

2020 BRANDT Research and Development Farm Results

Pleasant Plains and Lexington, IL

2020 Climate Data

April				May			
Location	Average Temp	Average Solar Rad	GDD	Location	Average Temp	Average Solar Rad	GDD
Pleasant Plains	51°	18.7	197	Pleasant Plains	61.3°	18.9	597
Lexington	48.6°	18.7	180	Lexington	59.3°	18.6	548
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a 15 1	PledSdill Pld	115 - 0.45		1017 4		112-2.00	28
	and the second					63. The	8- °9-
June			_	July			_
Location	Average Temp	Average Solar Rad	GDD	Location	Average Temp	Average Solar Rad	GDD
Pleasant Plains	74.2°	24.8	1334	Pleasant Plains	77.3°	24.0	2173
Lexington	74.4°	25.2	1243	Lexington	76.7°	24.8	2042
August	Lexin Pleasant Pla	gton - 0.94" ins - 4.10"	12	September	Lexin Pleasant Pla	gton - 4.76" ins - 6.14"	
Location	Average Temp	Average Solar Rad	GDD	Location	Average Temp	Average Solar Rad	GDD
Pleasant Plains	72.5°	22.5	2902	Pleasant Plains	66.4°	16.6	3663
Lexington	72.5°	23.6	2745	Lexington	64°	15.7	3440
	Lexin Pleasant Plai	gton - 0.67" ins - 1.65"			Lexin Pleasant Pla	gton - 6.60" ins - 1.90"	

The 2020 results are in! BRANDT Agronomic Services is pleased to present the 2020 results from the Pleasant Plains and Lexington, IL BRANDT Research Farms.

We like to look back at the climatic factors throughout the growing season as a good reference point for understanding the season. These are the variables that we cannot control, but also have the most influence on yield. This also points to the importance of multi-year data, no two years are the same. And, no two locations are the same. You can see the variance in conditions between Pleasant Plains, IL and Lexington, IL in 2020.

Our agronomy team has provided some key insights from the 2020 growing season. We utilize our research farms to bring our customers local data they can take back to their farms. We also can take on risks and ground-truth methods before applying them on your farms, strengthening our recommendations and your return on investment.

You will find great takeaways from our 2020 results. As always, if you have any questions or would like more information, please contact your BRANDT professional. Also, our research farms are always available for customer tours. Those can also be scheduled through your BRANDT professional.

Thank you for 2020 and we look forward to growing with you in 2021.

Ed Corrigan - Senior Technical Agronomist Dan Froelich - Technical Agronomist Kyle McClelland - Seed Manager Jacob Winans - Technology Information Specialist Steve Clement - Technology Specialist

Weather maps can be found at: https://water.weather.gov/precip/ Water and Atmospheric Resources Monitoring Program. Illinois Climate Network. (2015). Illinois State Water Survey, 2204 Griffith Drive, Champaign, IL 61820-7495. https://dx.doi.org/10.13012/J8MW2F2Q;

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Pleasant Plains, IL

Omission Trials - Standard Treatment

$Fall NH_{\mathfrak{s}}$	Spring NH_3	Total Nutrition	Planting Date	Population	Harvest Date			
160 Units	160 Units	Corn: 190-50-150-30S Soybeans: 15-50-150-30S	4/7/20 - 4/14/20 Corn: 42,000 Soybeans: 120,000		10/1/20 - 10/20/20			
Fungicide/Insec	ticide/Nutrition	Application	Herbicide/Nutrition Application					
Corn: Hero [®] , BRAN Soybeans: Hero, B	DT Smart B-Mo, Rev RANDT Smart Trio®,	vytek [™] , BRANDT Smart B-Mo & Revytek	Corn: (Pre-emergent) Resicore [®] ; (Post-applied) BRANDT Smart Trio & BRANDT Smart B-Mo					
			Soybeans: (Pre-emergent) Zidua [®] + Metribuzin; (Post-applied) Plus, BRANDT Smart Trio & BRANDT Smart B-Mo, Liberty [®] , Out					

