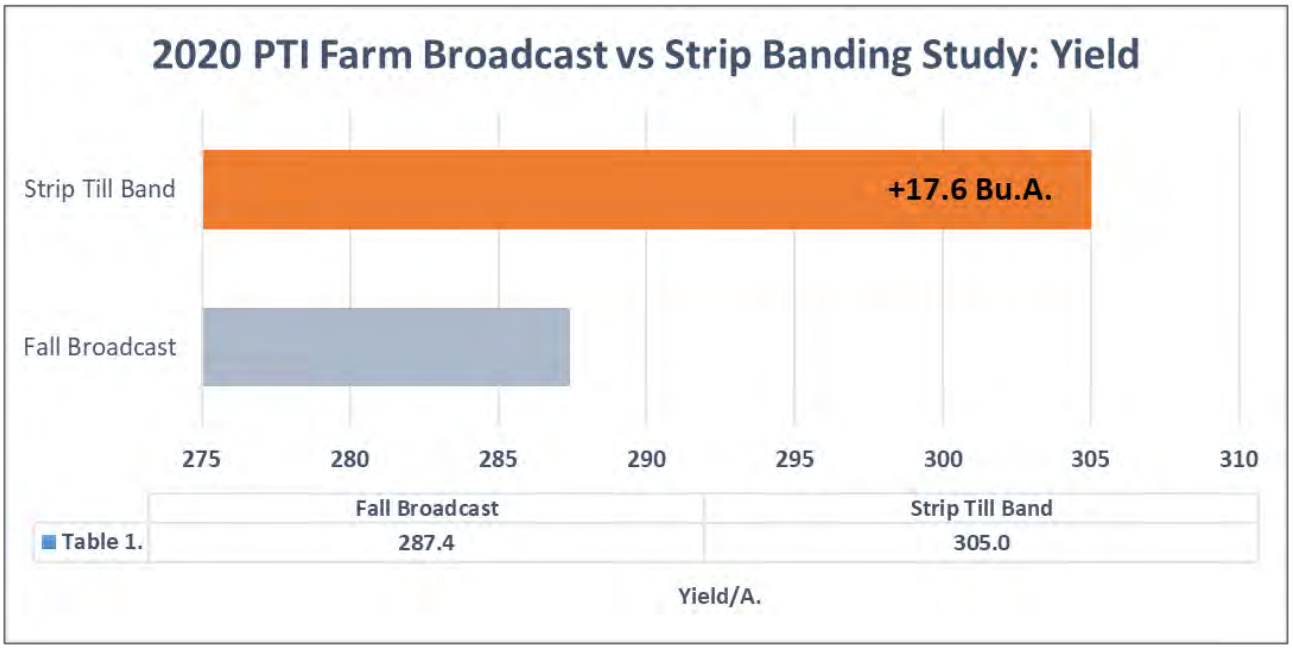
Objective: To evaluate yield and economics of traditional broadcast applications of dry fertilizer compared to 8" deep high concentrated strip-till banding.

Based upon soil test results and yield goals of 250 Bu/A. corn in a corn/soybean irrigated rotation, 260# 18-46-0 and 140# 0-0-60 was applied in both a traditional broadcast surface application and incorporated with a disk ripper after harvest (Figure 1). Using the same fertilizer rates, a strip-till bar was used to place fertilizer in high concentrated strips 8" deep on 20" corn rows (Figure 2). Corn was then planted directly into the strips above the 8" fertilizer placement.

Results Table 1. illustrates strip-till fertilizer resulted in +17.6 Bu/A. yield gains over traditional broadcast applications. Corn yield from broadcast fertilizer averaged 287.4 Bu/A., while strip-till pushed over the 300 mark and resulted in yields of 305 Bu/A.

Figure 1. Broadcast Dry Fertilizer

Figure 2. Strip-Till Banded Fertilizer



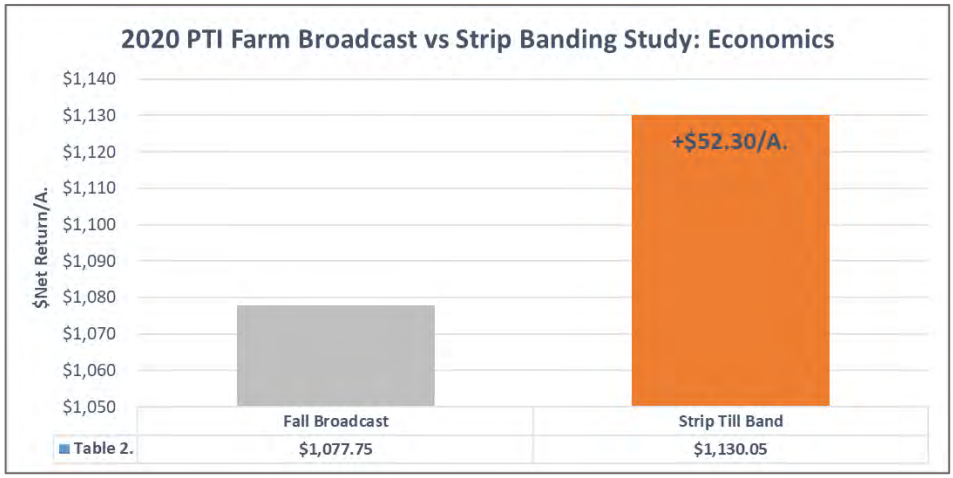
Broadcast vs Banding Dry Fertilizer Study Continued

Using University of Illinois Machinery Cost Estimates in Figure 1., strip-till results in additional costs of +$13.70/A. in comparison to a conventional tillage program. Using this cost scenario, Table 2. Illustrates the economic impact from our 2020 study. With the excellent yields from strip-till, this tillage and fertility system posted positive economic gains of +$52.30/A. over the conventional tillage system.

Tillage Practice	Category	Cost
Conventional Till	Ripper	$ 25.70
	Soil Finisher	$ 12.70
	Plant	$ 14.40
	Total:	$ 52.80
Strip Till	Strip	$ 16.70
	Plant	$ 14.40
	Burndown	$ 8.00
	Total:	$ 39.10

Figure 1. University of IL Machinery Cost Estimates

Seeing these optimistic results, protocols for the 2021 growing season have been implemented to include more strip-till studies with the focus fertility efficiencies. A KUHN Krause Gladiator® pulling a Montag Equipment 2208 Gen 2 fertilizer cart was used to implement a large testing program for 2021. These trials also concentrate on tandem fertilizer Reallocation programs where at-plant liquid fertilizer applications such as Conceal® and FurrowJet® systems offer additional opportunities for banding efficiencies.



Planting Date: 5/5 *Hybrid: GH 10D21, 10L16* *Population: 36K* *Row Width: 20”* *Rotation: CAB* *Corn Price: $3.75*

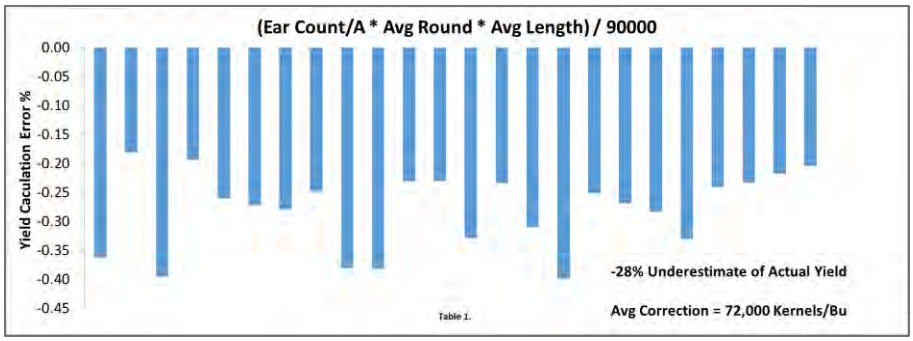
Precision Planting

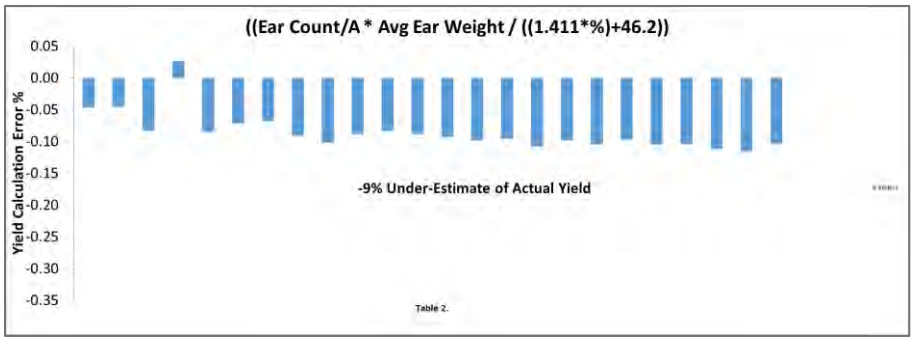
2020 PTI Results

Pre-Harvest Yield Estimation Study

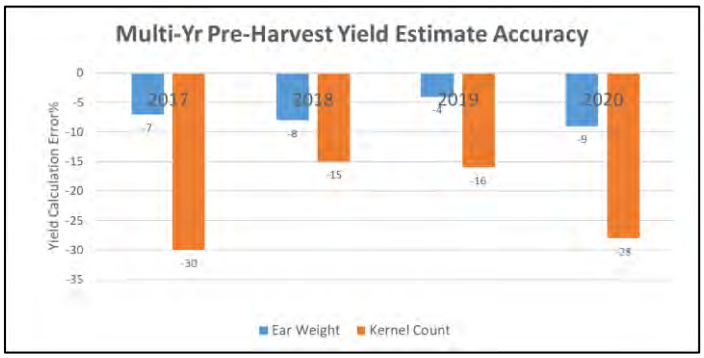
Objective: To calculate pre-harvest yield estimations and compare the accuracy levels of ear weight/moisture versus kernels/Bu. formulas.

A common method used to perform pre-harvest yield estimations has been to calculate ear count multiplied by average kernels round, multiplied by average kernels in length, and divided by the number of kernels of a bushel of corn (Table 1). The problem with this method has been that determining the number of kernels in a bushel of corn varies with different genetics due to size and weight of grain. Corn genetics can vary from hybrid to hybrid and even weather can commonly cause inconsistent test weights and kernel depth from one location to another.





Another pre-harvest yield estimate method is to calculate ear count multiplied by the actual average weight of the ears (Table 2). Since a portion of the ear weight is water from the moisture level of the grain, a moisture reading must take place to differentiate the weight of the actual grain. This calculation accounts for the weight of the grain and more closely depicts yield estimation.



Results: 24 corn hybrids evaluated in this study indicate that using the traditional kernel/Bu. method of calculating corn yield at 90,000 kernels, under-estimated yield by an average of -28%. Table 1. Illustrates the wide variance of yield calculation error varying from **-18%** to **-40%**. To correct the error, an average of 72,700 kernels should have been implemented to account for an average accurate yield range depiction. Conversely, the ear weight and moisture yield estimation method did a much better job of predicting yield within **-9%**. An interesting aspect using this formula is the very tight range of yield error (**-10%** to +3%), compared to the wide swings of the alternative method (Table 2.)

Over the last four years, the kernel/Bu. method has incurred average errors by **-22.3%** using the 90,000 kernels/Bu. method, while the ear weight and moisture method has proved better accuracy at **-7%** (+68.6% improvement).

Soybean Table of Contents:

Soybean Planting Principles:

CleanSweep® Residue Management ---------- 136-137
Closing Wheels ---------- 138-140
FurrowForce™ Automated vs Manual Control ---- 141
Planting Date ---------- 152
STP Opening Discs ---------- 155-156
Strip Planting ---------- 157-158
Downforce Management ---------- 159-160
Keeton® Seed Firmer ---------- 161
Keeton® Seed Firmer/Downforce ---------- 162
Singulation ---------- 164
Seeding Rate ---------- 165-166
High Speed ---------- 167

Soybean Fertility:

pH Acidity ---------- 149-150
Calcium Products 98G™ ---------- 151
Starter Fertilizer Response by Date ---------- 153-154
FurrowJet® Side Wall ---------- 163
Marco Quick Grow LTE FurrowJet®---------- 168
The Anderson's® Nutritional ---------- 169-170
Nachurs® Start2Finish ---------- 171
AgroLiquid® Fertilizer FurrowJet® ---------- 172
AgroLiquid® LiberateCa™ ---------- 173
AgroLiquid® S-Calate™ Calcium/Sulfur ---------- 174
Revytek™ Foliar Fungicide ---------- 175
Calcium Products SO4™ ---------- 176
Marco Fertilizer Conceal® 14-12-4-6s ---------- 177
Nachurs® Conceal® K-Fuse® Potassium ---------- 178
QLF® 7-21-3 MKP FurrowJet® ---------- 179
QLF Kelpak Seed Treatment ---------- 180
QLF AGRO GOLD™ + SEATONIC™ FurrowJet®----- 181
QLF Boost Conceal® ---------- 182
QLF Amino-15 Foliar ---------- 183

Soybean Harvest:

Chopping Head ---------- 185

Soybean Tillage:

Soybean Tillage ---------- 134-135

Soybean Intensive Management:

High Yield Irrigation Conventional Till-------- 142-145
20" High Yield Strip-Till Irrigated Cover Crop-146-148

Soybean Tillage Study

Objective: To evaluate the yield and economic impacts of various tillage programs in a soybean after corn rotation. Tillage programs include strip-till, vertical till, and no-till.

Table 1. University of IL Machinery Cost Estimates

Tillage Practice	Category	Cost
Conventional Till	Ripper	$ 25.70
	Soil Finisher	$ 12.70
	Plant	$ 14.40
	Total:	$ 52.80
Strip Till	Strip	$ 16.70
	Plant	$ 14.40
	Burndown	$ 8.00
	Total:	$ 39.10
Vertical Till	Vertical	$ 11.70
	Burndown	$ 8.00
	Plant	$ 17.20
	Total:	$ 36.90
No Till	Burndown	$ 8.00
	Plant	$ 17.20
	Total:	$ 25.20

Figure 1. Sunflower® 6833 Vertical Tillage Tool

Figure 2. Planting in No-Till

Figure 3. Figure 2. Kuhn® Krause Gladiator

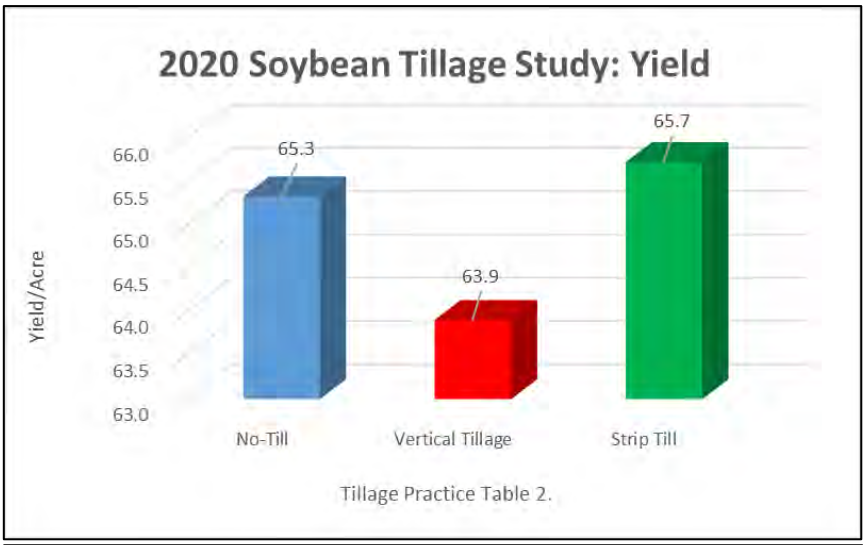
Soybean Tillage Study Continued

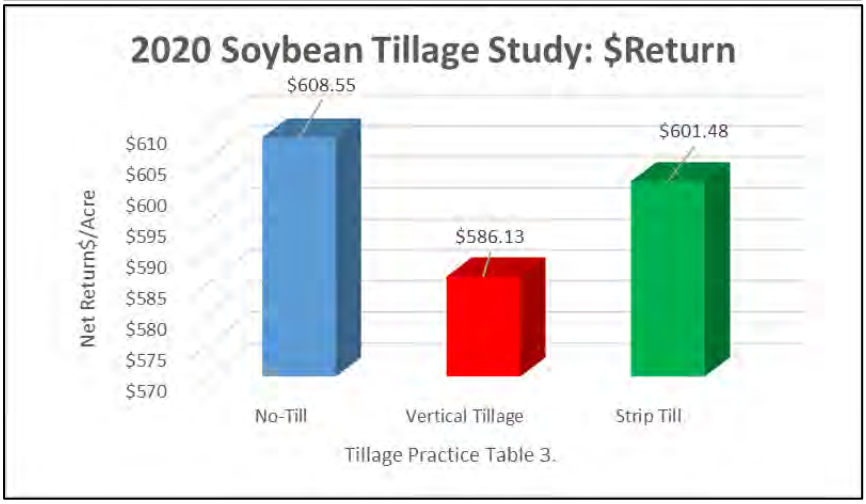
Results: To understand both yield and economics, the University of Illinois Machinery Cost Estimate Summary is used to calculate individual cost of each tillage program (Table 1). For the three reduced tillage programs, an $8/A. burn-down is also included.

Table 2. illustrates the overall yield for each tillage segment. The yields varied only 1.8 Bu/A. between all tillage programs with the no-till and strip-till offering the highest yields of 65.3 Bu/A. and 65. Bu/A. respectively.

After applying all appropriate costs to each individual tillage segment, Table 3., depicts the economics of each system.

$22.42/A. separated the difference between all tillage systems, with vertical tillage offering the lowest overall returns in the study.





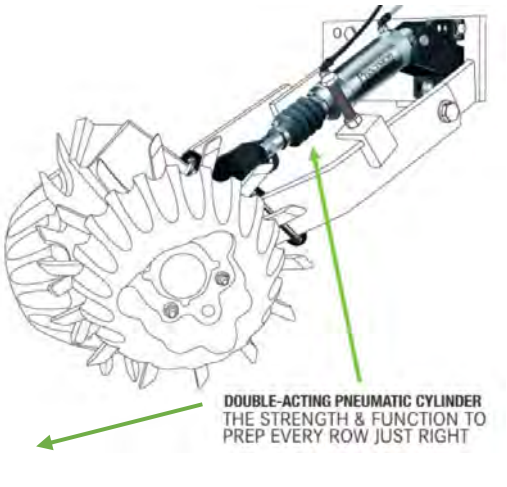
No-till and strip-till varied by **-$7.07/A.**, while vertical-till fell behind with economic losses of **-$22.42/A.**

Planting Date: 5/17 *Variety: Pioneer 31A22X* *Population: 140K* *Row Width: 30"* *Rotation: BAC* *SB Price: $9.75*

CleanSweep® Residue Management Study

Objective: This study evaluates the benefits of planter row cleaners equipped with CleanSweep® cylinders. Residue management has become a necessary part of today's operation to maximize profitability. Tougher stalks and more corn-on-corn acres mean a heavier load of residue that needs to be controlled. Residue in the seed trench competes with seedlings for moisture and harbors disease. CleanSweep® cylinders put row cleaners right where they need to be, moving residue but not the soil. Continuous adjustments can be made as field conditions change with the cab-mounted controller to easily lift or make more aggressive adjustments.

Figure 1. CleanSweep® System



In this study, we use air pressure to adjust CleanSweep® cylinder settings to allow the ability to change and evaluate the aggressiveness of row cleaners. These settings were then evaluated to study yield and economic advantages.

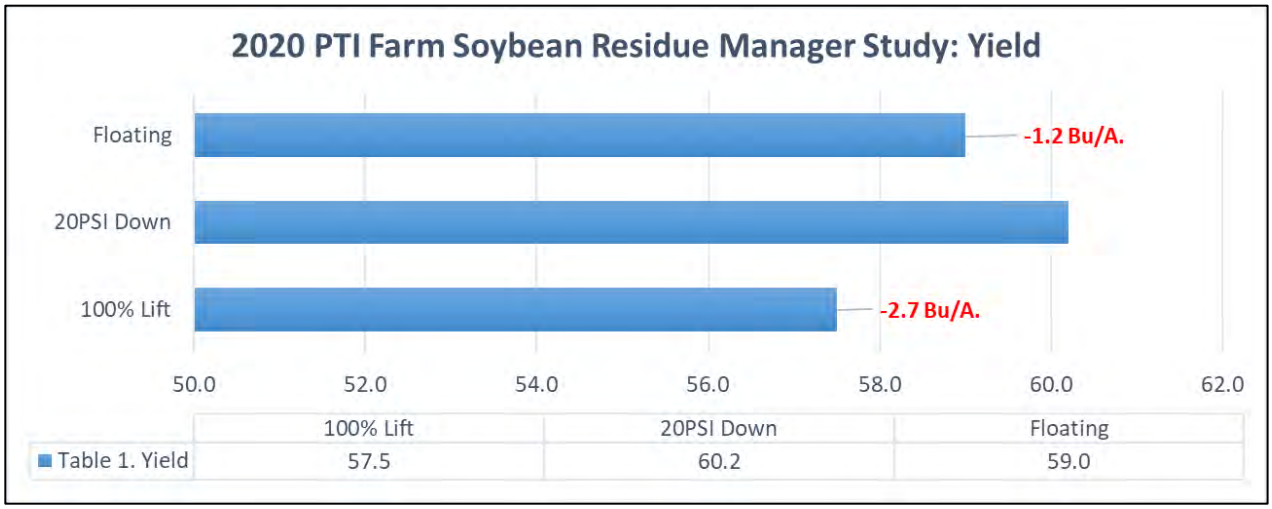
These agronomic settings consisted of:

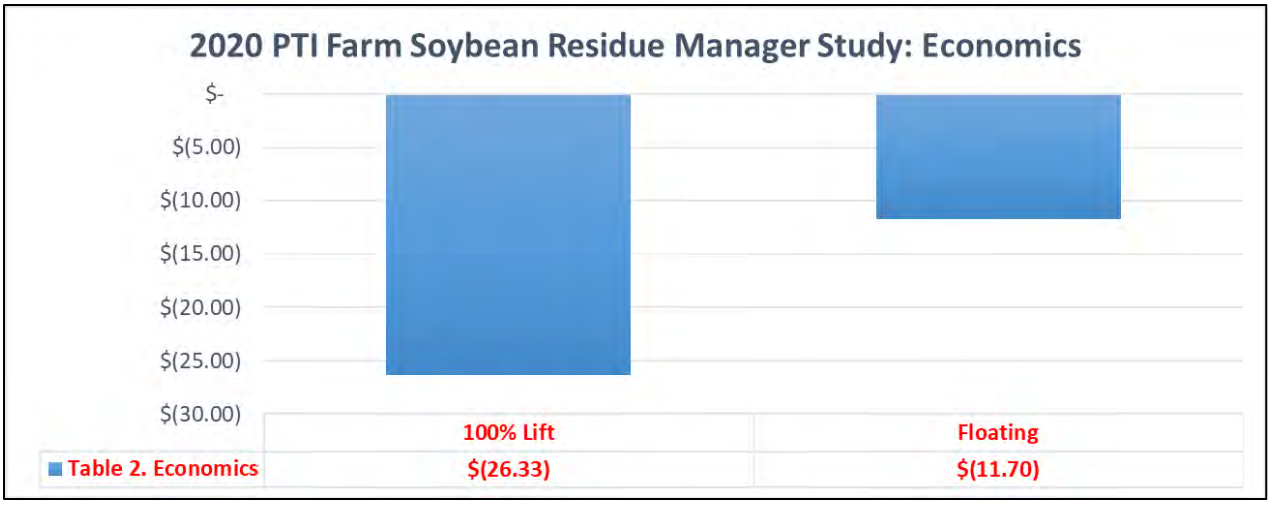
1. Lifting the row cleaners 100% to simulate the lack of row cleaners
2. A "floating" (0# psi) position that allows the row cleaner to ride along top of the soil surface with no air control, lift, or down-pressure.
3. 20# of air down-pressure, just aggressive to wipe crop residue and clods out of the way to lead a clean path ahead of the planter gauge wheels and seed disk openers.

CleanSweep® Residue Management Study Continued

Results: Table 1. illustrates CleanSweep® system yield results from the PTI Farm in 2020. 100% lift (no row cleaners), resulted in yield losses of **-2.7 Bu/A.** and floating row cleaners proved losses of **-1.2 Bu/A.** compared to the 20#psi down setting.

Table 2. summarizes the economics of having the correct residue manager setting. At $9.75 soybeans, 100% lift resulted in losses of **-$26.33/A.** while floating **-$11.70/A.**





Planting Date: June 8 *Variety: Champion 27X9N* *Population: 130K* *Row Width: 20"* *Rotation: BAC* *Soybean Price: $9.75*

Soybean Closing Wheel Study

Objective: To evaluate the performance of five different closing systems in three different tillage practices. Closing wheels are designed to close the seed trench, eliminate sidewall compaction/smearing, remove air pockets, all at the same time achieving good seed-to-soil contact. This study evaluates five distinct types of closing wheel systems in strip, vertical, and no-till situations.

FurrowForce® Closing and Sensing/Control System:

Advantages: Lifts and fractures sidewall compaction/smear

2nd stage stitching, removal of air pocket

Automatic Sensing of soil variability

Automatic Control to ensure proper settings

Single Rubber/Yetter Cast Spike Closing System:

Advantages: Lifts and fractures sidewall compaction/smear

Combination of Sealing and Aggressive Fracture

Disadvantages: Spikes can be aggressive

Dual Yetter Poly Twister™ Spike Closing System:

Advantages: Lifts and fractures sidewall compaction/smear

Center ring acts as depth maintainer

Disadvantages: Lightweight wheels require increased tension

Single Rubber/Yetter Poly Twister Spike Closing System:

Combination of above two systems for variable soils

Soybean Closing Wheel Study Continued

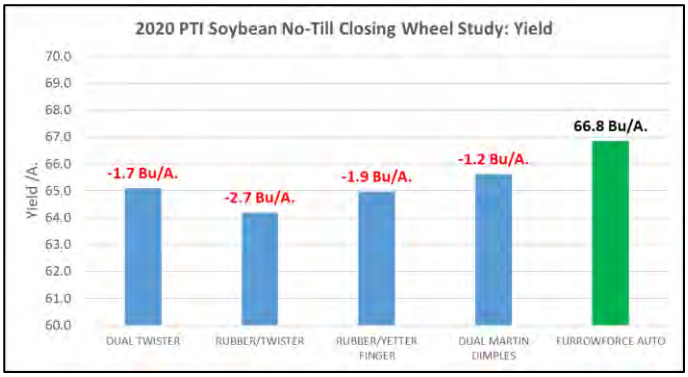
Dual Martin Dimple™ Spike Closing System:

Advantages: Lifts and fractures sidewall compaction/smear

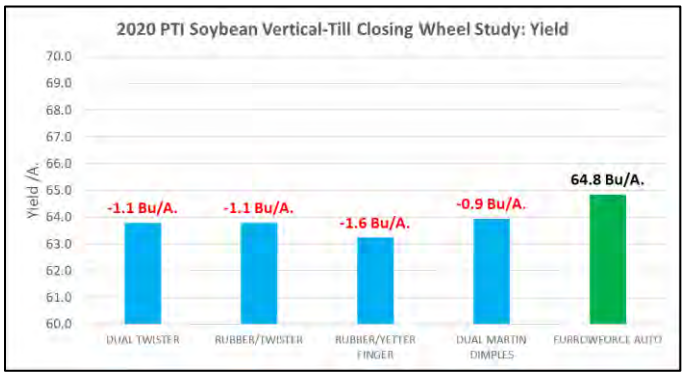
Versatile heavy wheel, great for reduced tillage

Depth Maintaining

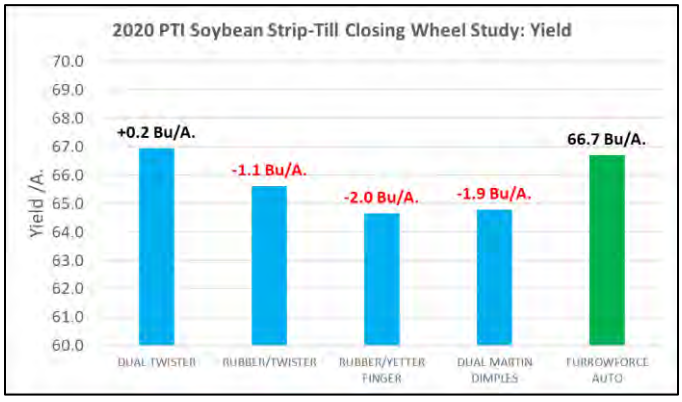
Disadvantages: Extra weight can be aggressive



No-Till Results: The FurrowForce® automated sensing and control closing system in a no-till environment shined with positive yield gains over all other closing systems. All non-sensing/control systems incurred yield losses of **-1.2** to **-2.7 Bu/A.** (Table 1). Using $9.75/Bu. soybeans equates to additional returns of +$11.70 to +$26.33/A. for the FurrowForce® system.



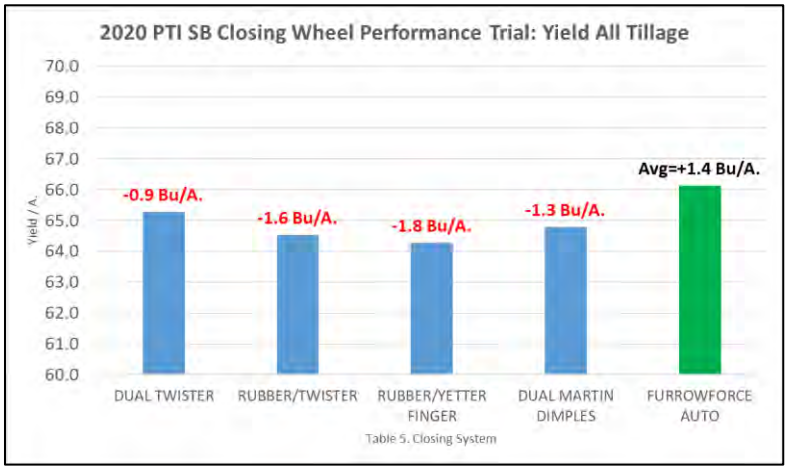
Vertical-Till Results: The FurrowForce® automated sensing and control closing system in vertical-till environments also proved positive yield gains over all other closing systems. Non-sensing/control closing systems incurred yield losses of **-0.9** to **-1.6 Bu/A.** (Table 2)., equating to additional returns of +$8.78 to +$15.60/A. for the FurrowForce® system.

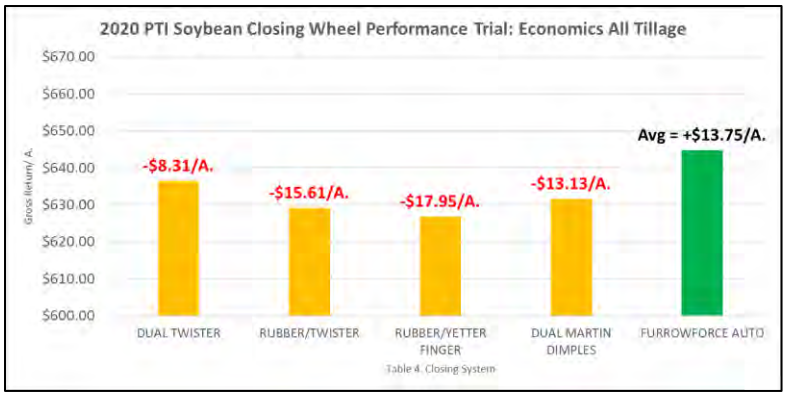


Strip-Till Results: The Yetter Poly Twisters out-performed the FurrowForce® system by +0.2Bu/A. resulting in economic gains of +$1.95/A.. All other non-sensing/ control closing systems incurred yield losses of **-1.1** to **-2.0Bu/A.,** resulting in additional average returns of +$16.26/A. for the FurrowForce® system.

Soybean Closing Wheel Study Continued

Tables 4-5. illustrate FurrowForce® automatic sensing and control average yield gains of +1.4 Bu/A. over all non-sensing closing systems, resulting in an average return on investment of +$13.75/A.





In summary, for years planters have struggled with closing systems with manual settings that offered the inability to account for and change for varying soil conditions. Today, we are excited that technology finally exists where farmers can use sensing technology on the planter row unit to determine how much force is needed on closing systems to address soil variability. By using a robust 2-stage closing system, load pin and sensing architecture, partnered with a 20|20® monitor, farmers can be confident of closing the seed trench, eliminating sidewall compaction/smearing, and removing air pockets all while planting through various seedbed conditions on a pass-pass basis.

Planting Date: May 11 *Variety: Pioneer 31A22* *Population: 130K* *Row Width: 30"* *Rotation: BAC* *SB Price: $9.75*

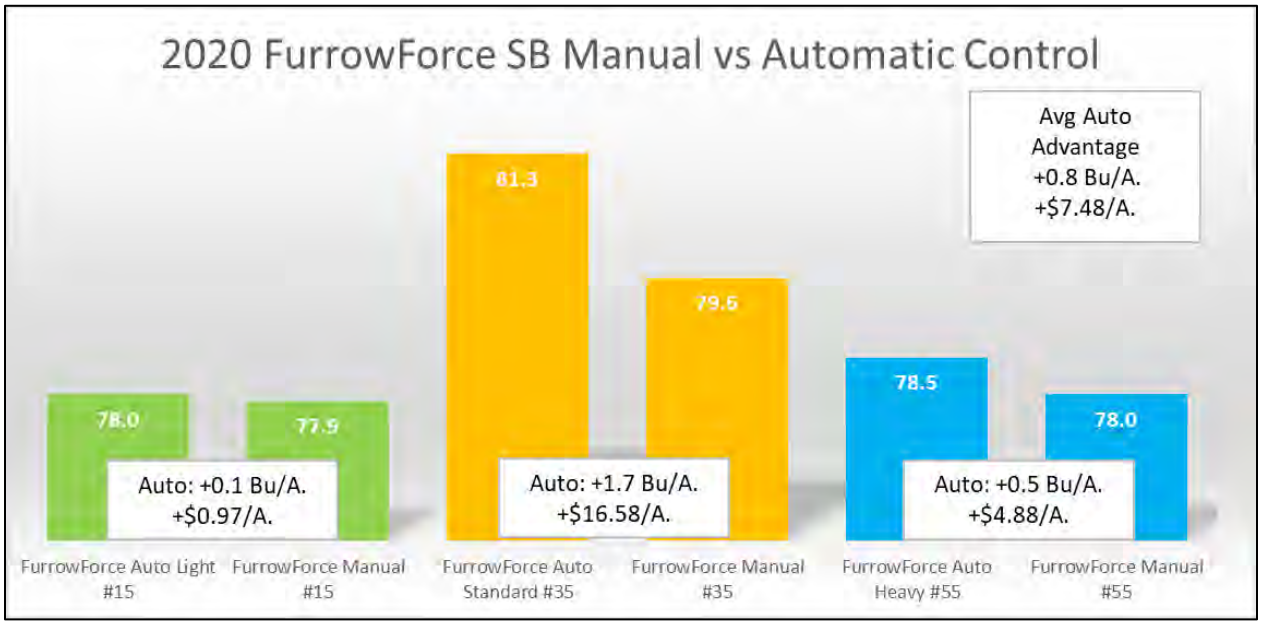
Precision Planting®

2020 PTI Results

Soybean FurrowForce® Automated vs Manual Control Study

Objective: This study evaluates the yield and economic effects of utilizing a FurrowForce® closing system in both manual and automated control settings in soybeans. FurrowForce® is a robust 2-stage closing system with load pins and a sensing architecture platform. When partnered with the 20|20® monitor, farmers can be confident of closing the seed trench, eliminating sidewall compaction/smearing, and removing air pockets, all while planting through various seedbed conditions on a pass-pass basis.

Results: The FurrowForce® system was used in three automated and manual settings consisting of Light (15#), Standard (35#), and Heavy (55#) as set by the 20|20® system. The graph below illustrates automated control outperformed each manual setting with average yield gains of 0.8 Bu/A. These yield gains correlated to positive economic returns of $7.48/A.



Planting Date: 4/17 *Hybrid: GH 5283Enlist* *Population: 130K* *Row Width: 30”* *Rotation: SAC* *SB Price: $9.75*

Precision Planting®

2020 PTI Results

30” High Yield Conventional-Till, Irrigated Soybeans

Objective: This study evaluates the yield and economic impact of implementing an irrigated high yield management program in soybeans. Our goal was to learn how to implement high yielding programs and what it takes to drive soybean yield, knowing that we would have ample irrigation and drainage throughout the growing season from our on-farm reservoir and water recycling system (For more information please reference pages 33-35).

NETAFIM™ GROW MORE WITH LESS

Figure 1. NetaFim® Drip Tape

This high yield study evaluates the use of NETAFIM drip tape designed by NutraDrip Irrigation Systems and its ability to feed soybeans with water and nutrients for high yield potential. This method of irrigating a crop uses NETAFIM drip tape with small pressure regulating emitters evenly spaced at 24” apart (Figure 1). Drip tape in this study is not sub-surface irrigation, rather the team at PTI installed this system on the soil surface to demonstrate how the system works and to have mobility with irrigating trials at the PTI farm. Water is sourced from the PTI Farm water recycling reservoir and pumped out through a 3” line and flexnet manifold system.

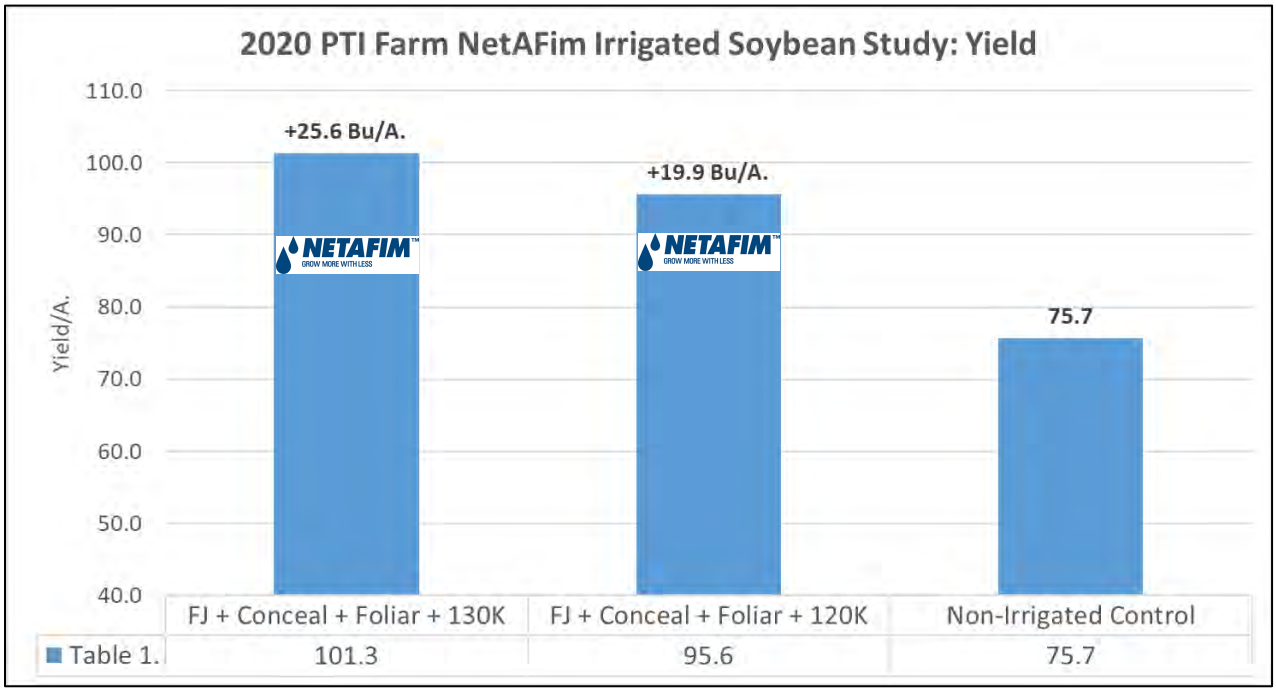
Figure 2. includes the individual treatments used in this study to try and achieve high yield, as well as the rates and placement of each product at seeding rates of 50K, 75K, 100K, 125K, 130K, and 150K.

Figure 2. 2020 Protocol

FurrowJet Center: At-Plant • 1 Gal/A. QLF Boost • 1.5 Pt/A. AgroGoldRC+SEATONIC • 96oz Ocean Blue Ag Nutrisphere	**FurrowJet Wing: At-Plant** • 2Gal/A. QLF Boost • 3 Gal/A.Nachurs TripleOption • 2 Gal/A. Water	**Conceal®: At-Plant** • 12 Gal/A. 32% UAN • 10 Gal/A. Marco BOOST • 3 Gal/A. Nachurs K-Fuse • 3 Gal/A. QLF Boost • 1 Pt/A. Nachurs 10% Boron • 32oz/A. Nachurs HumiFlexMax
Foliar: 3rd Trifoliate • 1Pt Nachurs FinishLine • 2Qt/A. Nachurs TripleOption • 1 Gal /A. QLF Boost	**Foliar: 5th Trifoliate** • 1 Pt Nachurs FinishLine • 2Qt/A. Nachurs TripleOption • 1 Gal /A. QLF Boost	
Foliar: 8th Trifoliate • 1 Gal/A. QLF Boost • 2 Qt/A. Nachurs TripleOption • 1Pt/A. Nachurs FinishLine	**Foliar: R1** • 1 Gal/A. Nachurs Balance • 1 Gal/A. QLF Boost • 2 Qt/A. Nachurs FirstDown	**Foliar: R3** • Syngenta Miravis Neo • 1 Gal/A. QLF Boost • 2Qt/A. Nachurs FirstDown

30" High Yield Conventional-Till, Irrigated Soybeans Continued:

Table 1. illustrates the overall yield advantage of irrigated versus non-irrigated soybeans. NETAFIM drip tape irrigation offered increased yield gains of +22.8 Bu/A., equating to additional gross revenue of +$221.94/A. As with any high yield study, additional costs were incurred from the treatments listed previously. After including expenses of high yield attempt treatments not used on the control treatment, a net profit of +$93.35/A. was realized from this high management system. A total of 9" of rain was applied as irrigation from the PTI water drainage and recycling system.



.

Only one treatment achieved over 100 Bu/A. levels as a result of irrigation and nutrition placement. The highest yield in the study came in at 101.3 Bu./A., which consisted of a "kitchen sink approach" where all products were applied on a 130K seeding rate

These soybeans were not planted on May 14, because some heavy rains that kept soils saturated. This later plant date did not help push yields and more than likely could have cost 10-20 Bu/A. in yield. The 2020 soybean planting date study at the PTI Farm indicated as planting dates were implemented past April 11th, yield fell considerably each week up until June 1st (See page 150 for details on soybean planting date study).

30” High Yield Conventional-Till, Irrigated Soybeans Continued:

A major objective of this high yield soybean study was the individual yield contributions of at-plant FurrowJet® and Conceal® systems nutritional treatments. The table below illustrates the protocol for rates and products applied in each segment for at-plant only treatments via FurrowJet® and Conceal® systems:

FurrowJet Center: At-Plant	FurrowJet Wing: At-Plant	Conceal®: At-Plant
• 1 Gal/A. QLF Boost • 1.5 Pt/A. QLF AgroGold + SEATONIC • 96oz Ocean Blue Ag Nutrisphere	• 2Gal/A. QLF Boost • 3 Gal/A.Nachurs TripleOption • 2 Gal/A. Water	• 12 Gal/A. 32% UAN • 10 Gal/A. Marco BOOST • 3 Gal/A. Nachurs K-Fuse • 3 Gal/A. QLF Boost • 1 Pt/A. Nachurs 10% Boron • 32oz/A. Nachurs HumiFlexMax

Table 2. illustrates the yield results for each individual treatment. The all combination treatment or “5 Point-touch” offered the highest yield response of +14.8 Bu/A., however Conceal® system applications offered the highest individual yield response at +10.5 Bu/A. FurrowJet® center applications averaged +2.4 Bu/A., while FurrowJet® wing treatments averaged +3.4 Bu/A..

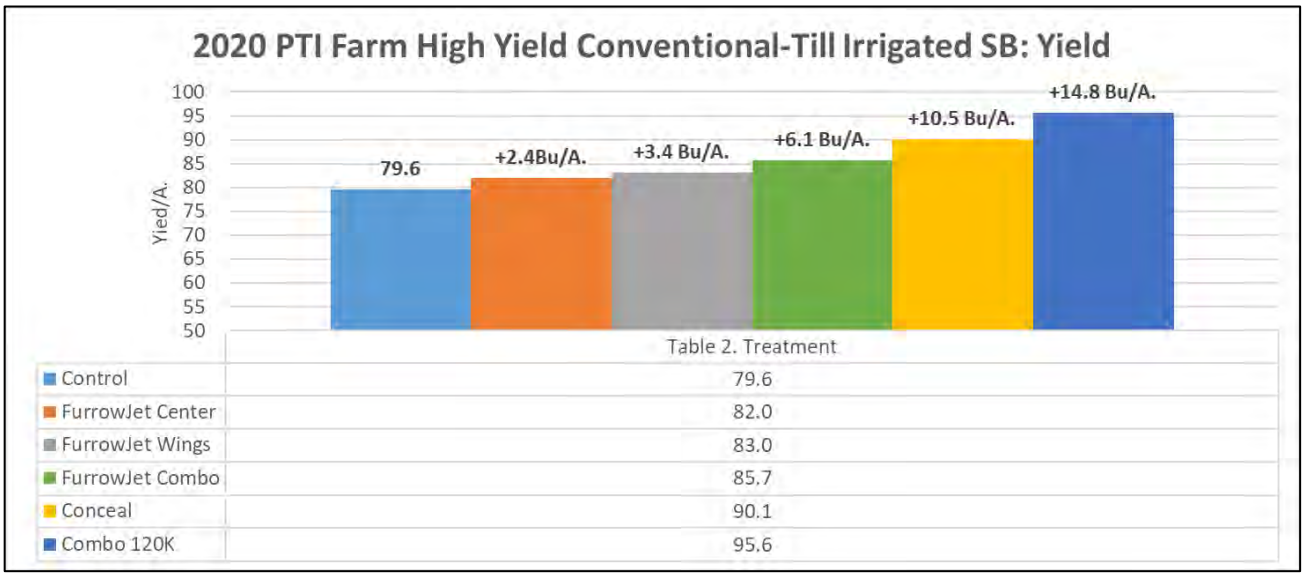
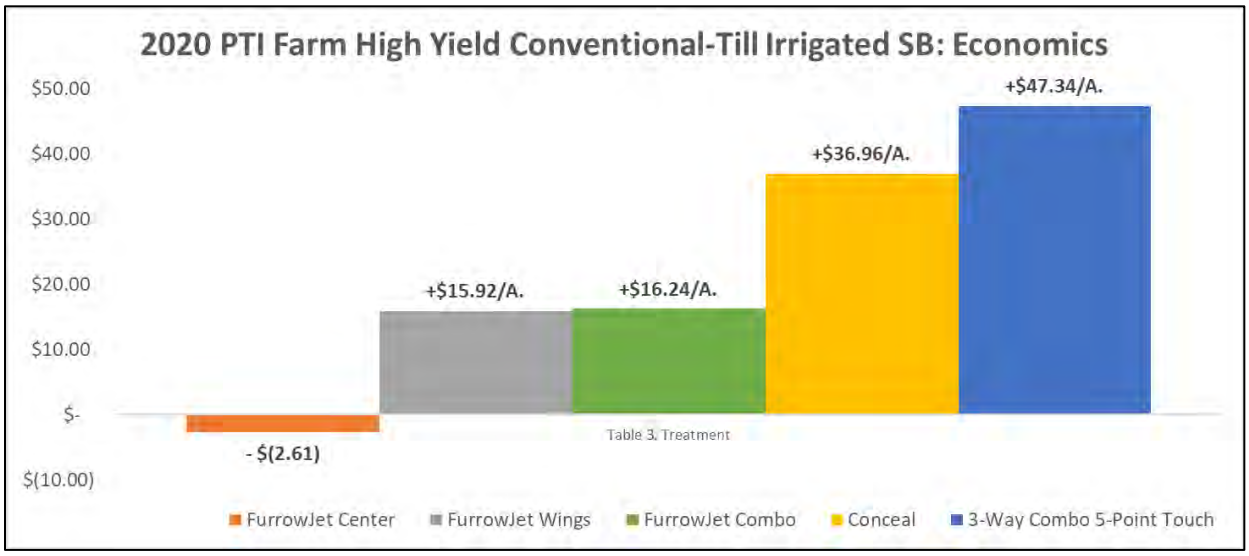


Table 2. Treatment	
Control	79.6
FurrowJet Center	82.0
FurrowJet Wings	83.0
FurrowJet Combo	85.7
Conceal	90.1
Combo 120K	95.6

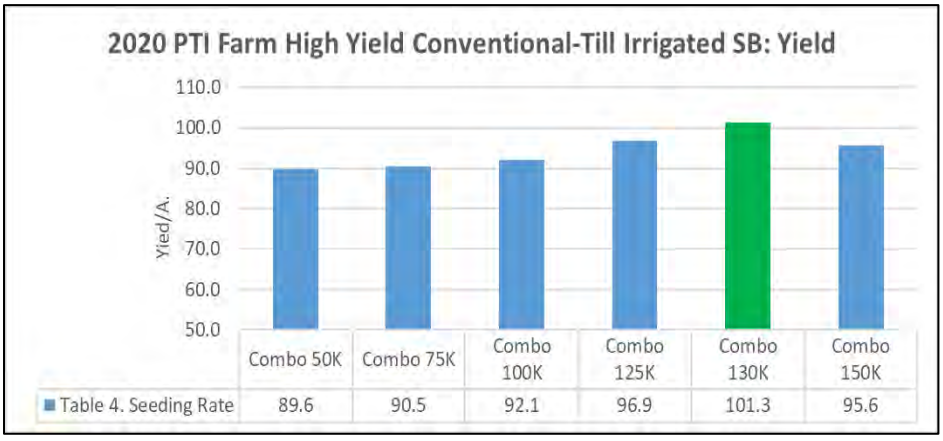
30" High Yield Conventional-Till, Irrigated Soybeans Continued:

Table 3. illustrates the net economic return from each treatment in this high yield study. The all combination treatment or "5 Point-touch" offered the highest economic advantage of +$47.34/A., however Conceal® system applications offered the highest individual yield response at +$36.96/A.