Trial Parameters

Block 1 - Continuous Corn • Foliar Nutritional Stimulants • Foliar V4 Stage • Conventional Till • 42,000 Population	Block 2 - Continuous Corn • Hybrid Trials • 30° Row Width • Conventional Till • 42,000 Population	Block 3 - Continuous Corn • Hybrid Trials • 30" Row Width • Conventional Till • 42,000 Population	Block 4 - Continuous Corn • Nutrient Response • 0 to 300 Units of N (no P&K) • Conventional Till • 42,000 Population
Block 5 - First Year Corn • Hybrid Trials • 30" Row Width • Strip Till • 42,000 Population	Block 6 - First Year Corn • Hybrid Trials • 30" Row Width • Strip Till • 42,000 Population	Block 7 - First Year Soybeans Variety Trials 30" Row Width Conventional Till 120,000 Population 	Block 8 - First Year Soybeans Variety Trials 30" Row Width Conventional Till 120,000 Population
Block 9 - Continuous Corn • Spring NH ₃ • Solar Maximization • Conventional Till • 42,000 Population	Block 10 - Continuous Corn • Spring NH ₃ • Sulfur Response at Plant • Conventional Till • 42,000 Population	Block 11 - Continuous Corn • Spring NH ₃ • Sulfur Response at Plant • Conventional Till vs No Till • 42,000 Population	Block 12 - Continuous Corn • Fall NH ₃ vs 28% • Sulfur Response at Plant • Conventional Till vs No Till • 42,000 Population
Block 13 - First Year Corn • Sulfur Response at Plant • Foliar Nutritional Stimulants • 42,000 Population	 Block 14 - First Year Corn High Yield Trial 20" vs 30" Row Width Fungicide Response vs Population 34,000 to 54,000 Population 	 Block 15 - First Year Soybeans 30" Rows Progressive Foliar Treatments Sulfur Response at Plant Conventional Till vs No Till 120,000 Population 	Block 16 - First Year Soybeans - 30" Row Seed Treatment - Sulfur Response at Plant - Conventional Till vs No Till - 120,000 Population - Seed Treatments
Planting Date Trials Corn and Soybeans - 4/3/20 - 6 	5/4/20	PipelinePopulation - 42,000 Corn and 120,0	00 Soybeans



Lexington, IL

Omission Trials - Standard Treatment

Total Nutrition	Planting Date	Population	Harvest Date			
Corn: 200-55-150-20S Soybeans: 18-46-120-20S	4/20/20 - 5/11/20	Corn: 36,000 Soybeans: 130,000	Corn: 9/30/20 Soybeans: 10/15/20			
Fall NH ₃	Preplant 28%	At Plant Nutrition	Side Dress 28%			
Corn: 140 Units - with N-Serve	60 Units	0	0			
Fungicide/Insecticide/Nutritio	n Application	Herbicide/Nutrition Application				
Corn: Trivapro [®] , Cobalt [®] Advanced, p	lus BRANDT foliar nutrition products	Corn: Acuron [®] , Roundup [®] , Halex [®] GT, plus BRANDT foliar nutrition products				

Soybeans: Quadris Top[®], Cobalt Advanced, plus BRANDT foliar nutrition products

Soybeans: Boundary[®], Roundup, Engenia[®], Outlook, Prefix[®], Liberty, Enlist One[®], plus BRANDT foliar nutrition products

Trial Parameters

Block 1 - Soybeans • Variety Trails • E3 Trait • Viable RM's	Block 2 - Corn • P&K Build • N Rate • S Rate	Block 3 - Soybeans Variety Trial XtendFlex Trait Variable RM's 	Block 4 - Corn • Hybrid Trial
Block 5 - Soybeans Seed Treatments ATS Rates 	Block 6 - Corn & Soybeans • Planting Date	Block 7 - Soybeans • P&K Rate • BRANDT Foliar Nutrient	Block 8 - Corn • P&K Rate • N Rate • S Rate
Block 9 - Soybeans • Fungicide Timing • Progressive Applications	Block 10 - Corn • Variable Population • Hybrid Trial	Block 11 - Corn • Starter • ATS • BRANDT EnzUp	Block 12 - Corn • Fungicide

We use an omission style plot technique at our research farms to determine the value of the BRANDT Total Acre and each individual application as it is omitted. We can then analyze the data to determine yield and return on investment outcomes. The goal is to develop local insights to maximize yield and return on every acre.

Throughout the book, there are areas where an economic analysis is paired with yield. For consistency, we use the 2020 harvest crop insurance price of \$3.99/bu for corn and \$10.55/bu for soybeans.



BRANDT Total Acre® Corn Pole Positions

The BRANDT Total Acre base applications reflect a high yield management recommendation that can be implemented in parts or as a whole to fit within a grower's current program. The BRANDT Total Acre base applications for 2020 were:

- 15-50-150 suspension in fall
- Fall NH₃ 160 units
- Band at plant 14-0-0-30S (2x0)
- 2.5 gal/ac in furrow starter + BRANDT EnzUp[®] Zn
- 42,000 population
- Conventional till in fall, Salford in spring
- Plant on top of RTK ammonia line
- Pre-emergent herbicide at plant with water
- 1 qt/ac glyphosate, BRANDT Smart Trio, BRANDT Smart B-Mo
- Fungicide at R1 + BRANDT Smart B-Mo + insecticide

We have illustrated the BRANDT Total Acre Pole Positions as they relate to application timing. Please note how many important decisions are made before and at planting.



BR/	ANDT Total Acre Pole Positions	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	10 yr Avg	10 yr ROI
1	Planting Date	n/a	67.6	99.6	94.2	41.8	97.3	47.0	36.4	100.2	72.9	73.0	\$\$\$
2	Hybrid Variance	56.2	39.3	18.1	11.5	47.1	33.1	35.1	65.3	66.3	38.7	41.1	\$\$\$
З	Crop Rotation Penalty	76.3	10.3	6.3	20.3	33.6	9.9	21.9	11.2	37.1	63.0	29.0	\$\$\$
4	Nitrogen Rate	18.3	16.3	47.8	36.1	35.7	31.2	15.1	14.9	12.6	36.4	26.4	2.3
5	Strobilurin Response	14.1	51.7	13.4	14.3	21.2	27.2	17.0	24.8	46.8	32.6	26.3	3.4
6	Tillage System	n/a	n/a	n/a	19.7	15.0	19.5	18.8	22.1	19.8	38.3	21.9	4.9
7	BRANDT Smart Trio	15.9	22.0	22.1	34.1	17.5	15.8	6.5	15.1	9.6	33.4	19.2	17.0
8	Row Width 20" vs 30"	n/a	n/a	n/a	n/a	n/a	10.8	4.1	36.5	36.0	6.8	18.8	\$\$\$
9	Population Rate	13.9	3.7	32.5	27.3	40.4	12.3	16.6	7.0	19.5	7.5	18.1	1.6
10	P&K Rate	27.4	23.3	10.7	16.7	10.1	14.1	16.0	24.1	8.3	66.0	21.7	1.5
11	Nitrogen Timing	n/a	n/a	23	20.5	7.6	16.3	2.0	21.7	0	30.4	17.4	\$\$\$
12	Banding Nitrogen	n/a	n/a	13.0	15.4	22.9	11.9	20.9	n/a	n/a	n/a	16.8	\$\$\$
13	Starter (28% + Sulfur at Plant)	4.5	4.0	11.1	13.6	13.6	13.4	6.7	21.3	15.5	18.8	12.3	3.3
14	Boron at Tassel	7.0	4.0	n/a	9.3	5.9	6.8	12.4	n/a	8.5	6.3	7.5	7.5
15	Zinc (1qt/ac)	10.9	8.1	4.6	20.7	5.0	1.2	4.1	4.1	5.8	7.4	7.2	4.6

The ROI (Return On Investment) listed is calculated using the 2020 fall crop insurance price of \$3.99 per bushel, multiplied by the yield response per acre, minus the cost per acre of a practice. For every dollar invested per acre in a practice, the ROI factor is how many dollars you get in return. We use a symbol of \$\$\$ for practices that had no measurable cost per acre, but offer the best ROI.



V12 VT R1 R2 R4 R6

With 10 years of BRANDT Total Acre Corn Pole Positions, We Have Determined the "Top 5" Grower Insights.