FurrowJet® wing treatments averaged economic advantages of +$15.92/A., however FurrowJet® center applications proved net economic losses of **-$2.61/A.**



Finally, seeding rates were also evaluated to monitor yield performance in this high yield study. Table 4. illustrates seeding rates ranging from 50K to 150K, where 130K offered the highest yield at 101.3 Bu/A. The lowest planted seeding rate of 50K, proved to offer the lowest yields at 89.6 Bu/A.



Planting Date: Varied *Variety: GH3546X* *Population: 130K* *Row Width: 30"* *Rotation: BAC* *SB Price: $9.75*

20” High Yield Strip-Till, Irrigated, Cover Crop Soybeans

Objective: This irrigated soybean study evaluates the yield and economic impact of implementing an irrigated high yield management program in 20” soybeans planted in a strip-till and ryegrass cover crop environment. Our goal was to learn how to implement high yielding programs and what it takes to drive soybean yield, knowing that we would have ample irrigation and drainage throughout the growing season from our on-farm reservoir and water recycling system (For more information please reference pages 33-35).

NutraDrip Irrigation Systems

NETAFIM™ GROW MORE WITH LESS

This high yield study evaluates the use of NETAFIM drip tape designed by NutraDrip Irrigation Systems and its ability to feed soybeans with water and nutrients for high yield potential. This method of irrigating a crop uses NETAFIM drip tape with small pressure regulated emitters evenly spaced at 24” apart (Figure 1). Drip tape in this study is not sub-surface irrigation, rather the team at PTI installed this system on the soil surface to demonstrate how the system works.

The photo to the right illustrates NETAFIM drip tape placed within the soybean row in this study. By adding water and nutrients with this system, it was very common to see soybean root architecture altering its normal state by creating a large fibrous root system that actively searched for nutrition near the drip line placement. This ability led to “luxurious” type feeding which supplied the soybean crop with nutrition that was easy to find and for uptake.

20” High Yield Strip-Till, Irrigated, Cover Crop Soybeans Continued:

Figure 2. includes the individual treatments used in this study to try and achieve high yield. The at-plant Conceal® system, R3 Foliar, and were used in every treatment of this high yield study. Cover crop was used only in the irrigated entries and not included in the control.

Figure 2. 2020 Protocol

FurrowJet Center: At-Plant • 1 Gal/A. QLF Boost	**FurrowJet Wing: At-Plant** • 3 Gal/A.Nachurs TripleOption	**Conceal®: At-Plant** • 12 Gal/A. 32% UAN • 10 Gal/A. Marco BOOST • 3 Gal/A. Nachurs K-Fuse • 3 Gal/A. QLF Boost • 1 Pt/A. Nachurs 10% Boron • 32oz/A. Nachurs HumiFlexMax *Used in all Treatments
Foliar: R1 • 1 Gal/A. Nachurs Balance • 1 Gal/A. QLF Boost • 1 Gal/A. Nachurs TripleOption	**Foliar: R3** • Syngenta Miravis Neo • 1 Gal/A. QLF Boost • 1Qt/A. Nachurs FinishLine *Used in all Treatments	

A fall ryegrass was planted in the fall of 2019 and used as an avenue to help increase soil health, ultimately hoping to increase soybean yield. The photo to the right shows a LAND LUVR strip-freshener with a APV® seeder tank used to plant ryegrass cover crop in 20” rows.

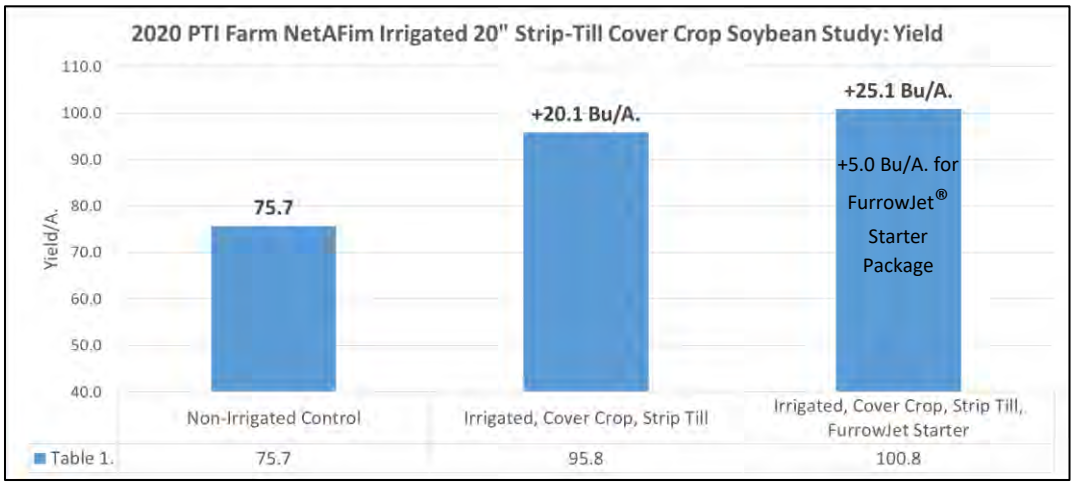
After cover crop emergence, a fall strip-till was then completed, creating 20” strips between the ryegrass. In the spring we planted directly into these strips and desiccated the ryegrass cover crop shortly after planting.

LAND LUVR

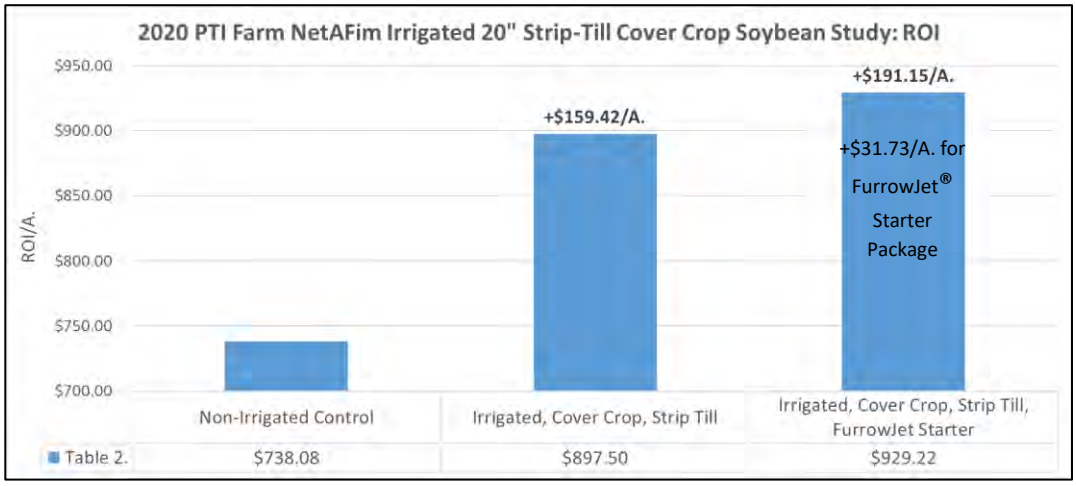
APV®
www.apv-america.com

20” High Yield Strip-Till, Irrigated, Cover Crop Soybeans Continued:

Results: Table 1. illustrates the yield advantages of irrigation for each treatment in the high yield study. Irrigated, cover crop/ strip till offered yield advantages of +20.1 Bu/A., while adding a FurrowJet® system starter fertilizer package added an additional 5.0 bu /A. with yield increases at +25.1 Bu/A.



These +22.6 Bu/A. average advantages increased overall gross revenue by +$220.73/A., however Table 2 illustrates the overall net economic return for each segment. While the irrigated, fall ryegrass cover crop contributed nearly gains of +$160/A., adding the FurrowJet® system starter package increased net gains by +$31.73/A..



Planting Date: Varied *Variety: GH3546X* *Population: 130K* *Row Width: 30”* *Rotation: BAC* *SB Price: $9.75*

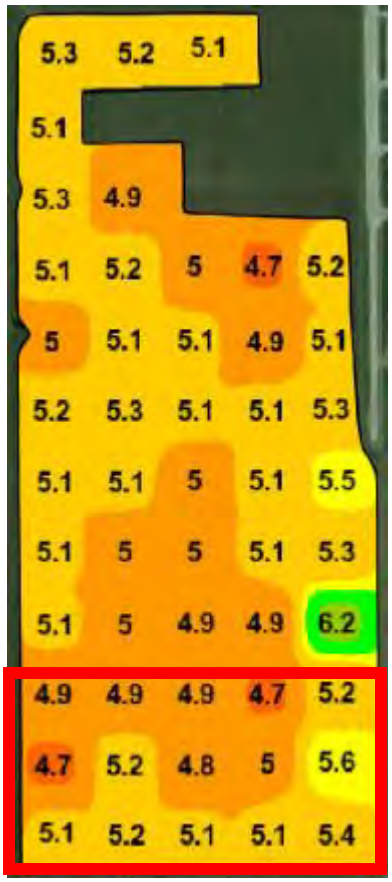
Soybean pH Acidity Study

Objective: To evaluate the long-term yield and economic impact of acidic soil pH in soybeans.

When the PTI farm was acquired in the fall of 2017, a soil test revealed some major issues with soil pH on a particular area of the east side of the farm. Soil test results indicated average pH values of 5.1, with lows of 4.7 pH. This acidic area offered an opportunity to evaluate the yield response of acidic soils compared to corrected basic or neutral pH soils. Three ton of Ag Lime was applied in 2017 and another 2.5 Ton in 2018. However, plots were left without Ag Lime applied, to compare yield and economics.

What is soil pH? The term pH stands for the potential (p) of hydrogen ions (H+) in water, and indicates a measure of the relative acidity or alkalinity of the soil solution. Soil pH is calculated on a 14-point scale, where a value of 7.0 is considered neutral or basic (Figure 2). Lower values on the pH scale denote increasing H+ ions and acidity, while higher values represent increasing hydroxyl (OH-) ions and alkalinity. Because pH is expressed on a logarithmic scale, each change of 1 pH unit represents a 10-fold increase in soil acidity or alkalinity.

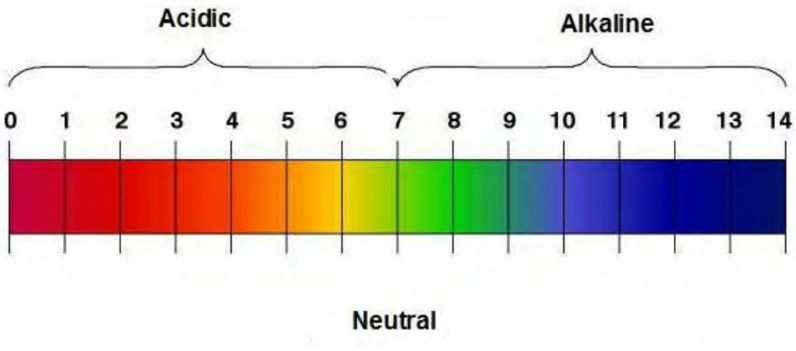
Figure 1. 2017 Soil Test pH

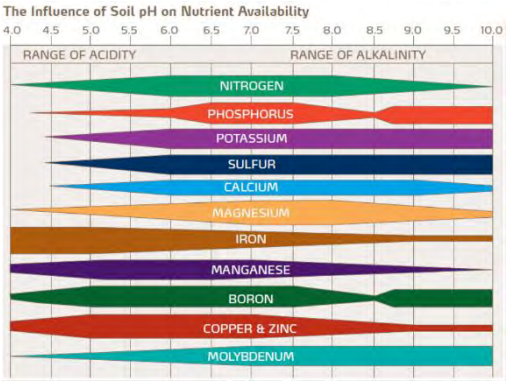


Limestone
Fall 2017=3 Ton/A
Fall 2018=2.5 Ton/A

Long-term Acidity Testing Area: No Ag Lime Applied

Figure 2. Soil pH Scale



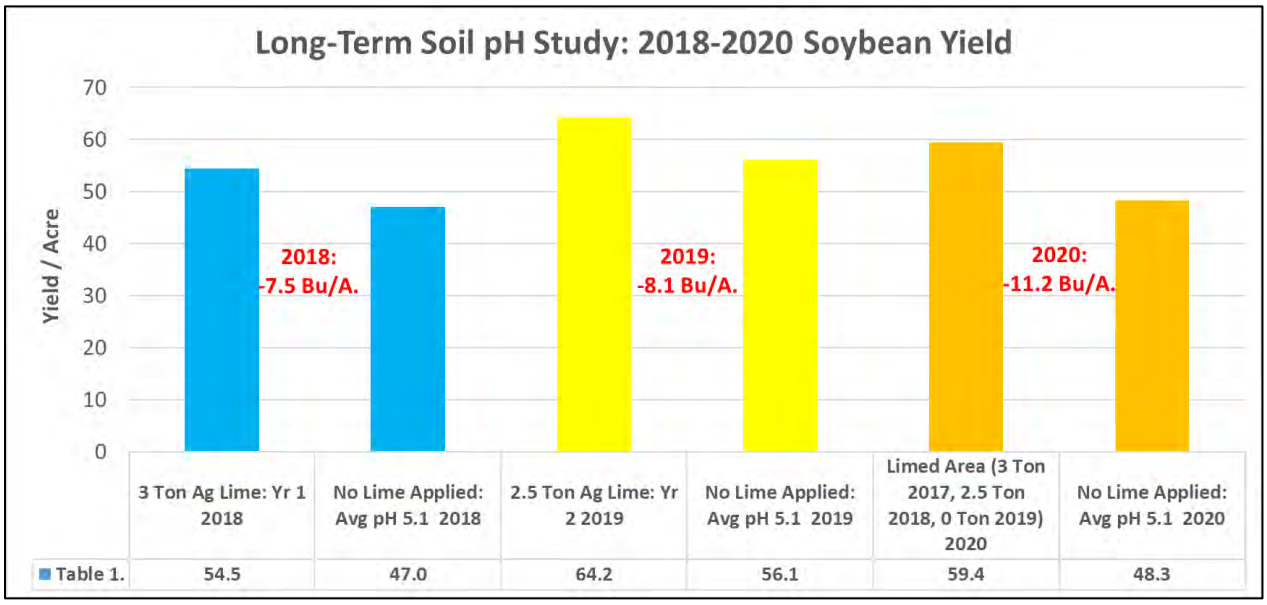


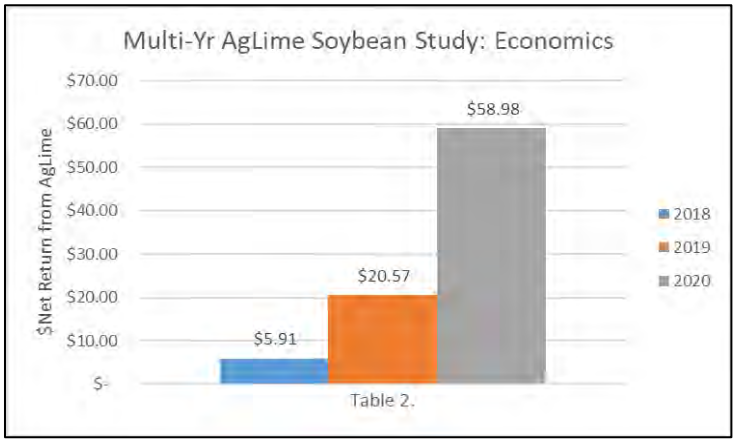
Soybean pH Acidity Study Continued

Results: Table 1. illustrates every crop year of our study incurred significant yield losses of **-7.5** to **-11.2 Bu/A.** in acidic soils near 5.1 pH.

Table 2. provides positive economic returns every year after aglime applications. These ranged from +$5.91 to +$58.98/A. respectively. 2018 and 2019 offered economic gains after the high cost of aglime, however 2020 sustained highest overall profits in this the 3rd year of the study.

We will continue this trial over the years to come in order to monitor yield, nutrient deficiencies, and other stress factors.





Planting Date: 5/10 *Variety: Pioneer 31A22* *Population: 130K* *Row Width: 30"* *Rotation: SAC* *Prices: Soybeans $9.75* *Ag Lime:$20/T Applied*

Calcium Products 98G™ Pell Lime Study:

CALCIUM PRODUCTS™

98G™ PELLETIZED LIMESTONE

Objective: This trial evaluates the yield response and economics of pelletized limestone (98G) applied fall broadcast. Soil pH is the foundation of nutrient availability and critical to maximizing crop yield. The availability of all nutrients is impacted by soil pH levels, especially phosphorus (P).

When soil pH is below 6.0, it can reduce your yield by as much as 30%. Calcium Products' 98G pelletized limestone is the most effective and consistent product to correct and maintain soil pH.

Change Soil pH Quickly

98G corrects soil pH faster and more completely than aglime. It is the most reactive liming material because it's made from 98% pure calcitic limestone and ground to an ultra-fine powder before it is pelletized. 98G pellets are engineered and manufactured to a specific size and hardness so that the pellets handle well and spread uniformly, yet break down in the field to change soil pH. 98G is fully reactive at about three to six months after application.

Maintain Soil pH to Consistently Maximize Yield

Once soil pH is restored, use 98G to maintain pH levels with more frequent, lower rate applications. Leaving yield on the table is unacceptable, and maintaining proper soil pH is a critical piece of good fertility management and maximizing yield.

Enjoy Application Flexibility

98G can be applied in flat-rate or variable-rate applications. It can be mixed with other dry fertilizers reducing the number of trips across the field and spread spring or fall. This flexibility means you can address soil pH when and how it works for you with the same equipment used to spread other dry fertilizers.

Soil pH has traditionally been addressed about every four years with aglime. Rather than create a pH "rollercoaster" in the field with infrequent aglime applications, 98G can be used as part of a pH maintenance program with annual or biannual applications. 98G is a more reactive liming material than aglime, keeping soil pH at a level to maximize yield potential (typically 6.0) year after year.

Results: Fall 2019 **broadcast** treatments of 98G resulted in yield gains of +2.0 Bu/A. (Table 1), and economic gains of +$1.10/A. Soil tests were pulled this fall (Fall 2020) and indicated soil pH at 6.4. Previous soil test results (Fall 17') indicated pH levels of 6.0 in this trial location.

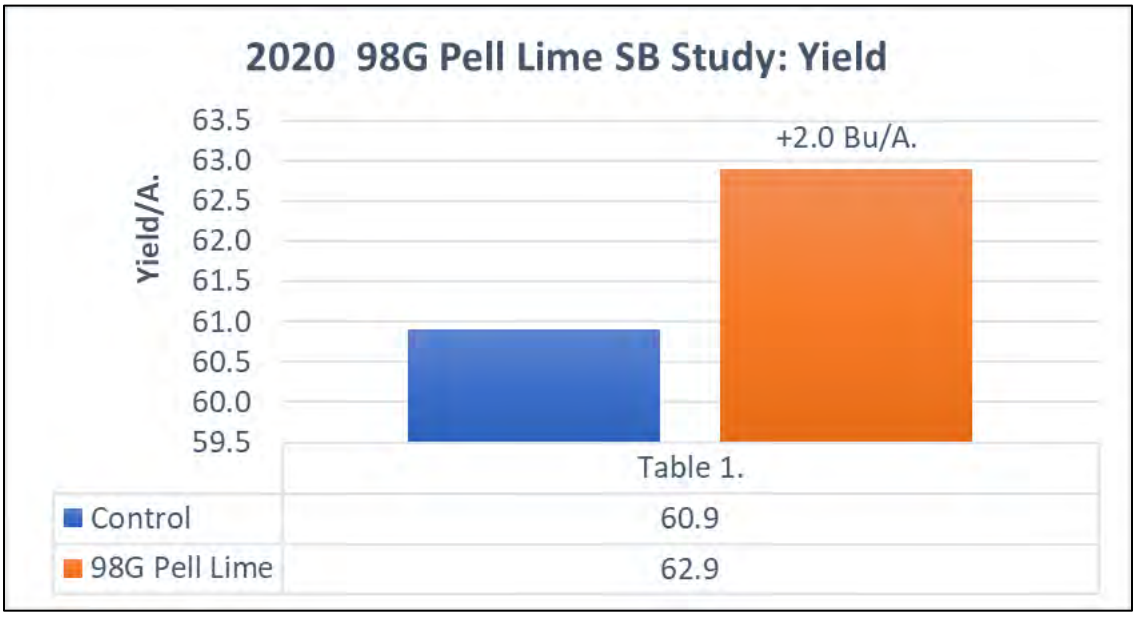


	Table 1.
Control	60.9
98G Pell Lime	62.9

Planting Date: 5/11 Hybrid: Champion 61A19 Population: 36K Row Width: 30" Rotation: BAC Soybean Price: $9.75

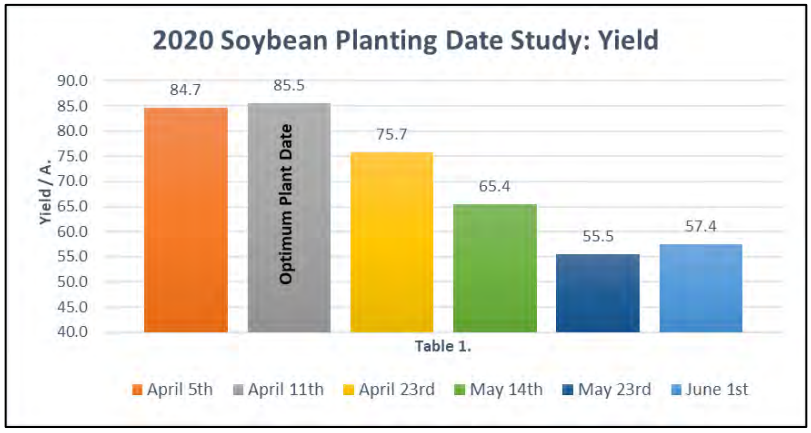
Pell Lime: $192/Ton + $4/A Application

Precision Planting®

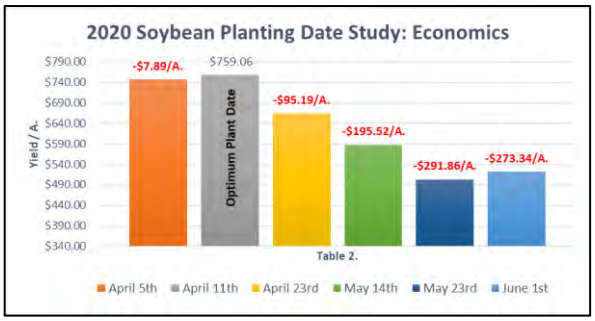
2020 PTI Results

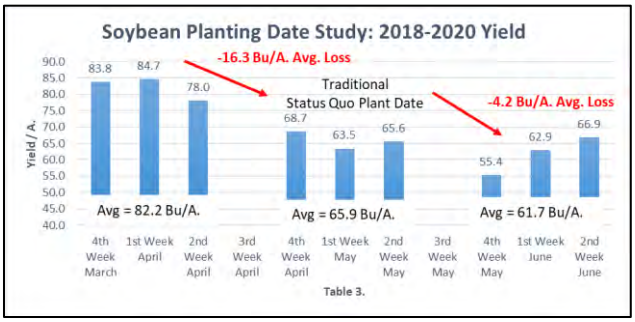
Soybean Planting Date Study

Objective: To evaluate various soybean planting dates throughout the spring to determine optimum planting date. Once optimum yield is discovered, data can then be analyzed to determine the deviation of yield at both early and late planting dates compared to traditional norms. With the recent trend of earlier soybean planting dates achieving higher yields, it is our intention to plant as early as possible in this study and plant every week throughout the spring planting season when fit.