- 1. Planting date is the top ROI producing practice on the BRANDT Research Farm in Pleasant Plains. (pg. 14)
- 2. Hybrid selection ranks #2. Choosing and placing the right hybrid to match soil fertility and management can pay dividends. (pg. 13)
- 3. Crop rotation has gained positions in recent years mainly due to residue from significant corn yields the last 3 years in our continuous corn plots. (pg. 9)
- 4. Nitrogen is a foundational element for corn production. Determine the MRTN (Maximum Return To Nitrogen) and use a 4R approach to nutrient stewardship. (pg. 11)
- 5. The fungicide application with BRANDT Smart System[®] foliar nutrition comes in fifth. It's sound practice for protecting and advancing yield on corn acres. New formulations should be targeted to the late vegetative growth stage. (pg. 19-21)



Corn Revenue

- With good corn yields over consecutive years, the residue penalty of continuous corn continues to be a major factor.
- Since 2016 the profitability gap between a corn/soybean rotation vs continuous corn has grown.
- In 2020, a cold and wet spring was also a contributing factor. The soils where the previous crop was soybeans, warmed and dried earlier.



Multi-Year Yield Response to Rotation - Pleasant Plains

Intercropping and Rotation

It's not a new practice, but the latest guidance technologies have made intercropping much easier to manage. The primary benefit of intercropping is to maximize the solar opportunity for the corn crop. Alternating corn and soybeans within a field allows for additional light interception into the rows nearest the soybean crop. This is the first year for this trial at the Pleasant Plains research farm and it produced some good results. We look to expand on this trial in 2021.





Early getative

Corn P&K

Phosphorus and potassium are two elements that are essential in maintaining and increasing soil productivity to support current and future corn yields.

- A seven year trial at our Pleasant Plains location has yielded a 66 bushel decrease where P&K was not applied vs. a grain removal program.
- The University of Illinois has clear guidelines to help determine an accurate grain removal fertilizer strategy. Below are examples using their calculations.



Fertilizer Rate Examples Based on U of I Recommendations

Сгор	Nutrients	Removed							
Corn Yield	P ₂ O ₅	K ₂ 0	DAP	or	MAP	Potash			
300	111	72	241		213	120			
275	102	66	221		196	110			
250	93	60	201		178	100			
225	83	54	181		160	90			
200	74	48	161		142	80			
(bu/ac)	(lbs/ac)			(lbs/ac)					
Сгор	Nutrients	Removed			Fertilizer				
Crop Soybean Yield	Nutrients P₂0₅	Removed K ₂ 0	DAP	or	Fertilizer MAP	Potash			
Crop Soybean Yield 100	Nutrients P₂0₅ 75	Removed K ₂ 0 117	DAP 163	or	Fertilizer MAP 144	Potash 195			
Crop Soybean Yield 100 90	Nutrients P₂0₅ 75 68	Removed K ₂ 0 117 105	DAP 163 147	or	Fertilizer MAP 144 130	Potash 195 176			
Crop Soybean Yield 100 90 80	Nutrients P₂0₅ 75 68 60	Removed K₂0 117 105 94	DAP 163 147 130	or	Fertilizer MAP 144 130 115	Potash 195 176 156			
Crop Soybean Yield 100 90 80 70	Nutrients P₂O₅ 75 68 60 53	Removed K₂0 117 105 94 82	DAP 163 147 130 114	or	Fertilizer MAP 144 130 115 101	Potash 195 176 156 137			

Two Crop Combined Fertilizer Maintenance

Corn		Soybeans		DAP	or	MAP	Potash
250	+	70	=	315		279	237
(bu/ac)		(bu/ac)				(lbs/ac)	

Late Vegetativ Early Reproductive

Corn

Corn Maximum Return to Nitrogen (MRTN)

The Maximum Return to Nitrogen (MRTN) is defined by Illinois Nutrient Research and Education Council (NREC) as the N rate at which the return in dollars to nitrogen is at its highest point across a set of trials. BRANDT Agronomist Ed Corrigan serves on the NREC Executive Committee and has been instrumental in developing methods and practices to identify the MRTN statewide using 4R practices. An app is available for iOS and Android devices to assist in determining MRTN.

Corn Yield Response to Fall Applied NH₃ First Year Corn - Pleasant Plains



Corn Yield Response to Nitrogen Source and Timing - Pleasant Plains



Corn Yield Response to Spring Applied NH₃ Continuous Corn - Pleasant Plains





Continuous corn nitrogen rate plot. This is a good visual to understand N movement in the soil vertically and not horizontally.

Planting Rate Optimization

Matching the population to the specific hybrid you intend to plant is key to the success of the hybrid. Factors such as soil type, planting date, desired yield, fertility, etc., all factor into the decision making process. This is why it's important to develop a plan for hybrid placement and planting population. Working with your BRANDT professional who knows your fields and has been trained on hybrid placement is an invaluable resource.

Use available data to determine the correct planting rate to produce the best economic outcome on a fieldby-field basis. Also, if you are not already using variable seeding rates within a field we strongly recommend you implement this practice where appropriate.

- 34,000 planting population lead across all hybrids except one on our Lexington research farm.
- The lack of precipitation at the Lexington research farm in June, July and August - 6.37 inches total - probably played into the success of the lower populations in this trial.
- Pushing populations too high can be detrimental to yield and ROI.



Row Width vs Population - May 11 Plant Date - Pleasant Plains

Yield Response to 34,000 Planting Population - Lexington



Corn Hybrid Selection

Corn hybrid selection is consistently one of the top contributors to ROI on our research farms. Matching the correct hybrid to field productivity and management practices will maximize the potential to achieve high yields.

- Top performing hybrids on our research farms were consistent with top performers in our BRANDT Community Trials throughout central IL.
- The variance in performance between our Pleasant Plains and Lexington locations identifies how hybrids respond to different soils, management and climatic scenarios. This also highlights hybrids that work well across different scenarios.
- First year corn performed best across the entire hybrid set. The margin between first year corn and continuous corn continues to widen.

Hybrid selection is a very important contributor to a successful crop. There are a lot of different products on the market and it's important to weigh the pros and cons of each. Determine which hybrid will perform best, but also mitigate risk in the presence of negative pest and/or environmental factors. Visit www.brandt.co/harvest for our vast resource of harvest data.



Community Trial Yield Across All Populations - Lexington

Corn Hybrid and Crop Rotation Trial - Pleasant Plains



Corn Planting Date Trials

Planting date should be determined by conditions and not the calendar. That said, over the last 5 years the highest yields were achieved between April 3-26.

- The 5 year trend points to early planted corn, more specifically in the month of April.
- ATS was applied 2 x 0 at planting.
- The first planting date in 2020 was April 3 and emergence was April 21.
- The average yield loss per day in 2020 was 1.2 bushels and the 5 year average is 1.3 bushels per day.





Corn Yield Response to Planting Date - Pleasant Plains

Corn Response to Ammonium Thiosulfate (ATS) - Multi Year

This is the fifth year for monitoring corn yield response to ATS. Sulfur management plays a significant role in our high yield environment at the Pleasant Plains research farm. Ammonium Thiosulfate is 12-0-0-26S. Of that, 50% of the sulfur is in the elemental form and 50% in the sulfate form. This is important because only sulfate is readily available to the plant. Elemental sulfur slowly converts to sulfate over time. This provides a very effective, slow release capability.

- The 5 year average yield advantage to 10 gal/ac of ATS is 9.5 bu/ac.
- In this specific trial ATS was applied 2 x 0 at planting.

No Sulfur Sulfur

 We have had success with both banded and broadcast ATS application scenarios.

5 Year Corn Yield Response to ATS Applied at Planting - Pleasant Plains

300 300.5 +11.5 bu/ad 290 287.6 287.2 280 285.8 81.5 277.9 276.1 270 274.8 268.4 260 264 6 250 240 230 220 2016 2017 2018 2019 2020 bu/ac 5 Year Average



ATS mixes perfectly with 28% N and together makes a great combination for a spring application to feed the crop at early development stages.

2020 Corn Yield Response to ATS

Over the last five years we have seen the positive results provided by early applications of ATS. We continue to expand that work into identifying rates and timings when applications are most effective.

We recommend ATS as the source of sulfur. ATS provides both elemental and sulfate forms for delayed and immediate plant availability. Sulfur management on our research farms and our on-farm trial work has been a consistent contributor to higher yields.

- The typical application rate across our customer acres is between 5 and 7 gal/ac. However, we are seeing a greater response to higher application rate on our research farms. It's important to identify the correct rate for maximum economic return.
- Banded or broadcast applications around or at the time of planting produced the best response.
- ATS applications at our Pleasant Plains location significantly increased the yield at earlier planting dates. All dates achieved positive results.