Results: Table 1. illustrates the results of six planting dates over April 5th, April 11th, April 23rd, May 14th, May 23rd, and June 1st. Yields varied 30 Bu/A. between all planting dates. Optimum planting date occurred on April 11th, receiving the highest yield of 85.5 Bu/A. Following through with what we have seen in past years, early plantings offered tremendous yield gains. April planting dates averaged 82 Bu/A. As the calendar hit May, yields fell by **-20.1** to **-28.1 Bu/A**., and June plantings by **-28.1 Bu/A.** Table 2. illustrates the overall economic implications from planting later than the optimum planting date resulted in net economic losses ranging from **-$95.19/A.** to **-$291.86/A.** Table 3. depicts similar trends by revealing multi-year the 2018-2020 soybean planting date yield summary. Early plantings through the 2nd week of April have garnered highest yields averaging 82.2 Bu/A. (interesting to note, within 0.2 Bu/A. of 2020's yield avg.), which is a **-16.3 Bu/A.** loss compared to traditional status quo planting dates of the 4th week of April through the 2nd Week of May. As plantings occurred later than this time frame, yields were reduced on average by another **-4.2 Bu/A.**





Planting Date: Varied *Variety: GH3546X* *Population: 130K* *Row Width: 20"* *Rotation: BAC* *SB Price: $9.75*

Soybean Starter Fertilizer Response by Planting Date Study

Objective: To monitor the performance of starter fertilizer at various planting dates. When does starter fertilizer give the highest returns? Does starter fertilizer respond differently at earlier planted dates versus later? In this study we evaluate six planting dates consisting of April 5th, April 11th, April 23rd, May 14th, May 23rd, and June 1st with and without a starter fertilizer, monitoring its performance throughout the planting season.

The starter fertilizer program used for this study consists of the following:

Product	Fertilizer Analysis	Placement of Fertilizer
1 Gal/A. Triple Option®	4-13-17-1S	FurrowJet® Center
2 Gal/A. Triple Option®	4-13-17-1S	FurrowJet® Wings
20 Gal/A.UAN	32-0-0	Conceal®
6 Gal/A. K-Fuse®	Potassium Sulfate	Conceal®
10 Gal/A. NutriStart™ BOOST	14-12-4-6S	Conceal®

Figure 1. FurrowJet® Placement

Figure 2. Conceal® Placement

Soybean Starter Fertilizer Response by Planting Date Study Continued

Results: Table 1. illustrates all starter fertilizer treatments offered yield gains at each of the six planting dates. Yield gains averaged +2.9 Bu/A., ranging 4.1 Bu/A. between all the planting dates. 2020 starter fertilizer treatments offered the highest yield gains in the early April plantings with average yield gains of +4.5 to +4.9 Bu/A. As planting dates progressed into May, yield gains fell to +0.8 to +2.1 Bu/A.

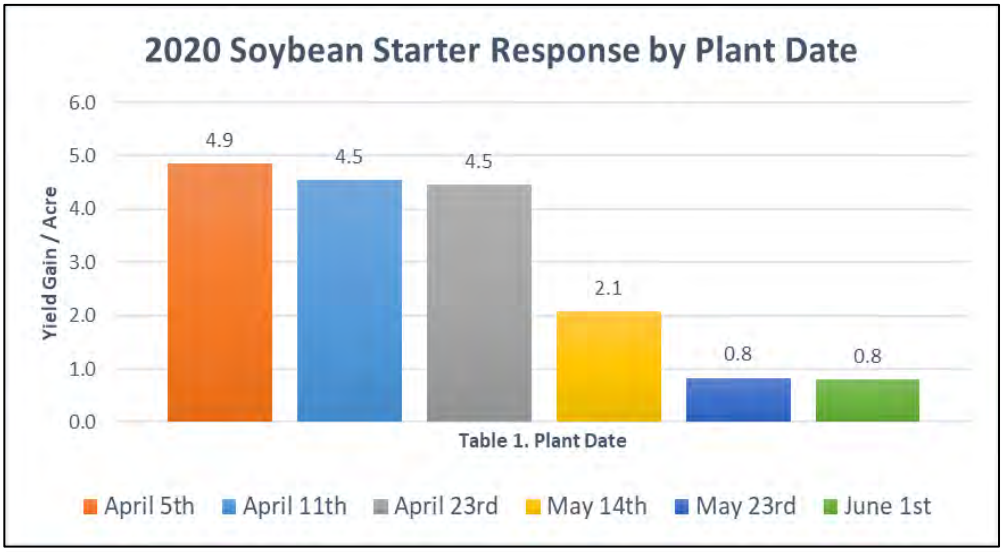
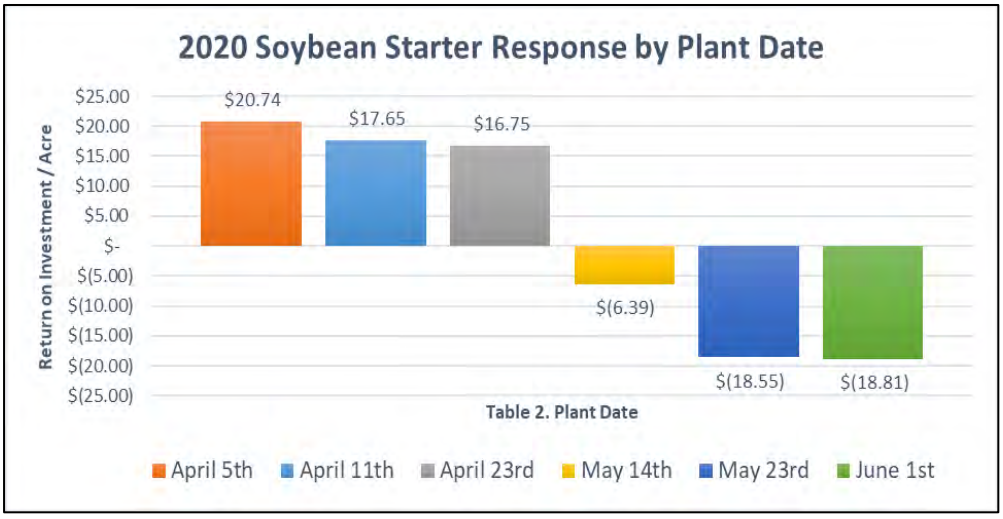


Table 2. focuses on net return on investment and illustrates earliest plantings during the month of April offered impressive economic gains ranging from +$16.75 to +$20.74/A. As planting dates progressed into May, starter fertilizer returns on investment fell to losses ranging from **-$6.39** to **-$18.81/A.**



The moral of the story with this study is that the earlier the planting date the higher the yield response. In addition, the later planting dates (May and June) offered minimal yield gains and economic losses.

Planting Date: Varied *Variety: GH3546X* *Population: 130K* *Row Width: 20"* *Rotation: BAC* *SB Price: $9.75*

K-Fuse: $4.55/Gal *NutriStart BOOST: $2.25/Gal* *Triple Option: $4.65/Gal* *$30 Fertilizer Reallocation*

STP Opening Disc Study

Objective: This study evaluates the use of 3 different types of opening discs from Prescription Tillage Technology L.L.C.

PRESCRIPTION TILLAGE TECHNOLOGY L.L.C.
Moisture and Nutrient Management System for the 21st Century

STV Standard True V

Standard True "V" Blade with Anti-Stubbing or Dulling Technology

- Shallow and full planting depth
- Sharp gravel and shale rock conditions
- Standard soils and planting conditions
- Standard and offset true-V planter configurations
- Available with off-set blade configurations on standard planters
- Fits John Deere, Kinze, Harvest International, Horsch, Monosem, White and Precision

STP Sabre Tooth Planter

True "V" & Single Blade Applications

- 1" minimum to full planting depth
- Challenging soil and planting conditions
- Challenging residue conditions
- Standard planter configurations
- Enhances early and late root development
- 14.75" inside with 15" outside combination fits John Deere, Kinze, Harvest International, Horsch, Monosem and older White
- 15.75" inside with 16" outside combination fits newer White and Precision

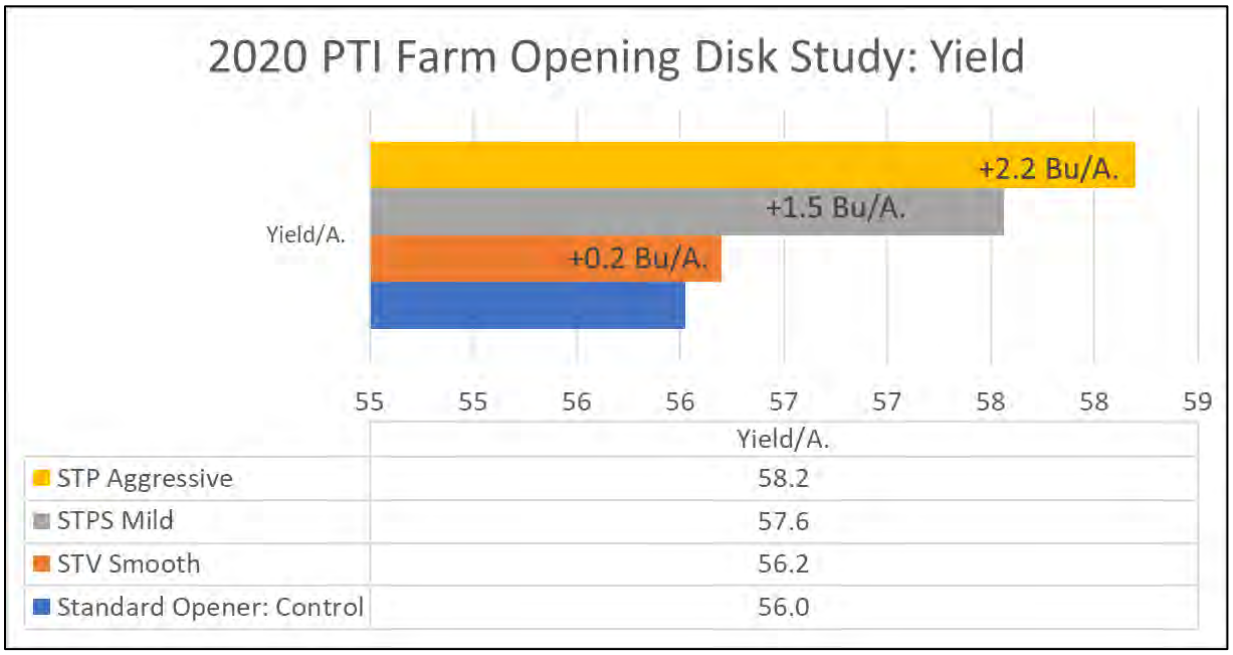
STPS Sabre Tooth Planter Shallow Fillet

Shallow Planting Sharp Gravel & Shale Rock Conditions

- Shallow and full planting depth for cotton, canola, and shallow seed placement requirements
- Sharp gravel and rock conditions
- Challenging soils and planting conditions
- Enhances early and late root development
- .100 cut out
- 15" inside with 15" outside combination fits John Deere, Kinze, Harvest International, Horsch, Monosem and older White
- 16" inside with 16" outside combination fits newer White and Precision

STP Opening Disc Study Continued

Results: STV smooth discs proved yield gains of 0.2 Bu/A. which resulted in economic gains of $1.70/A. Additionally the mild STV discs proved yield gains of 1.5 Bu/A. over a standard disc with economic gains of $14.63/A. Lastly the aggressive STP discs proved highest yield gains of 2.2 Bu/A. with significant economic returns of $21.20/A.



STP disc installed on International Harvest planter

"U" Furrow created by STP

True "V" created by standard opener discs

Soybean Strip Planting Study

Objective: This study evaluates the yield and economic advantages of planting corn and soybeans in alternate 40' strips (Figure 1.) In the past this helped to reduce erosion. The PTI team evaluated this system in 2020 to harvest more sunlight on outside rows, with the intention of trying to stimulate higher corn yield. It is quite common to have higher corn yield on the outside field edges, due to corn being able to harvest more sunlight to drive yields higher. More times than not, after the first few rows the yield advantage decreases due to more shading of corn biomass.

In an effort to increase corn yield with this strip cropping system, it seems as if we are using soybeans as a "sacrificial lamb" to help introduce a sunlight corridor to help increase corn yield. As a result, corn rows end up shading soybean rows at various times of the morning and evening hours (Figure 2.). This study is intended to measure any potential yield decrease and the associated economics from the system.

Figure 1. 40' Alternate Strips of Corn and Soybeans

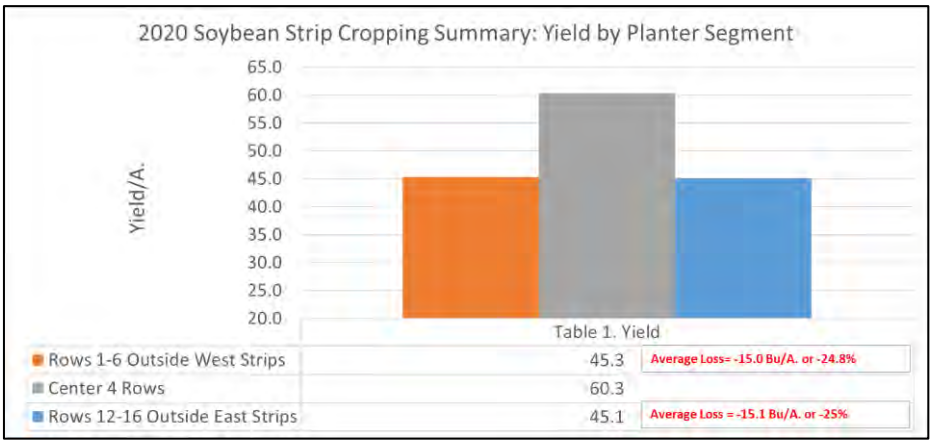
Results: In order to understand the agronomics of this system, we split our 16-row planter into 3 individual segments to include the following:

- West 6 Rows: 1-6
- Center 4 Rows: 7-10
- East 6 Rows: 11-16

Figure 2. Late Afternoon Corn Shading Effect

Soybean Strip Planting Study Continued

Table 1. illustrates the yield response of planting soybeans in 40' alternate strips next to corn. Yields of soybeans in this strip cropping system were devastating to say the least. Yield losses of **-15 Bu/A.** were realized in the outside strips next to the corn compared to the yield of the centers. Most of this yield loss is associated to shading and the lack of sunlight, but other weather effects such as temperature/air movement etc. could all be factors as well.



As for economics, Table 2. reveals the significant losses of nearly **-$150/A.** associated from strip cropping soybeans next to corn.

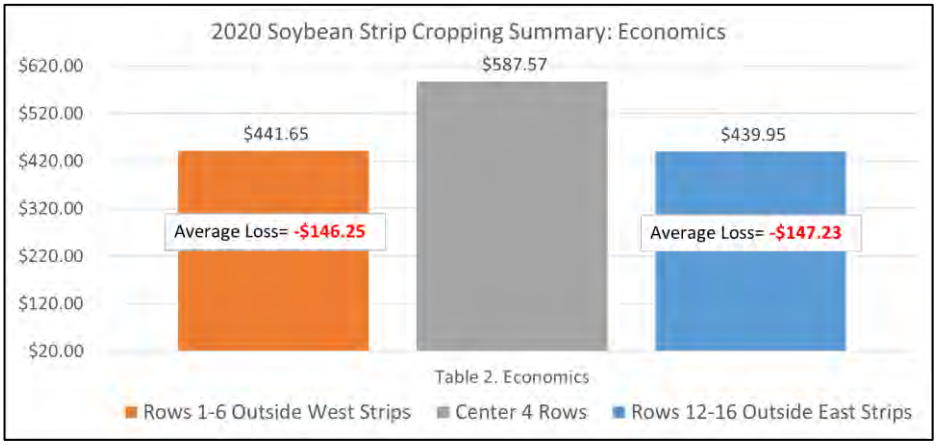
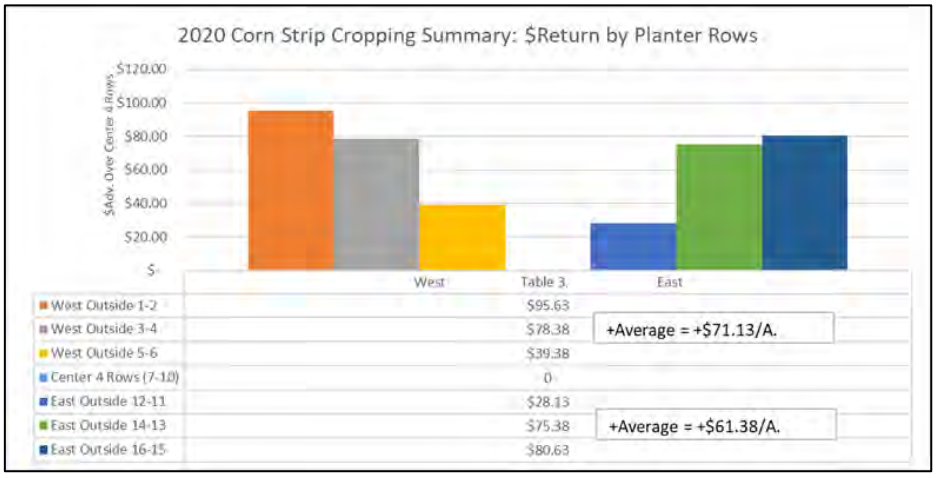


Table 3. summarizes the economic returns of +$28/A. to +$95/A. realized from the corn yield increases associated from harvesting more sunlight in a strip cropping environment (Pages 115-116). However, these gains were quickly negated from the losses in soybeans of **-$145/A** to **-$147/A,** resulting in overall corn/soybean strip cropping losses of **-$52/A.** to **-$117/A.**



This strip cropping system clearly resulted in huge gains for corn in the outside sunlight corridor rows, but the economic losses in soybeans quickly negated those advantages. These losses pose the question of decreasing strip crop block size down to smaller 10' or 20' strips. This would decrease soybean acreage and lower yield losses, while increasing corn acres and encouraging higher corn yield.

Planting Date: 4/24 *Variety: Credenz 3113LLRR* *Population:130K* *Row Width: 30"* *Rotation: BAC* *SB Price: $9.75*

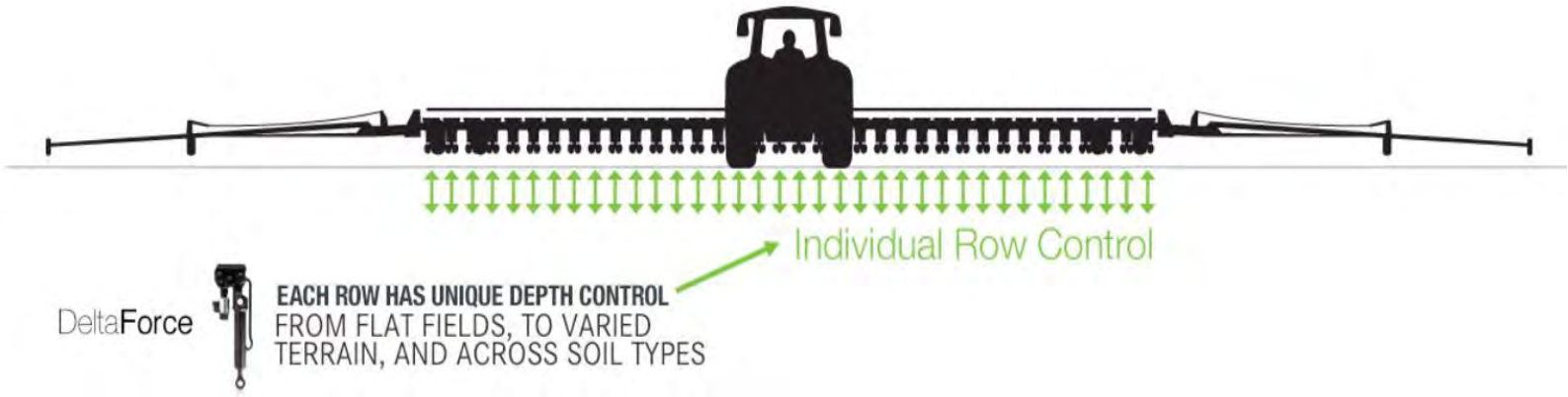
DownForce Management Study

Objective: This soybean study evaluates yield impact of implementing proper downforce compared to too light or too heavy row unit settings. Planter row unit downforce is a common agronomic issue that often goes unaddressed. When downforce matches field conditions, the depth of planting is consistent and correct. Too light of row unit downforce causes planting depth to shallow up, potentially placing seed in dry soil, creating poorly rooted plants that struggle for water and nutrients. Conversely, too much downforce can lead to furrow side-wall compaction, also creating an environment that can cause limited plant access to water and nutrients.

Figure 1. DeltaForce® Cylinder

DeltaForce® system replaces the springs or air bags on your planter with hydraulic cylinders (Figure 1). It automatically increases or reduces weight with military precision, on each row individually. When one row encounters conditions different than another (wheel tracks, old roadbeds, clay knobs, headlands, etc.), each will adjust independently (Figure 2). Row by row, foot by foot, even seed by seed an environment that fosters uniform germination, optimum growth and maximum yield can be produced.

Figure 2.



DownForce Management Study Continued

Results: Tables 1-2. illustrate the yield and economic impact of soybeans planted at 1 ¾" depth in three different downforce scenarios of too light, proper, and too heavy downforce.

Light downforce resulted in yield losses of **-3.5 Bu/A.**, with corresponding net economic losses of **-$34.13/A.** Heavy downforce caused yield losses of **-2.3 Bu/A.**, with economic losses of **-$22.42/A.**

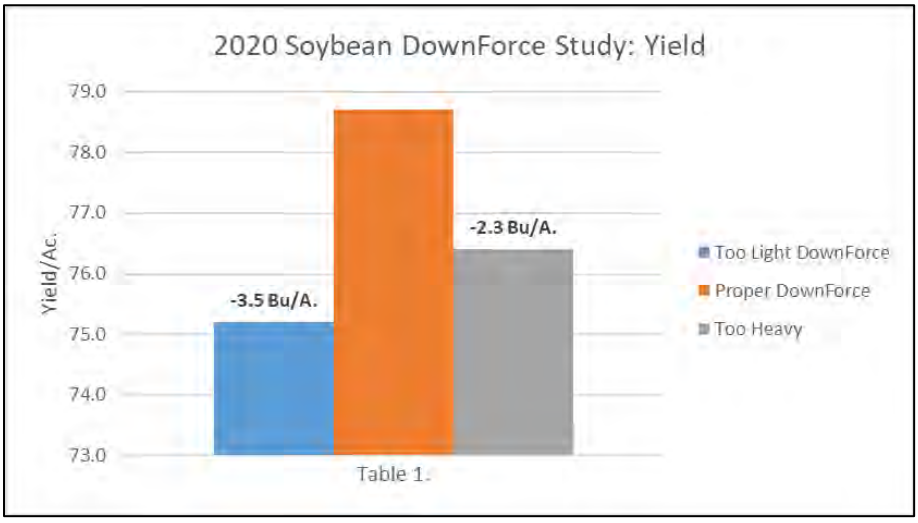


Table 1.

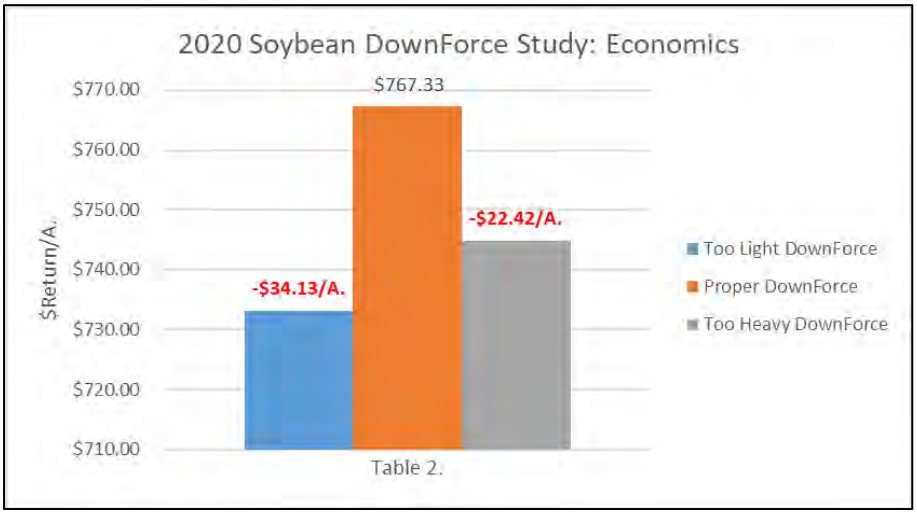


Table 2.

Planting Date: May 17 *Hybrid:Pioneer 31A22* *Population: 130K* *Row Width: 30"* *Rotation:BAC* *Soybean Price: $9.75*

Keeton® Seed Firmer Study

Objective: This study evaluates the benefits of Keeton® Seed Firmers (Figure 1). Seeds don't always land right in the bottom of the trench where they belong. With its unique, in-the-trench design, the Keeton® Seed Firmer gently firms those seeds to the bottom of the V-trench (Figure 1). The end result is even depth, correct seed-to-soil contact, and most importantly uniform germination.

Figure 1. Keeton® Seed Firmer

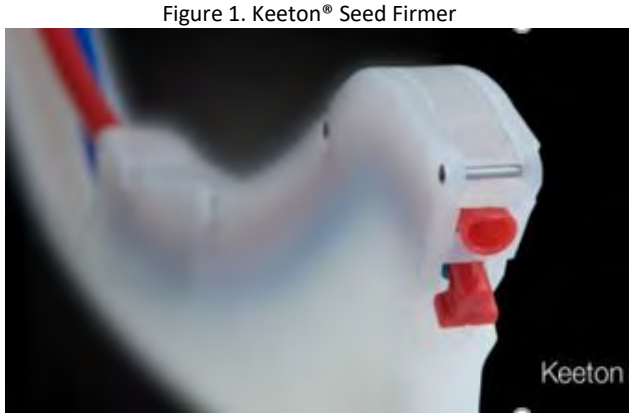
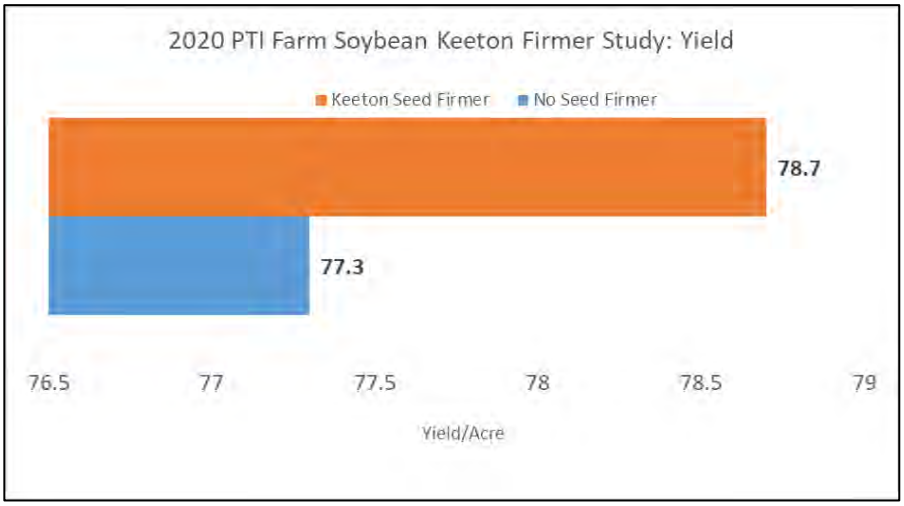


Figure 2. Good Seed to Soil Contact from Keeton®

Results: Table 1. illustrates the presence of Keeton® Seed Firmers resulting in average yield gains of +1.4 Bu/A.

Using $9.75 soybeans, Keeton® Seed Firmers resulted in average economic gains of +$13.65/A.

At a cost of $35/row for Keeton® Seed Firmers and quick attach brackets for a 16-row planter, using the +$13.65/A. increase in revenue, break-even occurs at 41 acres.



Planting Date: May 17 *Variety: Pioneer 31A22* *Population: 130K* *Row Width: 30"* *Rotation: BAC* *SB Price: $9.75*

Keeton® Seed Firmer/Downforce Study

Objective: This study evaluates the benefits of Keeton® Seed Firmers **in addition to both incorrect and correct downforce settings**. Seeds don't always land right in the bottom of the trench where they belong. With its unique, in-the-trench design, the Keeton® Seed Firmer gently firms those seeds to the bottom of the V-trench (Figure 1). The end result is even depth, correct seed-to-soil contact, and most importantly uniform germination.

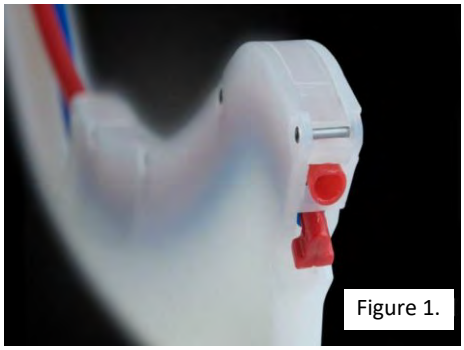
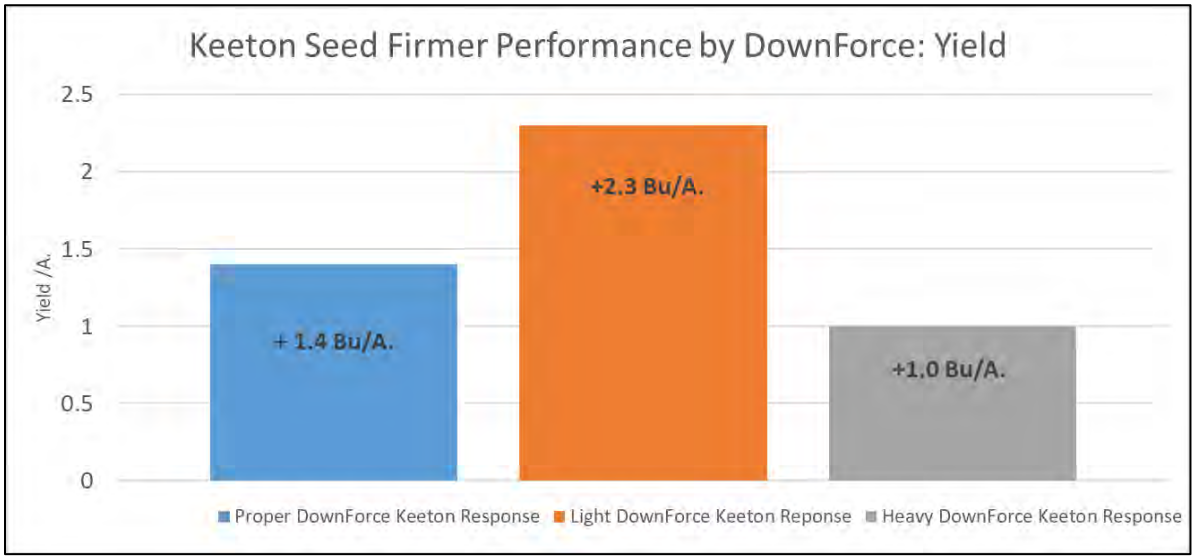


Figure 1.

Results: When too light of downforce is implemented, this usually results in loss of ground contact causing planting depth to shallow up. In these conditions, the presence of seed firmers resulted in yield gains of +2.3 Bu/A. compared to a +1.4 Bu/A. seed firmer advantage when downforce was correct. Using $9.75 soybeans, this +0.9 Bu/A resulted in economic gains of $8.78/A.

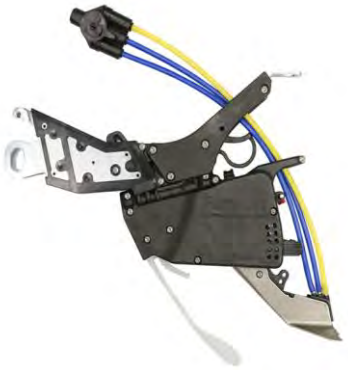
This study shows that seed firming can aid by having an inadequate downforce system by improving seed to soil contact and helping to minimize shallow planting due to loss of ground contact.



Planting Date: May 17 *Variety: Pioneer 31A22* *Population: 130K* *Row Width: 30"* *Rotation: BAC* *SB Price: $9.75*

FurrowJet® Side-Wall Study

Figure 1. FurrowJet®

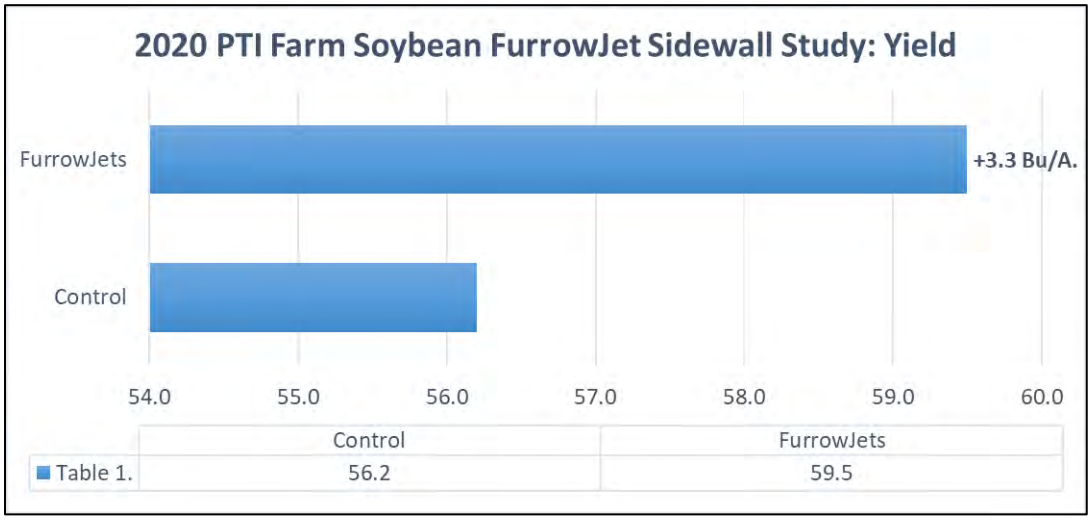


Objective: FurrowJet® system is a planter fertilizer attachment (Figure 1.) that enables placement of not only an in-furrow starter fertilizer, but also a dual-band of fertilizer 3/4" on each side of the seed. To achieve this dual-band placement, the wings on FurrowJet® system angle downward to cut into the sidewall and place fertilizer alongside the seed in a dual-band. By doing this, lifting and fracturing can occur that potentially could remove soil smearing or compaction created by disc openers. Additionally, closing wheel systems following FurrowJet® wings have a better opportunity to close the seed trench, remove air pockets, and allow for good seed-to-soil contact.

Figure 2: FurrowJet® Dual-Band Wings Fracturing Side-Walls

This study evaluates FurrowJet® dual-band wings offering the ability to cut, lift and remove side-wall compaction in the seed furrow. For this study, no liquid fertilizer was applied.

Results: This study has been implemented on corn at the PTI Farm for the last 3 years, however this is the 1st we have testing side-wall relief in soybeans. Table 1. illustrates FurrowJet® systems resulted in +3.3 Bu/A. yield gains compared to non-firmer/FurrowJet system. At $9.75 soybeans, these gains would reflect additional revenue of +$32.13/A. At a cost of $320/Row for FurrowJet® systems, break-even would occur with this scenario at only 160 acres. This study will be added each year at the PTI Farm to replicate this annually and to collect more data points within our soybean Core Principal Study.



Planting Date: June 5 *Hybrid: Champion 27X9N* *Population: 130K* *Row Width: 30"* *Rotation: BAC* *Corn Price: $9.75*

Soybean Singulation Study

Objective: To evaluate the agronomic and economic advantage of **singulating** soybeans. In this study we compare the use of an 80-cell vs 56 cell soybean crop kit (Figure 1). Typical spacing of soybean plants achieved with singulation is illustrated in Figure 2.

Figure 1.

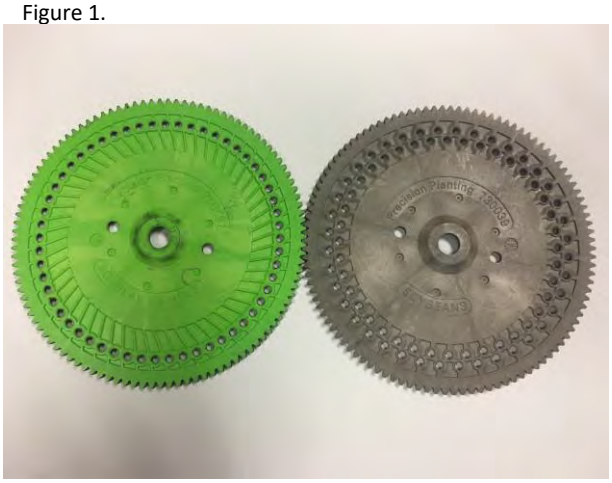
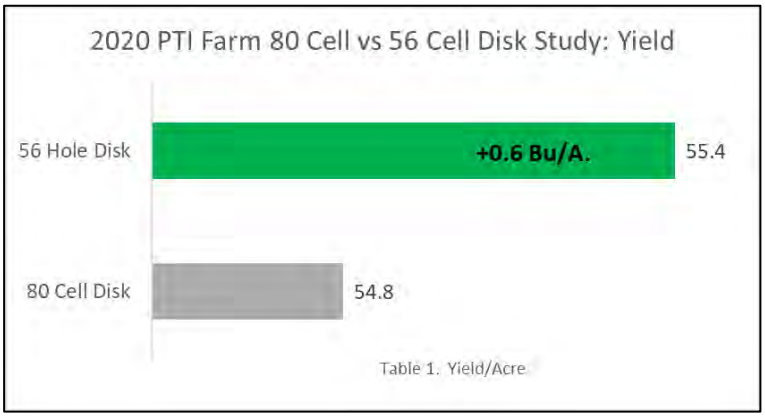
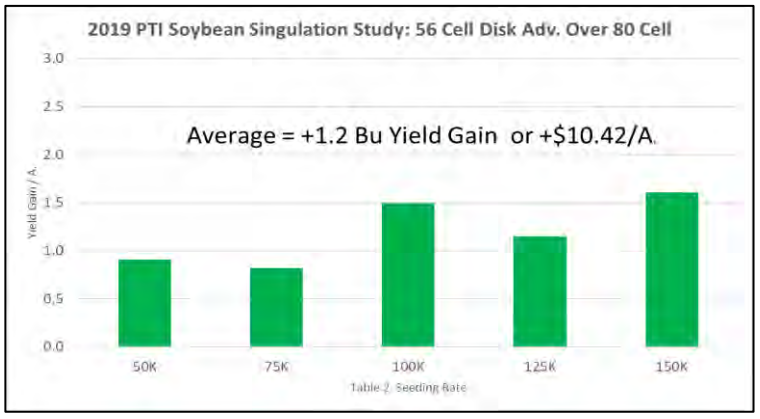


Figure 2.

Results: Table 1. summarizes the yields of both the 56 cell and 80 cell crop kits at seeding rates of 125K/A. in 30" rows. 56 cell crop kits resulted in +0.6 Bu/A. yield increases due to singulating soybeans. At $9.75/Bu. soybeans, this equates to an economic advantage of +$5.85/A. This yield advantage is a bit lower from the yield advantages we documented in 2019. Table 2. illustrates +1.2 Bu/A. advantages over the gray 80 cell disk.





Planting Date: May 31 *Hybrid: Champion 27X9N* *Population: 125K* *Row Width: 30"* *Rotation: SAC* *Soybean Price: $9.75*

Soybean Seeding Rate Study

Objective: This trial evaluates the agronomic and economic impact of planting two soybean varieties at seeding rates ranging from 50K to 175K in 30" rows.

Results: Asgrow® 27X0 achieved agronomic optimum seeding rate at 125K/A. with yields at 70.6Bu/A. As seeding rates lowered, yields fell **-0.2 Bu/A.** to **-7.5 Bu/A.** As seeding rates were increased, yields fell by **-0.8 Bu/A.** to **-1.8 Bu/A.**

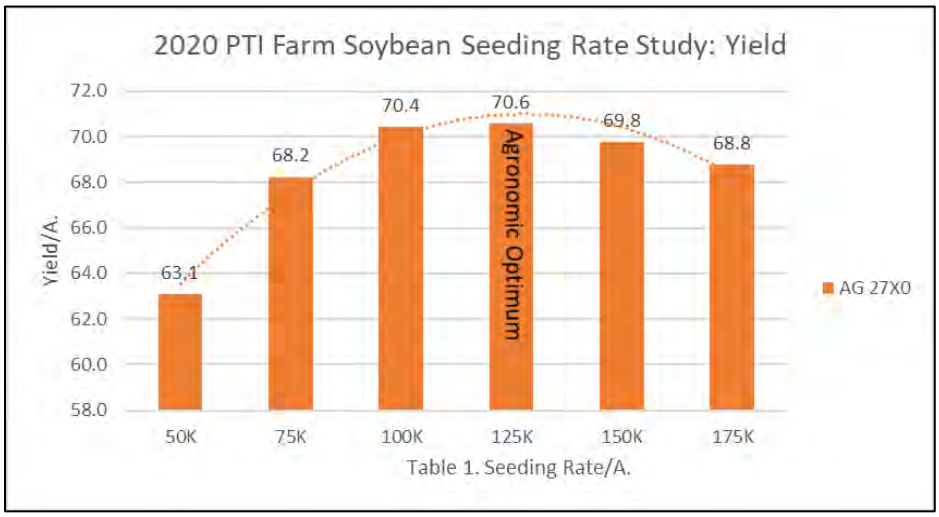
Golden Harvest® 3546X achieved agronomic optimum seeding rate at 125K/A. with yields at 72.4Bu/A. As seeding rates lowered, yields fell **-0.6 Bu/A.** to **-4.6 Bu/A.** As seeding rates were increased, yields fell by **-1.2 Bu/A.** to **-3.5 Bu/A.**

AG27X0
BRAND

RELATIVE MATURITY: 2.7

TRAIT: RR2X

- Medium tall plant with good emergence and standability
- Resistance to soybean cyst nematode
- Major gene resistance and field tolerance for Phytophthora rot
- Tolerance to white mold and brown stem rot



GoldenHarvest®

GH3546X BRAND **RM3.5**

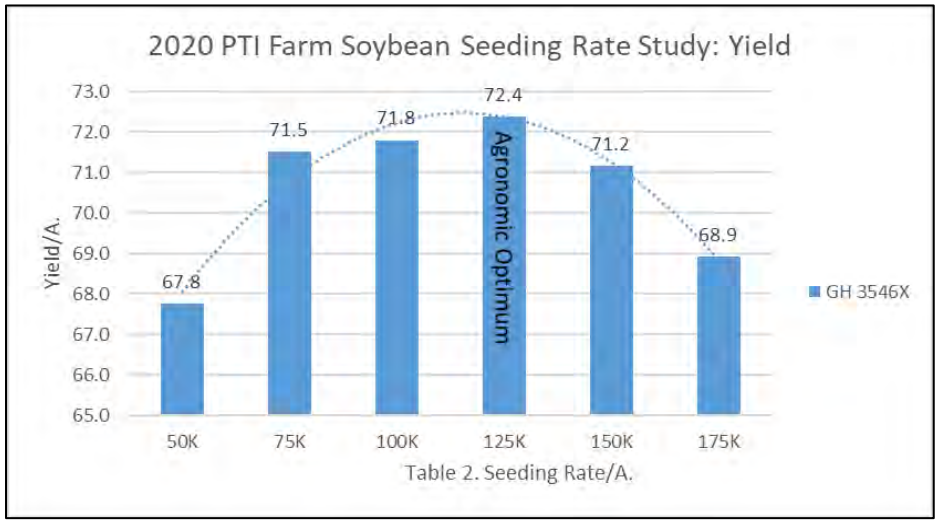
OFFENSIVE AND DEFENSIVE LEADER

- Great performance across yield levels
- Target fields with a history of Frogeye Leaf Spot or SDS
- Proven performance across varying soil types

Herbicide Tolerant Trait(s):
RR2X

Plant Characteristics

Medium-Tall	Plant height
Medium	Canopy type
Moderate	Branching
Indeterminate	Growth habit
Purple	Flower color
Light Tawny	Pubescence color
Brown	Pod color
Black	Hilum color
Includer	Chloride sensitivity

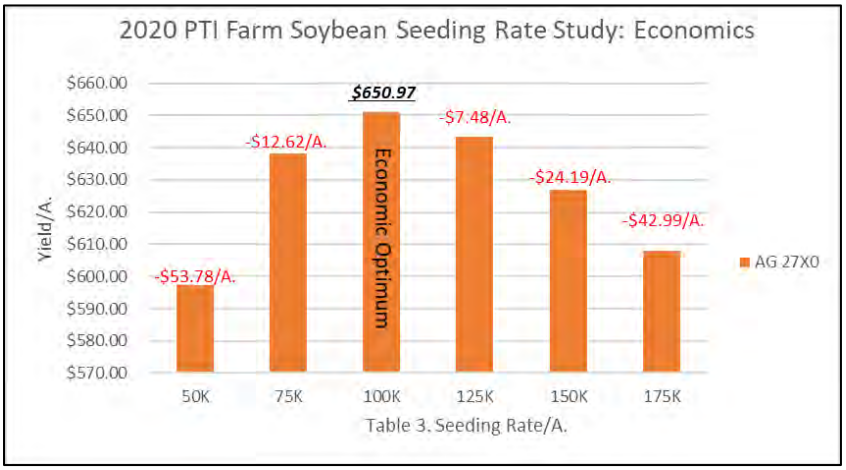


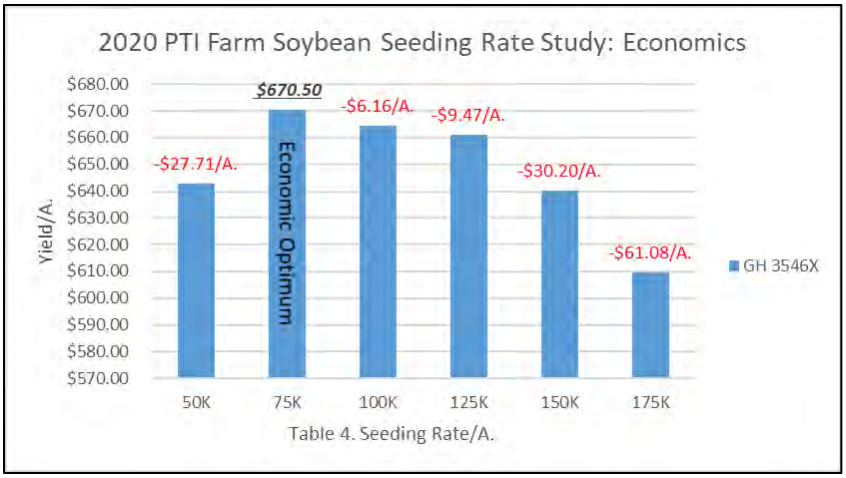
Soybean Seeding Rate Study Continued

The telling story in this study is the economics. After seed cost, Asgrow 27X0 achieved economic optimum rate at 100K seeding rates (Table 3). As seeding rates fell to 75K and 50K, net return diminished by **-$12.62/A.** and **-$53.78/A** respectively. As seeding rates were accelerated to 125K, 150K, and 175K, economic returns diminished by **-$7.48/A., -$24.19/A.,** and **-$42.99/A.**

Golden Harvest 3546X held its economic optimum ranking at the 75K seeding rate. As populations were reduced to 50K, net return diminished by **-$27.71/A.** As seeding rates went higher from the optimum 75K, returns fell by **-$6.16/A., -$9.47, -$30.20/A.** and **-$61.80/A.** respectively.

More work needs to be done to fully understand seeding rates in various row widths with today's soybean trait platforms. In the last two years, testing at the PTI Farm has indicated that if a grower lowers seeding rates, singulates those soybeans, and selects a soybean with proper architecture appropriate for row width, great yield potential can exist while reducing seeding expense.





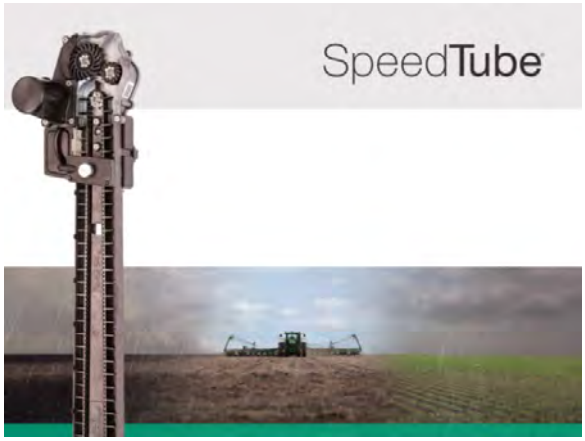
It is important to note that low seeding rates need special attention to weed control. In narrow rows (<30") it may be less of a concern, but with the 30" rows in this study we have had weeds creep through late in the season due to increased sunlight and less overall shading within the soybean canopy. Soil type also needs special attention. This study is conducted on a mostly flat, black and beautiful soils with little to no variability. As a producer would encounter soil type changes or variability within in the field, seeding rate changes may need to occur. For example, in drought stress clay knobs, a higher seeding rate may be needed to accomplish row canopy and to protect moisture. Conversely, darker soils on lower elevations may need lower seeding rates just as this study portrays.