Corn Yield Response to ATS Rate at Planting - Lexington

Corn Yield Response to Planting Date and ATS at Planting - Pleasant Plains





Early Reproductive

Corn

Corn Response to BRANDT EnzUp Zn and BRANDT 5-12-0-4S

BRANDT EnzUp Zn and BRANDT 5-12-0-4S have provided increased corn yields all three years trialed at our Lexington research farm. BRANDT EnzUp Zn is an enzyme technology that enhances water and nutrient availability. BRANDT 5-12-0-4S is a phosphoric acid derived source of P that is low-salt and contains sulfur. It also mixes well with 28% N.

- The combination of BRANDT EnzUp Zn and BRANDT 5-12-0-4S increased yield by 16.6 bu/ac vs. no application of the two products.
- BRANDT EnzUp Zn alone accounted for a 7.4 bu/ac yield increase.
- The 3-year average yield increase at our Lexington research farm is 15.8 bu/ac.

+16.6 bu/ad 220 +9.2 h +7.7 bu/ad 217.0 210 09 200 200. 190 180 170 160 150 140 BRANDT BRANDT BRANDT No bu/ac 5-12-0-4S plus 5-12-0-4S 5-12-0-4S Starter BRANDT EnzUp Zn plus EDTA Zn

Corn Yield Response to Starter Solutions - Lexington



BRANDT EnzUp Zn has contributed to both corn and

BRANDT 5-12-0-4S plus BRANDT EnZup Zn 3 year Yield Advantage - Lexington





Early Reproductive

Corn Yield Response to BRANDT Smart Trio

Since BRANDT Smart Trio entered the market in 2008, it has been the leader in foliar micronutrient performance. Its ability to provide nutrients critical to the plant's structure and functions, and also its tank mix compatibility, has given growers a product they can rely on year after year to produce a positive ROI.

Though BRANDT Smart Trio did not make the "Top 5" grower insights in terms of yield from the 10 year BRANDT Total Acre Pole Positions, it consistently ranks among the highest in terms of ROI.

- The yield advantage to BRANDT Smart Trio was highly significant in 2020. Specifically, as it applies to our continuous corn trials where early season environmental stress conditions and early planted fields played a factor.
- The 10 year yield advantage to BRANDT Smart Trio is 19.2 bu/ac, placing it at #7 among the BRANDT Total Acre Pole Positions.
- BRANDT Smart Trio adds and balances plant nutrition, alleviates plant stress and assists the plant to metabolize herbicides.



10 Year BRANDT Pole Position Corn Yield Advantage to BRANDT Smart Trio with Herbicide Application Across All Trials - Pleasant Plains



Corn Yield Response to V4 Fungicide Application

Corn fungicide products have developed greatly in recent years contributing to increasing adoption and profitability. Part of the product development has been a longer window of disease control. Therefore, we wanted to test an early stage application to determine the length of disease control and stress mitigation on this year's crop.

- A positive yield response was achieved by all products tested under both continuous corn and corn/soybean rotation scenarios.
- There was extended disease control. However, very late season disease was observed, but did not impact yield.

Today's fungicide products are substantially better than fungicides of the past. Also, consideration of an early fungicide application opens the door for ground-rig applications vs aerial application.



Corn Yield Response to V4 Fungicide Application and Crop Rotation - Pleasant Plains



Corn Yield Response to Fungicide and BRANDT Smart B-Mo

Fungicide applications paired with a proprietary BRANDT boron formulation is one of the longest running trials at the Pleasant Plains research farm. The disease protection from the fungicide combined with nutrients specifically targeting key utilization times has led to yield increases. With the development of longer disease control from the new fungicide products, the applications were made at V12 and R1 in Pleasant Plains and V10 in Lexington.

Fungicide with BRANDT Smart B-Mo increased yields +27.9 bu/ac @ V12 in Pleasant Plains and +8.5 bu/ac @ V10 in Lexington when compared to no fungicide application.

2020 Corn Yield Response to Fungicide and BRANDT Smart B-Mo at R1 - Pleasant Plains

No Fungicide or BRANDT Smart B-Mo Fungicide plus BRANDT Smart B-Mo



Corn Yield Response to V12 Application of Fungicide and BRANDT Smart B-Mo - Pleasant Plains



Corn Yield Response to V10 Application of Fungicide and BRANDT Smart B-Mo - Lexington



Late Vegetative

Corn

Corn Yield Response to Fungicide and BRANDT Smart B-Mo

 The average yield advantage across all fungicide and BRANDT Smart B-Mo trials at both farms was 20.6 bu/ac.