Planting Date: 6/8 *Hybrid: Asgrow 27X0, GH3546X* *Population: Varied* *Row Width: 30"* *Rotation: BAC* *Soybean Price: $9.75*

Precision Planting®

2020 PTI Results

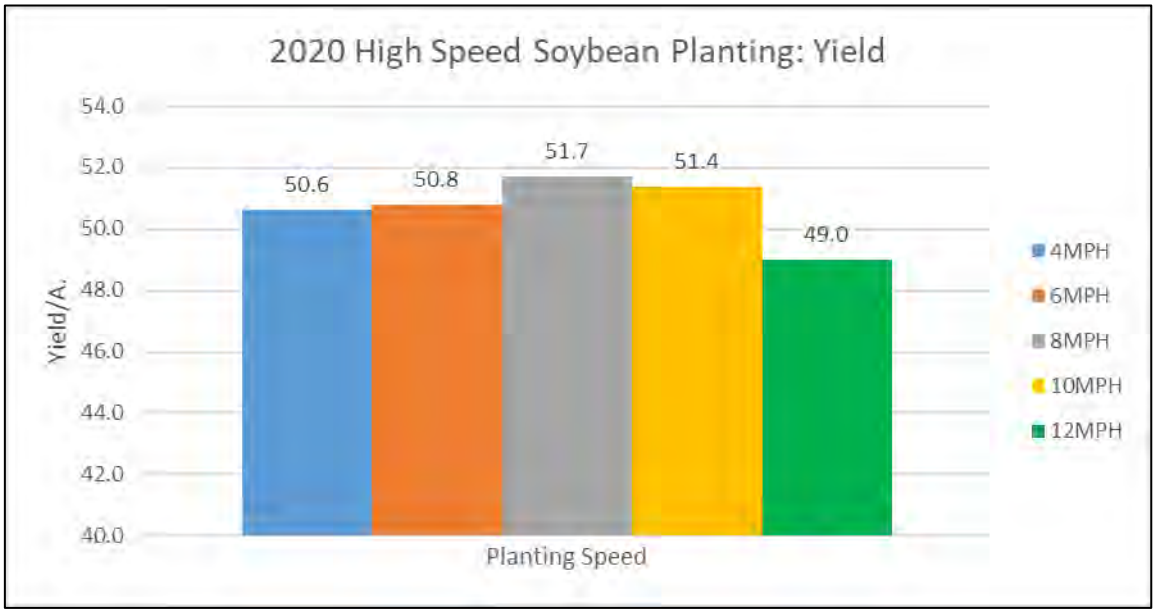
High Speed Soybean



Objective: To evaluate yield response of planting speeds of 4, 6, 8, 10, and 12 MPH with SpeedTube® system. This high-speed planting technology takes the place of conventional seed tubes and consists rather of a flighted belt that takes gravity out of the equation. By hand delivering each seed to the furrow, there is no opportunity for seeds to ricochet into the trench. Even at twice normal planting speeds, seed arrives safely at the bottom of the trench, spaced evenly, every time.

Results: Using SpeedTube® technology, there was only a 1.1 Bu/A. range difference between the very common producer planting speeds of 4MPH to 10MPH. 8MPH plantings did however prove optimum speed at 51.7 Bu/A.

This data would suggest that growers can plant at significantly higher speeds with SpeedTube® technology without sacrificing planter performance.



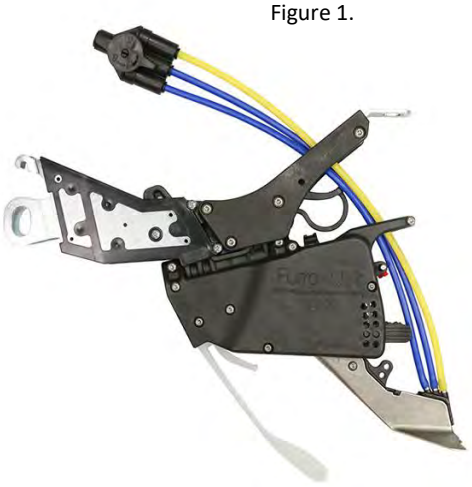
Planting Date: 5/17 *Variety: Asgrow 27X0* *Population: 130K* *Row Width: 30”* *Rotation: BAC* *Soybean Price: $9.75* *Seeds/#: 2800*

Tillage: No-Till *56 Cell Soybean Disk with Soybean Singulator*

Marco QuickGrow LTE FurrowJet® Study

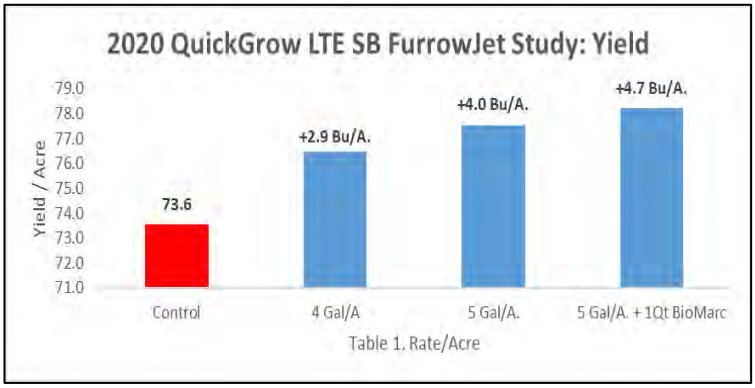
Objective: To evaluate the yield and net return of Marco Fertilizer's QuickGrow LTE 6-20-4-.25Zn-2.7S liquid starter fertilizer. QuickGrow LTE is a 70% polyphosphate and 30% orthophosphate formulation of nitrogen, phosphorus, potassium, sulfur, and EDTA Zn. Marco LTE starter treatments are applied at 4 and 5Gal/A. as a FurrowJet® ***wing*** treatment only (Figure 1.).

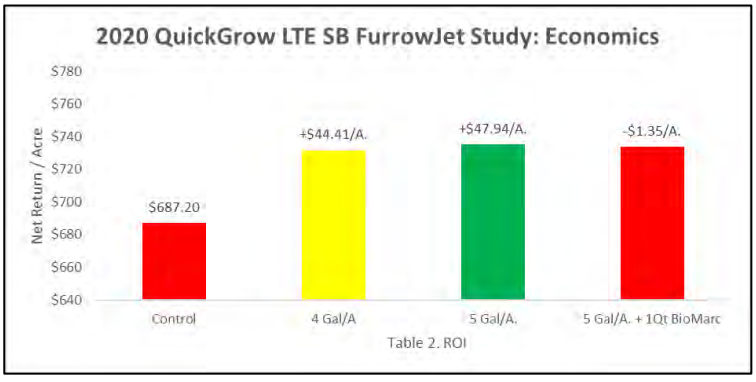
Figure 1.



Results: 5 Gal/A. rates showed both agronomic and economic optimum rate with yield advantages of +4.0 Bu/A. and a return on investment of +$47.94/A. (Tables 1-2).

As an additional entry, we added BioMarc to the 5 Gal/A. treatment. BioMarc, is a unique combination of naturally extracted biostimulants including kelp-based materials, coupled with nutrient-enabling technologies that enhance liquid fertilizer performance. BioMarc provided +0.7 Bu/A. yield gains and provided a negative return on investment of **-$1.35/A.**





Planting Date: May 17 Variety: GH 3582E3 Population: 130K Row Width: 30" Rotation:BAC SB Price: $9.75 Marco LTE: $3.50/Gal BioMarc: $28/Gal Dry Fertilizer Reallocation: $30/Acre

The Anderson's® Soybean Nutritional Study

Objective: To evaluate the yield and economic impact of a soybean liquid starter fertilizer nutritional program from The Andersons. This trial consisted of the following:

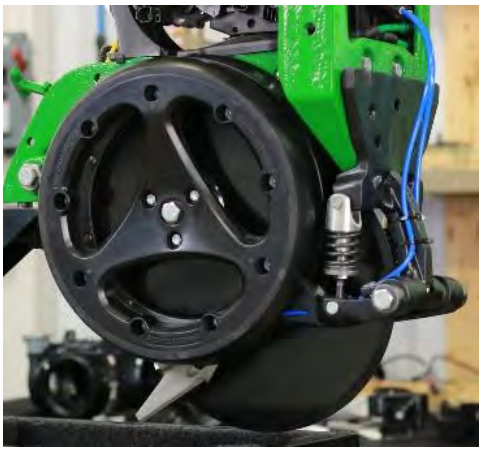
Protocol:

Program 1: 2qt Korrect + 0.5 Gal SweetNEezy + 1pt BioPass FurrowJet® Center

Program 2: 2-Gal First Pass 3-15-15 + MicroCarb + 1pt BioPass FurrowJet® Wings

Figure 1. FurrowJet® Center and Wing Placement

Figure 2. Conceal®



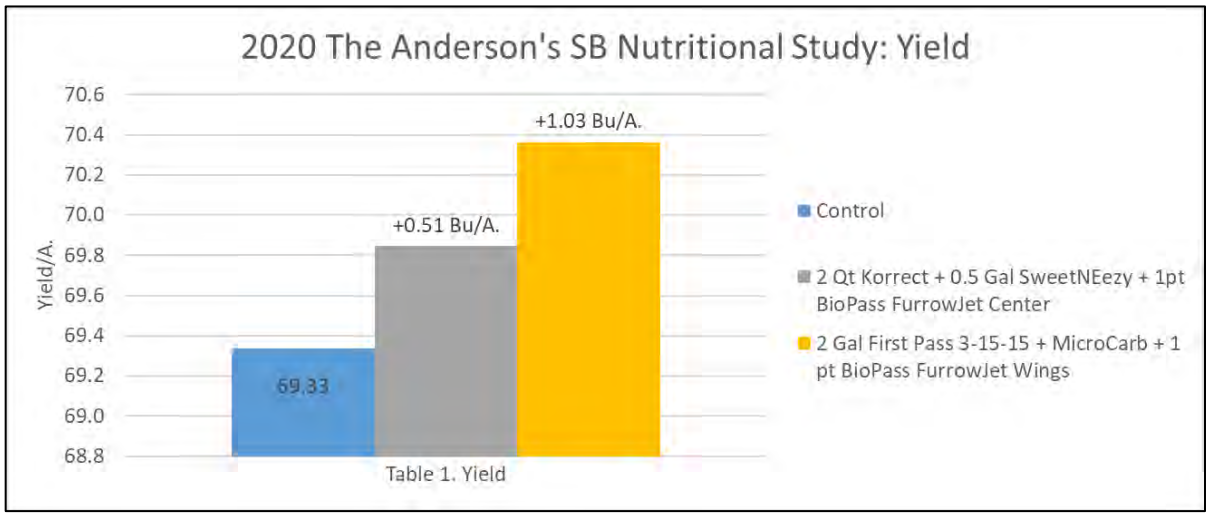


Table 1. Yield

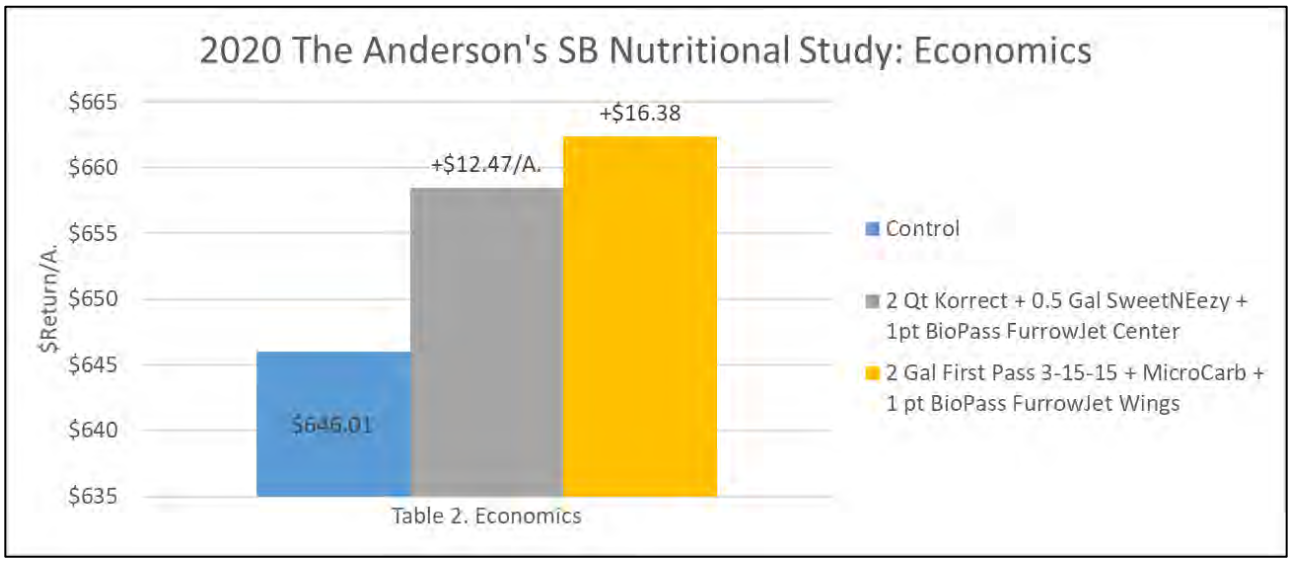
Planting Date: 5/17 Hybrid:GH5283E3 Population: 130K Row Width: 30" Rotation: BAC SBPrice: $9.75 .

SWeeNEezy: $4.96 FirstPass/Microcarb:$10.40 BioPass: $13.25 Fert Reallocation: $30

The Anderson's® Soybean Nutritional Study Continued

Results: FurrowJet® Center treatments of Korrect, SweeNEezy and BioPass resulted in yield gains of +0.51 Bu/A. along with economic gains of +$12.47/A.

FurrowJet® wing applications of FirstPass, MicroCarb, and BioPass achieved +1.3 Bu/A. yield gains with economic returns of +$16.38/A.



Nachurs® Start2Finish™ Soybean Fertility Trial

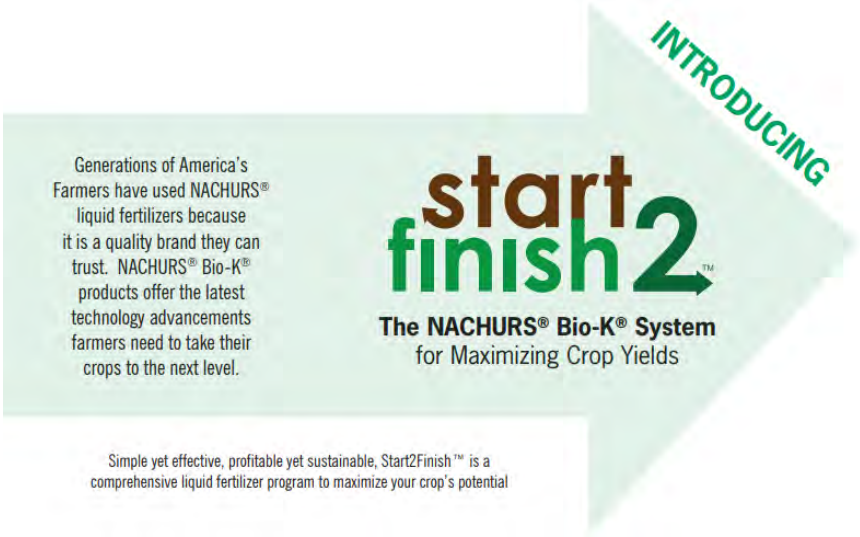
Objective: To evaluate the effect on yield and economics of Nachur's Start2Finish soybean fertility program. This 3-way program consists of the following treatments:

At-Plant: 3 Gal/A. TripleOption® applied via FurrowJet® system 3-way band

At-Plant: 5 Gal/A. K-Fuse® applied via Conceal® dual band

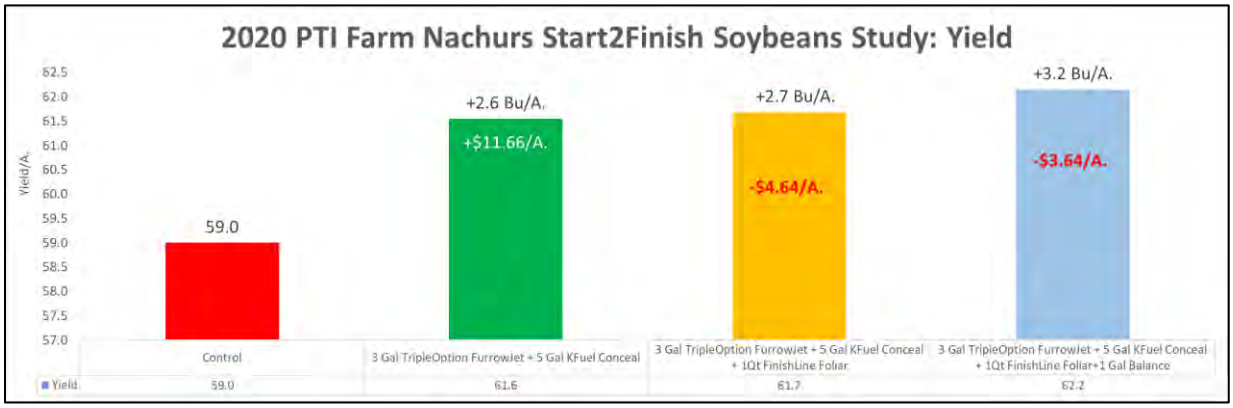
Foliar: 1 Gal/A. FinishLine® + 1Qt TripleOption®

Foliar: 1 Gal/A. FinishLine® + 1Qt TripleOption® + 1 Gal Balance®



Results: Table 1.illustrates that planter treatments of TripleOption and K-Fuel resulted in positive economic gains of +$11.66/A. and economic gains of +$11.66/A.

Foliar treatments provided yield gains of +0.1 to +0.6 Bu/A., but best response in this study came from at-plant in-furrow and high concentrated bands of fertilizer next to the row.



Planting Date: 5/27 Hybrid: GH 2818E3 Population: 130K Row Width: 30" Rotation: BAC SB Price: $9.75

$30/A Fert.Re-Allocation Balance: $3.55/A. K-Fuse: $5.85/Gal FinishLine: $12.95/A. TripleOption: $4.65/Gal

Precision Planting®

2020 PTI Results

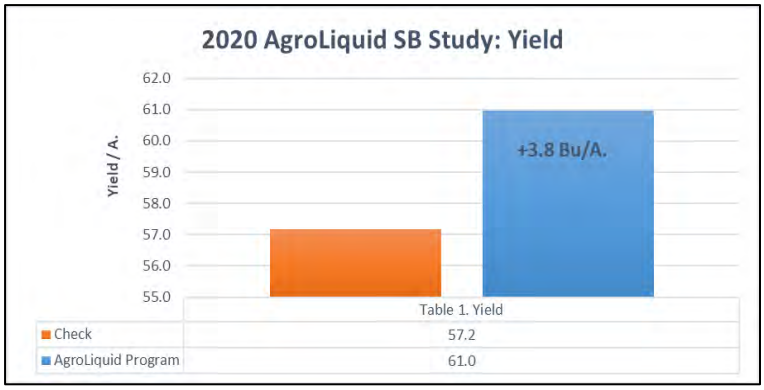
AgroLiquid® Fertilizer FurrowJet® Soybeans Study

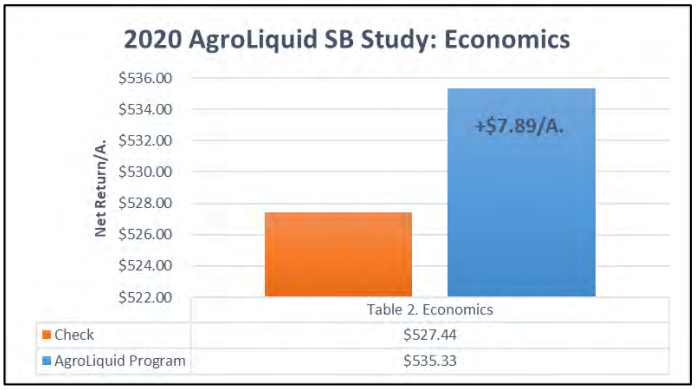
Objective: To evaluate the yield and net return of a blend of AgroLiquid starter fertilizers. The following products are used in this in-furrow study as a single at-plant application, as well as a foliar post program.

Product/A.		Application
1 Gal Pro-Germinator®	9-24-3	FurrowJet®
2 Gal Sure-K	2-1-6	FurrowJet®
1 Qt Micro 500	.02B-.25Cu-.37Fe-1.2Mn-1.8Zn	FurrowJet®
1 Pt Boron	5%	FurrowJet®
1 Gal Ferti-Rain®	12-3-3	R1 Foliar Post
1 Gal Sure-K	2-1-6	R1 Foliar Post
1 Qt Manganese	4%	R1 Foliar Post

Results: Table 1. illustrates that in-furrow and foliar AgroLiquid nutrition treatments increased average soybean yields by +3.8 Bu/A. across all replications (Table 1).

At prices listed below, this yield increase translates into a positive return on investment of +$7.89/A. (Table 2).





AGROLIQUID

Planting Date: 5/25 Hybrid: Asgrow 36X6 Population: 130K Row Width: 30" Rotation: BAC SB Price: $9.75 ProGerm: $6.20/Gal Sure-K: $5.65/Gal Micro500: $16.78/Gal FertiRain: $7.10/A. Boron: $17.50/Gal Manganese: $20.34/Gal $30 Fert. Reallocation

AgroLiquid LiberateCa™ Soybean Study

Objective: To evaluate the yield and net return of a blend of AgroLiquid's LiberateCa, a 3% liquid calcium as an in-furrow FurrowJet® application or as an R1 foliar post application.

LIBERATECa™

Calcium 3%

Guaranteed Analysis

Calcium(Ca)..... 3.00%

Derived from: Calcium Sulfate

Product/A.		Application
2 Gal Sure-K	2-1-6	FurrowJet® Tri-Band
1 Qt Micro 500	.02B-.25Cu-.37Fe-1.2Mn-1.8Zn	FurrowJet® Tri-Band
1 Qt Manganese	4%	FurrowJet® Tri-Band
1Qt Liberate Ca	3%	FurrowJet® Tri-Band
1 Gal Ferti-Rain®	12-3-3	R1 Foliar Post
1Qt Liberate Ca	3%	R1 Foliar Post

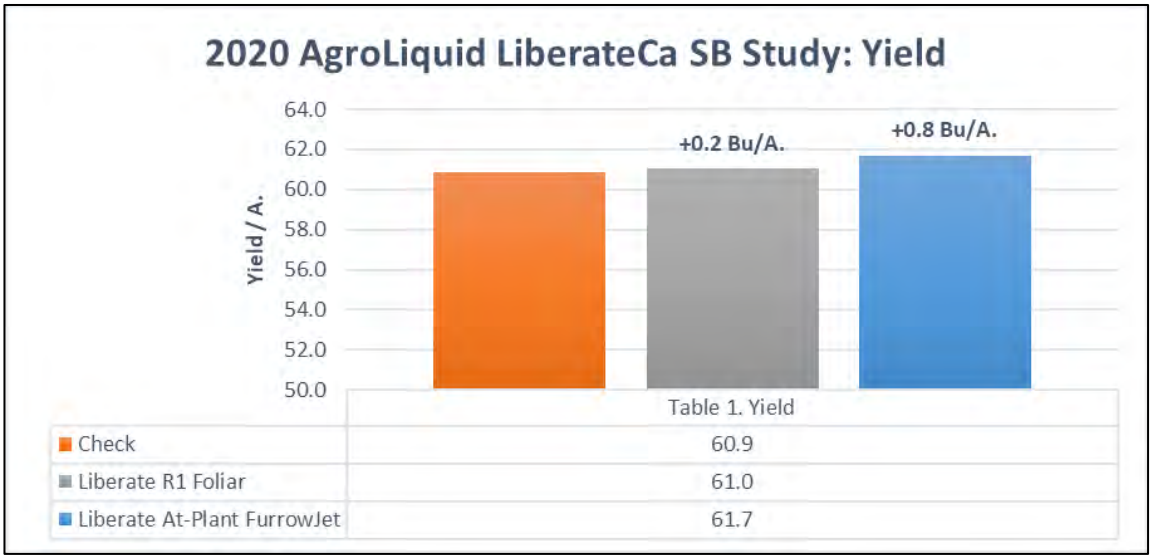


Table 1. Yield

Check	60.9
Liberate R1 Foliar	61.0
Liberate At-Plant FurrowJet	61.7

Results: Table 1. illustrates that both application treatments resulted in yield gains of less than 1 Bu/A. In-furrow treatments increased average soybean yields by +0.8 Bu/A. across all replications, while foliar treatments gained +0.2/Bu/A. (Table 1).

At prices listed below, this yield increase translates into a positive return on investment of +$7.80/A. for the FurrowJet® system at-plant application and +$0.98/A. for the foliar R1 post app.