A late V-stage fungicide application with a BRANDT foliar product is a perfect time to protect the plant and introduce nutrition going into the R-stage and grain fill. The ability of the combination to protect and add yield makes it a win-win outcome. Average of All V-Stage Fungicide plus BRANDT Smart B-Mo Applications - Pleasant Plains and Lexington



15 Year Corn Yield Advantage to Fungicide and BRANDT Foliar Boron Application - Pleasant Plains





Evolution of Management Practices

	2011	2012	2013	2014	2015
Environment	Light rains during April and May combined with a warming trend into summer. Timely rains with a hot summer produced high heat unit numbers and sped up crop progress. Drying trend for fall harvest.	Record warm temperatures and dry spring creating perfect soil conditions. Light frost April 9. The warm and dry spring led into a very dry and hot summer. An early dry harvest.	A moderately cool and moist winter led to a cool and wet spring. Light rains in April and late May with cloudy conditions. A cloudy summer was warm with ample moisture slowing crop maturity. Warm and dry harvest conditions through the fall.	A cold winter led to an early spring with warm temperatures and dry soils. A rainy May and June turned into a moderate temperature summer with ample moisture. The fall began dry and quickly moved into a cold and rainy late harvest.	A moderately cool/moist winter led to a cool/dry spring. Light rains fell in April and May making good planting conditions with slow corn emergence due to the cold. June was unusually wet with 20 plus inches for the month. July and August were dry and cooler than normal.
Identified Practices	 Planting date affected corn yields in corn on corn Split timing of nitrogen and banding near planting Foliar insects attack soybeans at flowering Narrow rows compliment shorter hybrids and lower N rates Applying 210 units of nitrogen/acre maximized yields 	 Early planting maximized yields except for scattered frosted fields Corn tasseling followed potash applications Fungicides applied at VT slowed plant metabolism and drought stress Sulfur applications with zinc maximized yields Foliar insecticides improved yields and reduced green stem syndrome 	 Fall applied nitrogen moved deeper into the 2nd foot of soils Crops suffered from transient nutrient deficiencies until June At plant applications of nitrogen, sulfur, and zinc were valuable Early growth stage applications of nutrients and stimulants added yield Late applied side dress nitrogen had no effect on yield 	 Banding beats broadcast nitrogen applications at plant Late side-dress nitrogen applications did not perform well Higher plant densities and narrow rows maximized the nutrition Sulfur is needed on corn and soybeans Hormone applications need adequate nutrition to perform 	 Even emergence fields were critical for top yields Banded nitrogen at planting time improved nitrogen efficiency Hybrids with early plant vigor maximized yields Insect damage was minimal in 2015 due to the wet June Cover crops improved soybean yields
Advancing Practices	 Zinc at planting Soybean maturity Potash applications Omission plots Short hybrids with narrow rows 	 Apply sulfur Fungicides reduce stress Potash reduces stress Early flowering Lower pH of foliar insecticides Narrow row shading improves yields Strobilurins stopped frost damage Cover crops absorb unused nutrition 	 Hormones assist plants Apply sulfur Split apply nitrogen Higher populations Apply side dress nitrogen early Long maturity soybeans Seed treatments Foliar applications mitigate transient nutrient deficiencies 	 Banding at plant Early foliar applications VOTiVO® treated seed High populations Strip till provided better plant health Sulfur at plant on soybeans Crown rot controlled with potash 	 Even corn emergence Band nitrogen at plant Cover crop allelopathy did not affect soybeans Allelopathy in corn was stopped by strip tillage Amplified boron deficiency Zinc at plant continues to improve yields Plant soybeans by the end of April to maximize yields