AGROLIQUID®

Planting Date: 5/25 Hybrid: Asgrow 36X6 Population: 130K Row Width: 30" Rotation: BAC SB Price: $9.75 Sure-K: $5.65/Gal

Micro500: $16.78/Gal FertiRain: $7.10/A. Manganese: $20.34/Gal LiberateCa:$20.84/Gal $30 Fert. Reallocation

AgroLiquid S-Calate™ Calcium/Sulfur Soybean FurrowJet® Study

Objective: To evaluate the yield and net return of a blend of AgroLiquid's S-Calate, a 7-0-0-1Ca-14S liquid calcium/sulfur in-furrow FurrowJet® application.

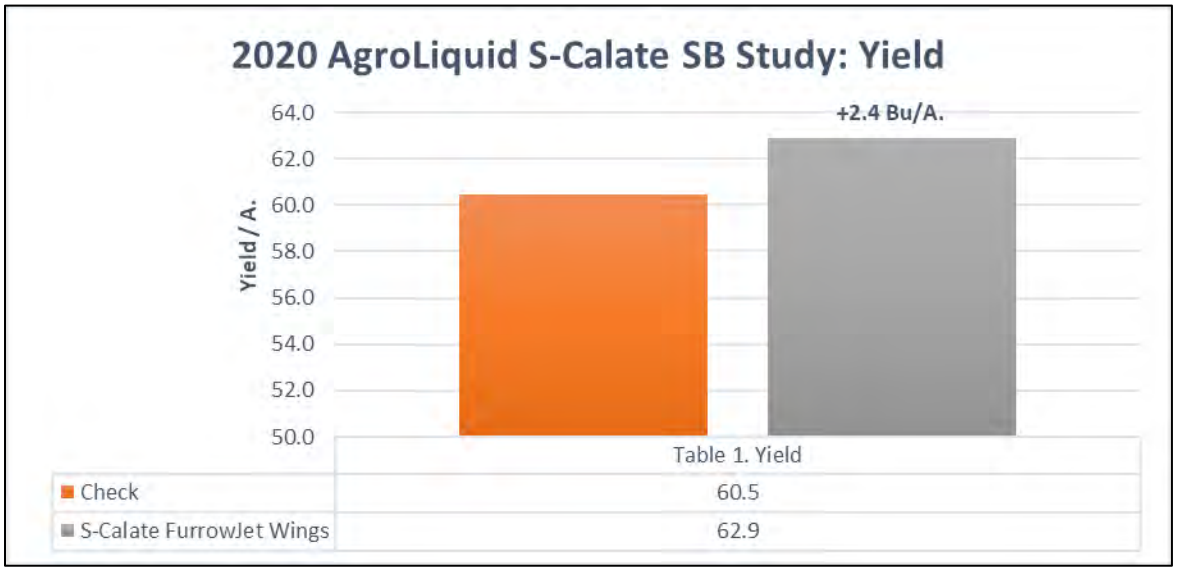
S-Calate™

S-Calate 7-0-0
with 14% Sulfur

Guaranteed Analysis	
Total Nitrogen(N)	7.00%
7.00% Ammoniacal Nitrogen	
Calcium(Ca)	1.00%
Sulfur(S)	14.00%
14.00% Combined Sulfur (S)	

Derived from: Calcium Carbonate, Ammonium Sulfate

Product/A.		Application
2 Gal Sure-K	2-1-6	FurrowJet® Tri-Band
1 Qt Micro 500	.02B-.25Cu-.37Fe-1.2Mn-1.8Zn	FurrowJet® Tri-Band
1 Qt Manganese	4%	FurrowJet® Tri-Band
1Qt S-Calate	7-0-0-1-1Ca-14S%	FurrowJet® Wings Only
1 Gal Ferti-Rain®	12-3-3	R1 Foliar Post



Results: Table 1. illustrates that in-furrow wing treatments increased average soybean yields by +2.4 Bu/A. across all replications.

At prices listed below, this yield increase translates into a positive return on investment of +$23.40/A.

AGROLIQUID®

Planting Date: 5/25 Hybrid: Asgrow 36X6 Population: 130K Row Width: 30" Rotation: BAC SB Price: $9.75 Sure-K: $5.65/Gal Micro500: $16.78/Gal FertiRain: $7.10/A. Manganese: $20.34/Gal S-Calate:$6.70/Gal $30 Fert. Reallocation

Precision Planting®

2020 PTI Results

Revytek™ Soybean Foliar Fungicide Study

Objective: To evaluate the yield and net return of a new triazole soybean fungicide introduced called Revytek™. Revytek contains Revysol, which is a DeMethylation Inhibitor (DMI) fungicide that is part of the triazole group of fungicides. It was initially labeled for 17 crops, including corn and soybeans. Revytek gives excellent control of frogeye leaf spot, septoria, target spot, and Asian soybean rust.

Mefentrifluconazole	Group	3	Fungicide
Fluxapyroxad	Group	7	Fungicide
Pyraclostrobin	Group	11	Fungicide

Revytek™ Fungicide

BASF We create chemistry

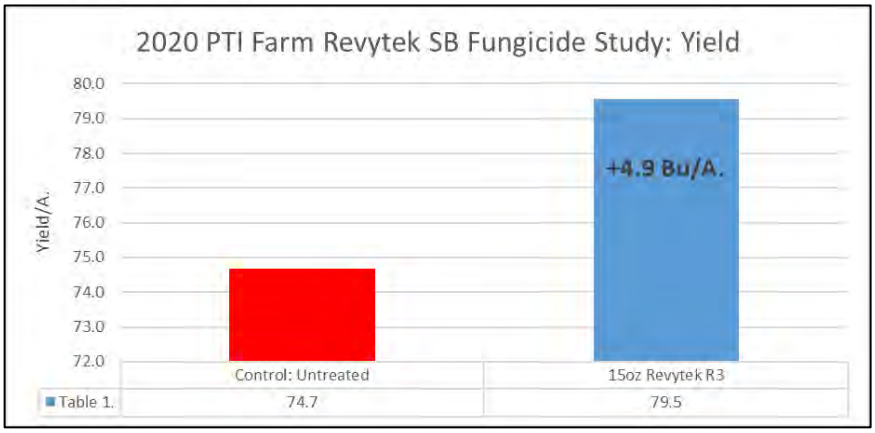
Active Ingredients*:

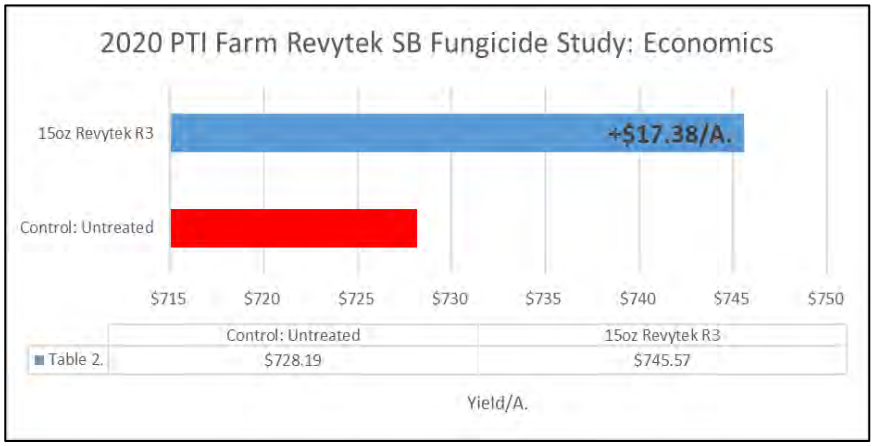
mefentrifluconazole: 2-[4-(4-chlorophenoxy)-2-(trifluoromethyl)phenyl]-1-(1H-1,2,4-triazole-1-yl)propan-2-ol	11.61%
pyraclostrobin: (carbamic acid, [2-[[[1-(4-chlorophenyl)-1*H*-pyrazol-3-yl]oxy]methyl]phenyl]methoxy-, methyl ester)	15.49%
fluxapyroxad: 1*H*-Pyrazole-4-carboxamide, 3-(difluoromethyl)-1-methyl-N-(3',4',5'-trifluoro[1,1'-biphenyl]-2-yl)-	7.74%
Other Ingredients:	65.16%
Total:	100.00%

*__Revytek™ fungicide__ contains 1.11 lbs mefentrifluconazole, 1.48 lbs pyraclostrobin, and 0.74 lb fluxapyroxad per gallon.

Results: Tables 1 illustrates that R3 foliar applications of Revytek™ resulted in yield gains of +4.9 Bu/A.

After cost of application and fungicide, using a $9.75 soybean price, Revytek™ provided positive net returns of +$17.38/A. (Table 2).





Planting Date: May 24 *Variety:Credenz 3099RRLL* *Population: 130K* *Row Width: 30"* *Rotation:BAC* *SB Price: $9.75* *Revytek/App.: $30/A.*

Precision Planting®

2020 PTI Results

Calcium Products SO4™ Study

Objective: This trial evaluates the yield response and economics of pelletized calcium sulfate (SO4) applied fall broadcast and as banded spring strip-till. Sulfur is an essential component of plant growth with key processes relying on chlorophyll formation and protein production. Sulfur is considered the fourth major nutrient behind N, P, and K.

CALCIUM PRODUCTS™

SO4™ PELLETIZED GYPSUM

SO4 from Calcium Products is a 21% Calcium (non-pH neutralizing) and 17% Sulfur dry pelletized fertilizer and is mined and manufactured in NW Iowa. It is finely ground and pelletized to achieve a balance of solubility and pellet strength.

Releases Sulfur to Match Plant Needs

SO4 supplies a balanced initial sulfur release and a steady supply throughout the growing season. AMS releases sulfur too quickly, and elemental sulfur releases sulfur too slowly, neither meeting the crop's complete needs.

Spreads Easily

SO4's consistent pellet size allows it to be blended and applied with other dry fertilizers, which means it doesn't require a separate application. It can be applied pre-plant in the spring, in-season via top dress or post-harvest in the fall.

Will Not Acidify Soil

SO4 is pH neutral, meaning it will not acidify the soil like other sulfur sources. Proper soil pH maximizes a plant's utilization of nutrients promoting good plant health and optimizing yield.

Historically, much of the sulfur need was satisfied with atmospheric deposition as result of coal burning industries. Amendments to the Clean Air Act in 1990 targeted sulfur emissions, resulting in less than ½ of the amount of sulfur today compared to 30 years ago.

Results: Fall 2019 **broadcast** treatments of SO4 resulted in average yield gains of +1.8 Bu/A., however it also offered negative returns of **-$3.98/A.** after cost of product and application (Tables 1-2). Spring Strip-till **banding** of S04 resulted in higher efficiency and pushed yield gains an additional +1.5 Bu/A. over broadcast applications and posted positive net economic returns of +$10.44/A.

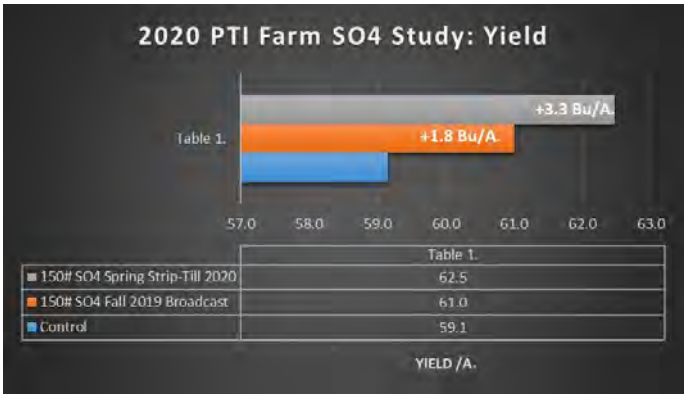


Table 1.

150# SO4 Spring Strip-Till 2020	62.5
150# SO4 Fall 2019 Broadcast	61.0
Control	59.1

Table 2.

150# SO4 Fall Broadcast	$(3.98)
150# SO4 Spring Strip-Till 2020	$10.44

We look forward to continuing our long-term multi-year testing of SO4 and understanding its benefits of supplying plant nutrition, but also its effect on soil health advantages.

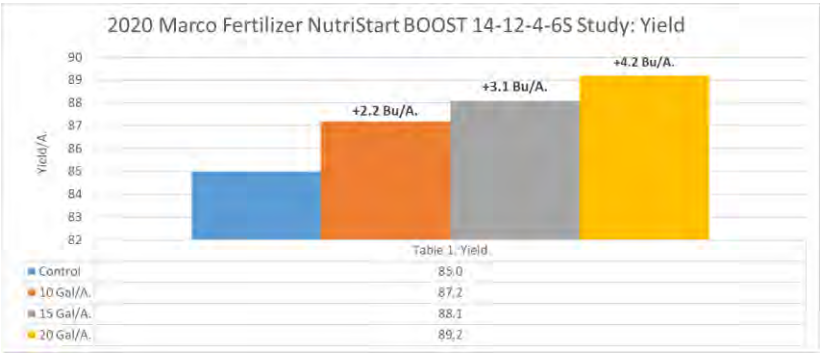
Planting Date: 5/27 Variety: Asgrow 36X6X Population: 130K Row Width: 30" Rotation: BAC Soybean Price: $9.75 SO4: $240/Ton + $4/A App.

Marco Fertilizer NutriStart BOOST 14-12-4-6S Study

Objective: This irrigated soybean application trial evaluates the yield and net return of Conceal® system dual band treatments of NutriStart™ BOOST 14-12-12-4-6S at 10, 15, and 20 Gal/A. rates. This liquid fertilizer is a 70% polyphosphate and 30% orthophosphate formula designed for non-in furrow applications in soybeans. NutriStart products are manufactured with Marco 10-34-0, Potassium - soluble potash (K2O), Sulfur - Ammonium Thio-Sulfate and Zinc - 9% EDTA or ammoniated.

Conceal® system is an ideal placement for this product as its far enough away from the seed furrow to prevent seed injury, yet close enough to enable access to seedling nutrition (Figure 1).

Results: Table 1. illustrates that all rates of 14-12-4-6S proved positive yield gains from +2.2 Bu/A. to +4.2 Bu/A., however 10 Gal/A. provided the economic optimum rate applied resulting in a positive return on investment of +$28.95/A.



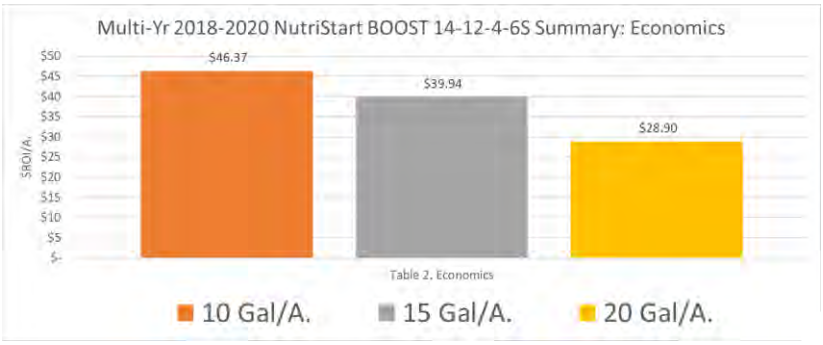


Table 2. reveals long-term multi-year economics during 2018-2020. Over this 3-year period, economic optimum has occurred at the 10 Gal/A. rate of NutriStart BOOST with an average return on investment of +$46.37/A. NutriStart BOOST has been a solid performer at the PTI farm achieving some of the highest yield and economic gains in soybeans.

Figure 1. Conceal® Dual Placement 3" from furrow

Planting Date: April 23 Variety: GH 5283Enlist Population: 130K Row Width: 30" Rotation: SAC SB Price: $9.75 BOOST 14-12-4-6: $2.25/Gal

K-Fuse® Potassium Study

Objective: To evaluate the yield and economics of Nachurs K-Fuse powered by Bio-K (Figure 1.), a potassium/sulfur product designed to be applied on the planter or at side-dress. For this study we applied one, three, and five gallons of K-Fuse at planting in a dual band Conceal® system application (Figure 2.).

Results: Tables 1-2. illustrate dual band K-Fuse Conceal® system applications proved yield increases of +1.2 to +2.1 Bu/A. with the 3 Gal/A. rate providing both agronomic and economic optimum Rate/A.

Table 3. shows average economic response of K-Fuse in soybeans during both the 2019 and 2020 crop years with positive return on investment with all rates. However, 3 Gal/A. rates have provided the economic optimum rate.

Figure 1. Nachurs K-Fuse® Potassium Additive

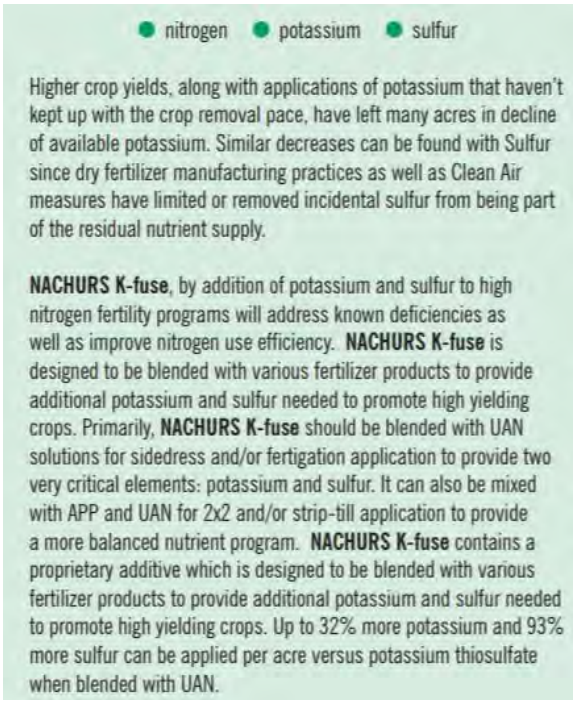
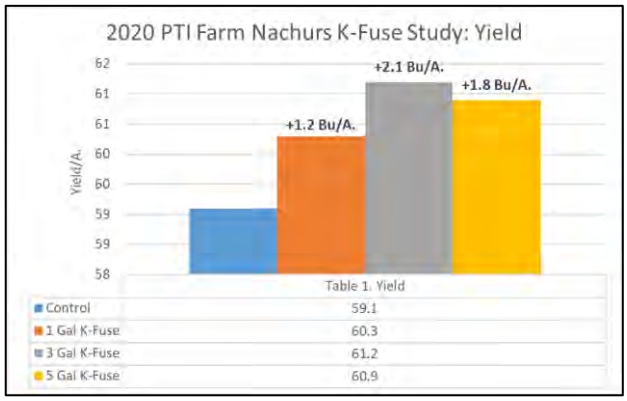
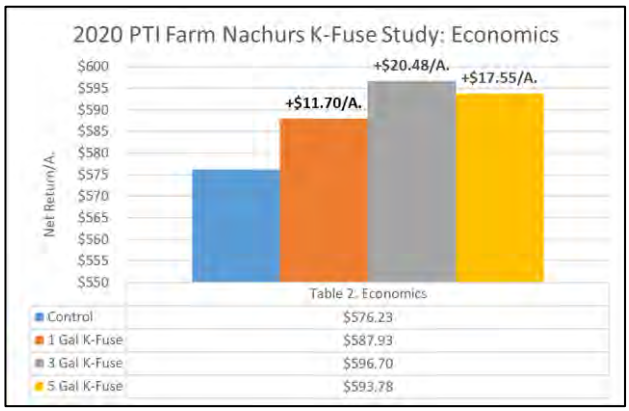
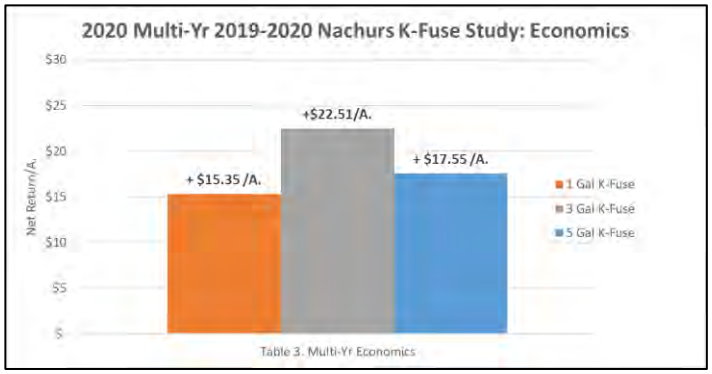


Figure 2. Conceal® Dual Placement 3" from Seed Furrow, 1.5" in Depth







Planting Date: May 17 *Variety: GH 3546X* *Population: 130K* *Row Width: 30"* *Rotation: SAC* *SB Price: $9.75* *K-Fuse: $4.55/Gal*

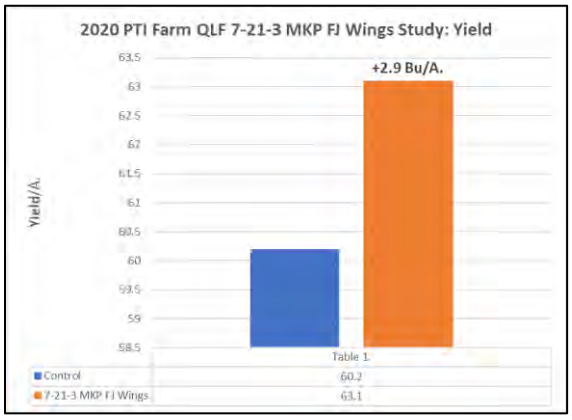
L-CBF 7-21-3 MKP FurrowJet® Study

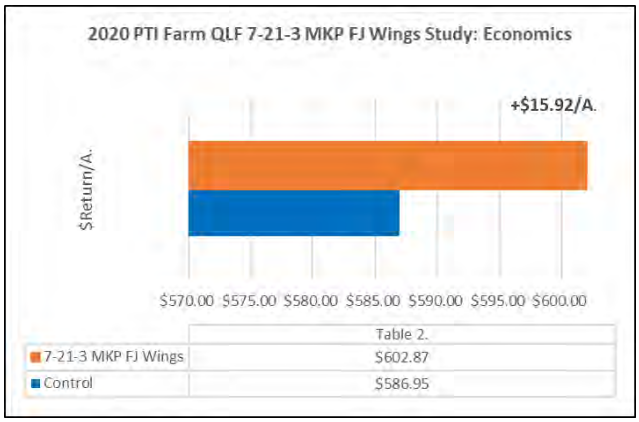
Figure 1. FurrowJet® Wing Application

Objective: To evaluate yield and net return of QLF Agronomy's Liquid Carbon-Based Fertilizer (L-CBF) starter 7-21-3 MKP applied through FurrowJet® Wings (Figure 1).

L-CBF 7-21-3 is a liquid starter blend derived from premium orthophosphate MKP (monopotassium phosphate) for plant available phosphorus, available carbon from sugar cane molasses as an energy source for soil microbes, and enhanced biological function with an added fermentation yeast extract.

Results: Table 1. illustrates a +2.9 Bu/A yield advantage from using 3 Gal/A of 7-21-3 MKP. Table 2. reveals a positive net return of $15.92/A.





Planting Date:5 /27 Variety: Asgrow 36X6 Population: 130K Row Width: 30" Rotation: BAC Bean Price: $9.75 7-21-3:$12.36/Gal. Rate: 3 Gal/A.

Kelpak® Seed Treatment Study

Objective: To evaluate the yield and economic impact of a liquid seaweed concentrate called Kelpak applied as a seed treatment.

Kelpak is manufactured from the kelp species *Ecklonia maxima*, which grows only in the clean, cold waters off the Atlantic Coast of southern Africa.

Kelpak is a highly concentrated liquid seaweed extract, making it a cost-effective tool. It is approved in the USA by USDA's National Organic Program (NOP) for use as an input in organic farming.

Results: Table 1. illustrates that 8oz/100# seed of Kelpak ST resulted in +0.5 Bu/A. yield gains as a seed treatment, while Table 2 reveals an economic gain of +$4.25/A.

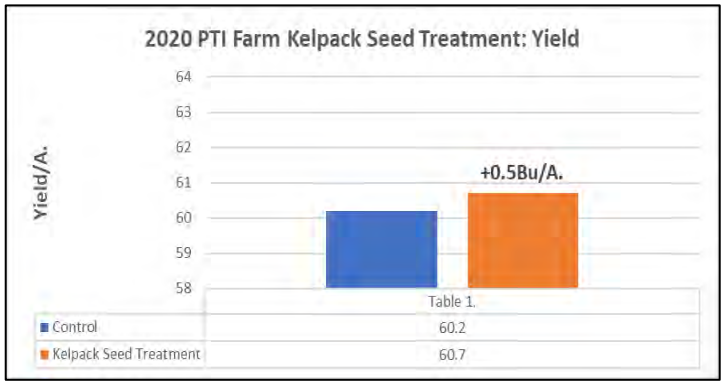


Table 1.

Control	60.2
Kelpack Seed Treatment	60.7

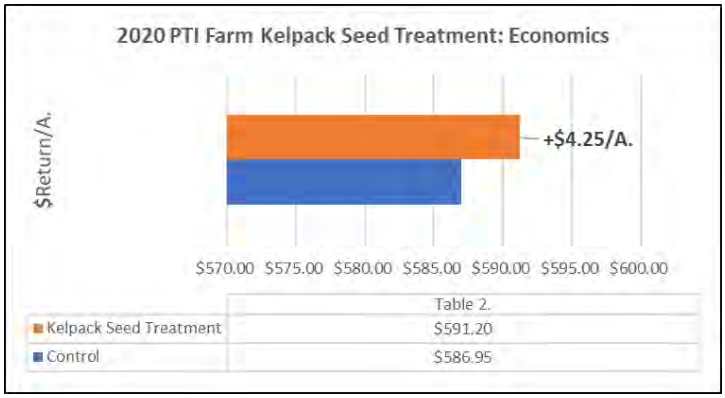


Table 2.

Kelpack Seed Treatment	$591.20
Control	$586.95

Planting Date: 5/27 Variety: Asgrow 36X6 Population: 130K Row Width: 30" Rotation: BAC Bean Price: $9.75 Kelpak: 0.625/A. Rate:4oz/100#.

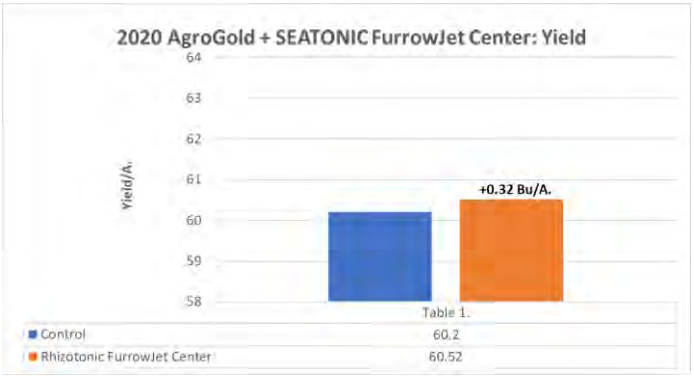
AGRO GOLD™ + SEATONIC™ FurrowJet® Study

Objective: To evaluate the yield and economic impact of a tank-mix of AGRO GOLD and SEATONIC applied in FurrowJet® center applications only.

SEATONIC™ is a formulation made of an organic concentrated water-soluble liquid extract from cold water seaweed (Ascophyllum nodosum).

AGRO GOLD™ is a biological amendment containing soil enhancing bacteria recommended for all vegetable crops, small fruits, berries, citrus, banana, tobacco, alfalfa and all row (field) crops including but not limited to, cotton, sorghum, corn, wheat, sugarcane and soybeans.

Results: This year at the PTI farm the use of AgroGold and SEATONIC in a FurowJet center application proved yield gains of +0.32 Bu/A. with negative economic returns of +$5.88/A.



Planting Date: 5/27 Variety:Asgrow 36X6 Population: 130K Row Width: 30" Rotation: BAC Soybean Price: $9.75 AGRO GOLD + SEATONIC: $9/A.

L-CBF Boost 4-0-3-2S Conceal® Study

Figure 1. Conceal® placement 3" away from seed furrow and 1.5" deep

Objective: To evaluate yield and net return of QLF Agronomy's Liquid Carbon-Based Fertilizer (L-CBF) BOOST 4-0-3-2S applied through Conceal® system.

BOOST is a concentrated source of available carbon in a low pH chemistry package, L-CBF BOOST 4-0-3-2S enhances soil biology creating more plant available nutrients.

Derived from sugar cane molasses (30% sugar) with an added fermentation yeast extract for enhanced biological function, and paired with non-protein nitrogen, sulfate sulfur, and strong acids, L-CBF BOOST 4-0-3-2S is not only an added energy source for soil microbes, but also a safer approach to improving fertilizer performance.

Results: Table 1. illustrates a +2.2 Bu/A yield advantage from using 2 Gal/A of L-CBF BOOST 4-0-3-2S. Table 2. reveals a positive net return of $14.89/A.

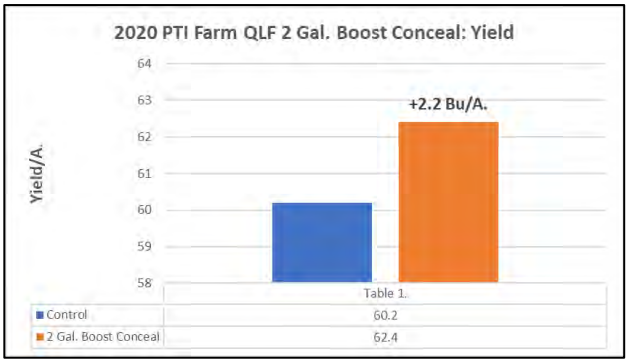


Table 1.

Control	60.2
2 Gal. Boost Conceal	62.4

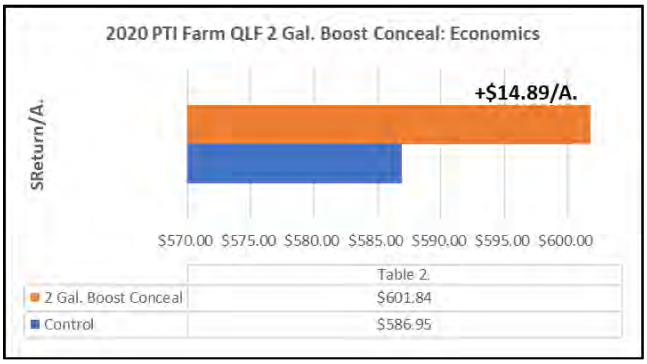


Table 2.

2 Gal. Boost Conceal	$601.84
Control	$586.95

QLF® Agronomy

Planting Date: 5/27 *Hybrid: Asgrow 36X6* *Population: 130K* *Row Width: 30"* *Rotation: CAB* *Corn Price: $9.75* *Boost: $3.28/Gal.*

L-CBF Amino 15-0-1 Foliar Study

Objective: To evaluate yield and net return of QLF Agronomy's Liquid Carbon-Based Fertilizer (L-CBF) Amino 15-0-1 applied foliar at the R3 growth stage.

Amino 15-0-1 is a balanced source of foliar nitrogen with available carbon in a low pH chemistry package. L-CBF Amino 15-0-1 has 10% sugar. For every gallon, a full pound of sugar is delivered in a microscopic form, raw and undegraded, further enhancing the adjuvant characteristics of this liquid fertilizer blend.

Derived from sugar cane molasses with an added fermentation yeast extract for enhanced biological function, and paired with high quality Urea solution and L-Amino Acid forms of nitrogen, L-CBF Amino 15-0-1 is a safer and more efficient approach to foliar nitrogen applications and plant protein formation.

Results: Table 1. illustrates Amino 15 proved yield gains of 2.1 Bu/A. with economic gains of $11.24/A.

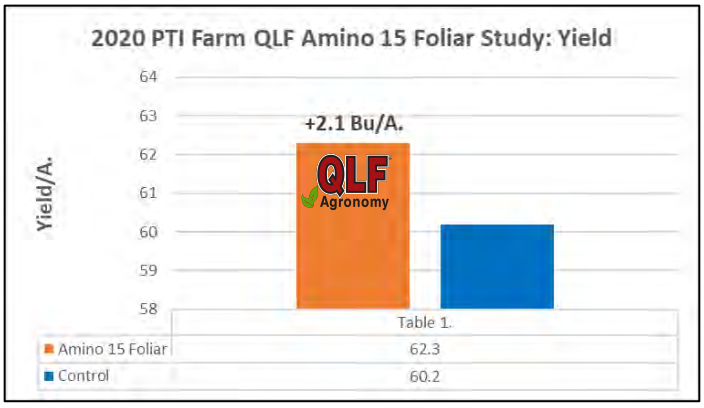


Table 1.

Amino 15 Foliar	62.3
Control	60.2

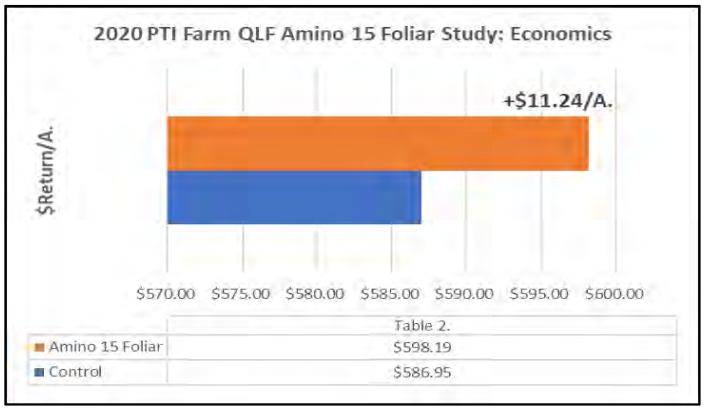


Table 2.

Amino 15 Foliar	$598.19
Control	$586.95

Planting Date: 5/27 Variety: Asgrow 36X6 Population: 130K Row Width: 30" Rotation: BAC Corn Price: $9.75 Amino-15: $3.08/Gal. Rate:8oz/100#.

Soybeans Summary of 2020 FurrowJet® Applications

	Soybean FurrowJet 2020	Classification	Bu/A.	$ROI	Page #
1	Marco QuickGrow LTE FJ 5 Gal Soybean	Fertility	4	$ 47.94	168
2	High Yield Irrigated Conventional Till 5 Point Touch Soybeans	Irrigated Fertility	16	$ 47.34	144-145
3	Marco QuickGrow LTE FJ 4 Gal Soybean	Fertility	2.9	$ 44.41	168
4	20" Irrigated Strip Till Cover Crop + Conceal and FJ High Management over Irrigated Conceal Soybean	Irrigated Fertility + Cover Crop	5	31.73	148
5	Soybean AgroLiquid S-Calate	Calcium + Sulfur	2.4	$ 23.40	174
6	April 5th Plant Date w/Starter	Planting Date/Fertility	4.9	$ 20.74	154
7	April 11th Plant Date w/Starter	Planting Date/Fertility	4.5	$ 17.65	154
8	April 23rd Plant Date w/Starter	Planting Date/Fertility	4.5	$ 16.75	154
9	The Andersons 2Gal First Pass 3-15-15 + MicroCarb + 1pt Biopass FJW Soybean	Fertility	1.1	$ 16.38	169-170
10	High Yield Irrigated Conventional Till FJ Combo Soybeans	Irrigated Fertility	6.1	$ 16.24	144-145
11	QLF 7-21-3MKP FurrowJet Wings	Fertility	2.9	$ 15.92	179
12	High Yield Irrigated Conventional Till FJW Soybeans	Irrigated Fertility	3.4	15.92	144-145
13	The Andersons 2qt. Korrect + .5 Gal. SweetNEezy + 1pt Biopass FJC Soybean	Fertility	0.5	$ 12.47	169-170
14	3Gal Triple Option FJ + 5Gal Kfuse Conceal Soybean	Fertility	2.6	$ 11.66	171
15	Soybean AgroLiquid FurowJet Program	Fertility	3.8	$ 7.89	172
16	Soybean AgroLiquid LiberateCa	Fertility	0.8	$ 7.80	173
17	The Andersons 3 Way combo Soybean	Fertility	4.6	$ 0.08	169-170
18	Soybean Marco Quickgrow LTE 5 Gal + 1Qt BioMarc	Fertility	4.7	$ (1.35)	168
19	HY Irrigated Conventional Till FJC Soybeans	Fertility	2.4	$ (2.61)	144-145
20	3Gal Triple Option FJ + 5Gal Kfuse Conceal + 1qt. Finish Line Foliar + 1Gal Balance	Fertility	3.2	$ (3.64)	171
21	3Gal Triple Option FJ + 5Gal Kfuse Conceal + 1qt. Finish Line Foliar	Fertility	2.7	$ (4.64)	171
22	AgroGold + Seatonic FJ	Biological	0.32	$ (5.88)	181
23	May 14th Plant Date w/Starter	Planting Date/Fertility	2.1	$ (6.39)	154
24	May 23rd SB Plant Date w/Starter	Planting Date/Fertility	0.8	$ (18.55)	154
25	June 1st SB Plant Date w/Starter	Planting Date/Fertility	0.8	$ (18.81)	154
	Averages		3.48	$ 11.70	

Soybeans Summary of 2020 Conceal® Applications

	Soybean Conceal 2020	Classification	Bu/A.	$ROI	Page #
1	High Yield Irrigated Conventional Till 5 Point Touch Soybeans	Irrigated Fertility	16	$ 47.34	144-145
2	High Yield Irrigated Conventional Till Conceal Soybean	Irrigated Fertility	10.5	$ 36.96	144-145
3	Marco NutriStart BOOST 14-12-4-6s 10Gal. Soybeans	Fertility	2.2	$ 28.95	177
4	The Andersons 5oz. RGS Conceal + 10Gal 14-12-4-6s Soybean	Fertility	2.8	$ 28.63	169-170
5	Marco NutriStart BOOST 14-12-4-6s 15Gal. Soybeans	Fertility	3.1	$ 26.47	177
6	Marco NutriStart BOOST 14-12-4-6s 20Gal. Soybeans	Fertility	4.2	$ 25.95	177
7	April 5th Plant Date w/Starter Fertilizer	Planting Date/Fertility	4.9	$ 20.74	154
8	Soybean Nachurs K-Fuse 3 Gal	Potassium Fertility	2.1	$ 20.48	178
9	April 11th Plant Date w/Starter Fertilizer	Planting Date/Fertility	4.5	$ 17.65	154
10	Soybean Nachurs K-Fuse 5 Gal	Potassium Fertility	1.8	$ 17.55	178
11	April 23rd Plant Date w/Starter Fertilizer	Planting Date/Fertility	4.5	$ 16.75	154
12	Soybean QLF Boost	Carbon Based Sugar	2.2	$ 14.89	182
13	Soybean Nachurs K-Fuse 1 Gal	Potassium Fertility	1.2	$ 11.70	178
14	3Gal Triple Option FJ + 5Gal Kfuse Conceal Soybean	Fertility	2.6	$ 11.66	171
15	The Andersons 3 Way combo Soybean	Fertility	4.6	$ 0.08	169-170
16	3Gal Triple Option FJ + 5Gal Kfuse Conceal + 1qt. Finish Line Foliar + 1Gal Balance	Fertility	3.2	$ (3.64)	171
17	3Gal Triple Option FJ + 5Gal Kfuse Conceal + 1qt. Finish Line Foliar	Fertility	2.7	$ (4.64)	171
18	May 14th Plant Date w/Starter Fertilizer	Planting Date/Fertility	2.1	$ (6.39)	154
19	May 23rd SB Plant Date w/Starter Fertilizer	Planting Date/Fertility	0.8	$ (18.55)	154
20	June 1st SB Plant Date w/Starter Fertilizer	Planting Date/Fertility	0.8	$ (18.81)	154
	Averages:		3.84	$ 13.69	

Chopping Head Study: Soybeans

Objective: To study the yield impact of utilizing a chopping corn head in no-till soybeans. A Capello Quasar chopping head is used to create replicated strips of chop and non-chop residue management trials. The goal of this trial is to evaluate sizing of residue and allowing heavy corn stalks and residue to break down faster to advance the degradation process.

Results: Chopping corn residue improved soybean yields by 2.0 Bu/A. and increased gross revenue by $19.50/A. (Table 1). Table 2. illustrates multi-year yield increases averaging +2.74 Bu/A. during 2018-2020 from chopping corn stalks ahead of soybeans at the PTI Farm.

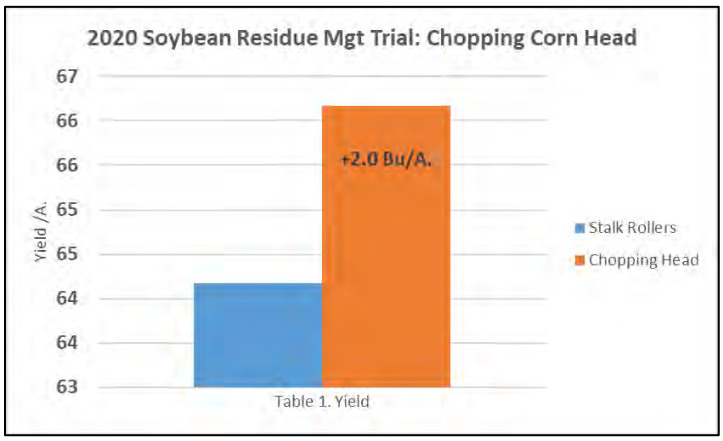


Table 1. Yield

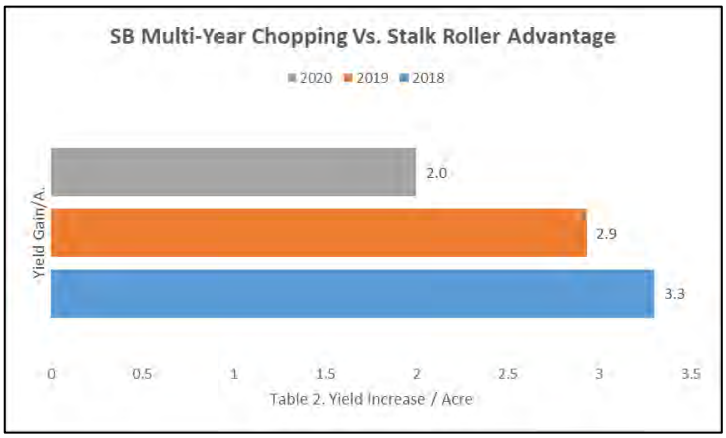


Table 2. Yield Increase / Acre

Planting Date: May 12 *Variety: Asgrow 36X6XR* *Population: 130K* *Row Width: 30"* *Rotation: SAC* *Soybean Price: $9.75*

Wrap Up

Precision Planting is excited to share our 2020 PTI research farm results and findings. We hope they provide useful insights that help drive thoughtful consideration around future crop management. The PTI Farm is working diligently to continue with long-term studies that provide multi-year data analysis for decision-making purposes. We will continue to work with our Precision Planting premier dealers to identify opportunities to find new research objectives, driving innovation and development of new solutions in the field. Precision Planting continues to find new ways to provide commitment to the development of innovations and insights that allow for the highest yield and ROI opportunities for your farm and family.

One of our goals at the PTI Farm is to continue to bring new, fresh, and unique ideas, so that when growers visit the farm they see and experience new technology. "Challenging the Status Quo" is an important concept to us and we always want to offer the opportunity for growers to experience, compare, and challenge their traditional ways of farming to other means. We all know that change is inevitable, but knowing what and when to change is critical to a business. At the PTI farm, we are excited about all of the agronomic trials slated for 2021 and you will not want to miss our upcoming field days. We look forward to seeing you throughout July-September at the Precision Planting Precision Technology Institute at Pontiac, IL.

Precision Planting would like to extend our sincere gratitude to the support and dedication of our Precision Planting Premier Dealers. Precision Planting Premier Dealers are world-class certified precision agriculture experts, with rigorous training and knowledge of the industry and issues facing farmers today. Our Premier Dealers are experienced professionals helping you know and yield more.

The ability to provide unbiased and objective insights into the agronomic research is important to us and we appreciate all Premier Dealers who scheduled and invited growers to the farm in 2020. If you are interested in visiting the PTI Farm in 2021, please contact a Precision Planting Premier Dealer to schedule your visit to the PTI Farm. For your convenience, click here to use our Dealer Locator to find the Precision Planting Premier Dealer nearest you. http://www.precisionplanting.com/#dealer_locator/

Premier Dealer

PRECISION TECHNOLOGY INSTITUTE

All the research summarized here, was conducted as part of multiple research plots, by a team of experienced agronomists at the Precision Technology Institute research farm in Pontiac, Illinois. PTI is committed to challenging the status quo, to give growers agronomic insights and the tools that can help provide improved yield and economic bottom line on your own farm.

One of the questions that you may be asking after reviewing the extensive data and results from our 2020 research plots, is why? Why implement over 100 research plots, over 400 acres, with daily on-farm visits and agronomic discussions, through this time of uncertainty and so many new unknowns. The answer is what it has always been; we must continue to challenge the status quo. We must find better, smarter, and higher return on investment solutions for the growers and their farms. Precision Planting created the Precision Technology Institute in Pontiac, Illinois to provide a place for growers to meet and learn, while providing results of research plots that illustrate the practical value of their products in real world situations. The research we are sharing is designed by Precision Planting to better understand what solutions, in combination with real-world scenarios can actually provide, both a yield and economic benefit. These are learnings that we will continue to develop, implement, study and share, to provide our growers with the tools to help improve their bottom line.

Precision Technology Institute's feels the best way to serve this goal to growers is as simple as having conversations. As part of this vision of having an on-going dialogue with growers, there are many ways to become part of the learnings and findings throughout the year, including an exciting new opportunity to visit PTI's new state of the art facility.

INSIDEPTI

Become an Insider

A simple way to stay informed, as well as up to date on the research we are collecting here at the PTI Farm is to become an Insider. Subscribe to the InsidePTI weekly videos at insidepti.com for all your agronomic needs.

Come Visit us at the New Home of PTI

While a lot of research was happening over the year, PTI also broke ground and completed the vision of a showplace for Precision Planting and growers to meet to continue conversations. In the late fall of 2020, we have a new home and we cannot wait to have everyone here to enjoy it in person as we have more and more amazing and welcome conversations with growers through-out the year.

Precision Technology Institue now includes a 80x120 foot shop that will double as an exhibit hall, two classrooms, two conference rooms, and a dining hall. With the new features of this state of the art facility, conferences can be held both virtually and in-person throughout the Winter season, as well as have it be our homebase for the popular field days during the summer months.

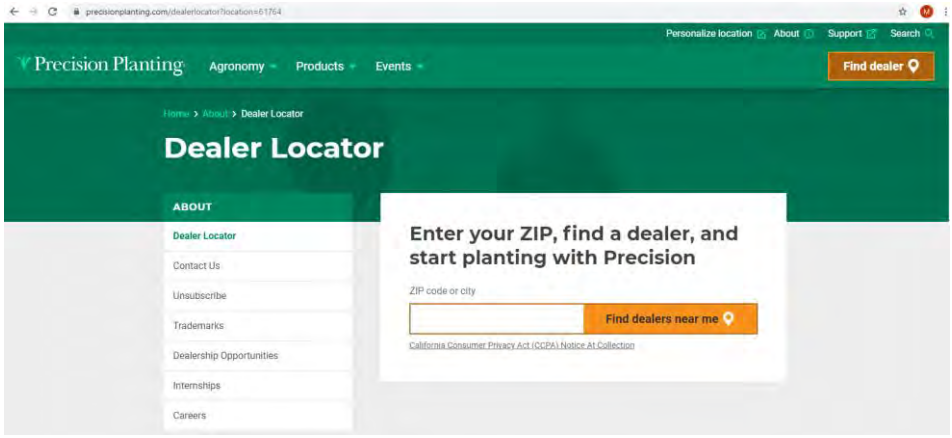
2020 PTI Results

Come Experience Field Days at PTI

So what can you expect when attending summer field days at PTI? Whether you are a frequent visitor or looking forward to your first visit, PTI field days are a high energy, information packed, learning experience. Here are some of the one of a kind experiences you can choose to take advantage of all provided by Precision Planting at the Precision Technology Institute.

- ### The Driver's Seat
  In our 27-acre sandbox, you take the wheel. Here, we hand YOU the keys to four different tractor/planter combinations and allow you to run the equipment in real time, learning more in depth about how each piece works and the technology behind it. Precision Planting Support Technicians will be co-piloting in the buddy seat at this time, to answer any questions that may come about throughout your experience.
- ### Core Principles and Planting Fundamentals
  This hands-on demo is led by the Precision Planting Regional Managers walking the growers through the importance of planter maintenance and furrow creation. Growers can see in person correct and incorrect furrow creation from two different planter row units. During this time, growers can interactively measure and correct the furrow created throughout the different planting conditions.
- ### Agronomy Tour
  Lead Agronomist and PTI Farm Director, Jason Webster, takes you out into the field to dive deeper into the innovative agronomy and technology that we use each season throughout the different plots. You will learn about our new water recycling and tile drainage system, research tools, and technology/products available to implement on your farm.
- ### Industry Days
  Each year, we invite industry partners to use PTI as an avenue to showcase their products and technology during the year. These customer focused field days are led by the industry partner's employees. If you are interested in hosting an industry day or becoming an industry partner of Precision Planting, contact Jason Webster at jason.webster@precisionplanting.com.

For more information regarding attendance of a PTI Field Day or Industry Day, reach out to your Precision Planting Premier Dealer or visit our website at precisionplanting.com/events to schedule a visit.



Acknowledgements and Legal Statement

The University of Illinois Machinery Cost Estimates provided by The University of Illinois Farm Business
The Iowa State University Tillage Rate provided by the Iowa State University Extension and Outreach