2016	2017	2018	2019	2020
A record rainfall in late December flushed a lot of residue and mobile nutrients into the watersheds. Even with this loss of nutrients, the soil conditions at planting time were excellent. A 45 day dry spell starting in June led to one of the wettest July's on record with above average temps.	A mild and dry winter led to an early spring warm up. Excellent soil conditions for early April planting was interrupted on April 27 with heavy rains over 7 days. A dry summer with periods of high night time heat stressed crops through August.	A mild and near record dry fall and winter preceded gentle rains in February and March that recharged soils for planting. Excellent soil planting conditions and near perfect emergence set the stage for top yields.	Wet conditions began on Halloween 2018 which impeded harvest, tillage and fertilizer applications. Wet conditions continued through the winter to spring. This made for unprecedented late and unfavorable planting conditions.	Soybean stubble was dry enough to apply NH_3 early November 2019. Corn stalk ground was damp which limited tillage and fall ammonia. It was late March before soils began to dry out enough for tillage or spring ammonia. The soil temperature at 4" remained near 50° from early April to mid May.
 Plant early for the best yields Mobile nutrient management had the best ROI Strobilurin and boron applications greatly improved yields by reducing stress on corn and soybeans At plant applications of nutrients were the most efficient due to the dry June weather Cover crops improved soybean yields 	 Plant early for the best yields Sulfur management had the best ROI Strobilurin and boron applications greatly improved yields by reducing stress on corn and soybeans At plant applications of nutrients were the most efficient due to the dry May to August weather Cover crops improved soybean yields 	 Plant early for the best yields Yellow corn from sulfur deficiency was the talk of the state! Must apply sulfur at planting Strobilurin and boron improved yields by reducing disease and stress on corn and soybeans At plant applications of nutrients were the most efficient due to the dry June to August weather The coldest April on record pushed record yields in conventional tilled fields 	 Must apply sulfur "at plant" in a sulfate form. Early and late application timing failed due to rainfall Strobilurin and boron improved yields by reducing disease and stress on corn and bean At plant applications of nutrients were the most efficient due to a wet spring followed by a dry June Foliar applications of micronutrients, hormones, and fungicides drove yields 	 Planting early April into the 50° soils. Soils were mellow with only some fields dry enough to plant It was imperative to "prime" the soil with nutrients to feed the young plants and the microbial population using enzymes Applications of N, P, and S at planting time assisted the mineralization process until soil temps elevated to the 70° Corn plants improved with early stress reducing applications of foliar nutrients and fungicides The carbon penalty of corn on corn immobilized high amounts of N and S. Sidedressing N and S improved yields
 Even corn emergence Band nitrogen at plant Cover crop allelopathy did not affect soybeans Allelopathy in corn was stopped by strip tillage Amplified boron deficiency Zinc at plant continues to improve yields Plant soybeans by the end of April to maximize yields 	 Even corn emergence Band nitrogen at plant Terminate cover crops in mid March Protect early planted crops with foliar insecticides Increase B applications; amplified boron deficiency Sulfur at plant continues to improve yields and mineralization Plant soybeans by mid April to maximize yields 	 Near perfect corn emergence Band nitrogen at plant Terminate cover crops early Protect early planted soybean with foliar insecticides and seed treatments Sulfur at plant continues to improve yields and starts early season mineralization Multiple post foliar applications of nutrients turns poverty peas into prairie pearls 	 Plant soybeans first Band nitrogen at plant Protect early planted soybean with foliar insecticides and seed treatments Wet soils at planting respond to fungicide seed treatments Sulfur at plant continues to improve yields and starts early season mineralization Multiple post foliar applications of nutrients turns poverty peas into prairie pearls 	 Prime soil with enzymes Band N & S at plant Foliar insecticides on soybeans Soybean seed treatments containing Methylotrophs improve rooting & nodules Cold soils respond to fungicide seed treatments Sulfur at plant continues to improve yields and starts early season mineralization Multiple post foliar applications of nutrients turns poverty peas into prairie pearls Help eliminate early stress with fungicide & BRANDT Smart B-Mo

BRANDT Total Acre Soybean Pole Positions

BRANDT Total Acre is an omission style trial system that is focused on exposing the differences between variety phenotypes. The "omission design" is based on providing all the treatments and then removing one to see what value each practice has on yield of that phenotype. This creates an environment where the yield responses reflect the total high management system rather than a limited response due to some or all parts of the system.

- 15-50-150 suspension in fall
- 120,000 population
- 10 gal/ac ATS at plant (2x0)
- BRANDT Battleground[®] seed treatment
- Conventional tillage
- Spring applied preemergent herbicide prior to plant

- Post applied herbicide tank mixes + BRANDT Smart Trio plus BRANDT Smart B-Mo at 3rd trifoliate
- Foliar insecticide at R1 plus 1 qt/ac BRANDT Smart Trio plus 1 pt/ac BRANDT Smart B-Mo
- Strobilurin at R3/insecticide + 1 pt/ac BRANDT Smart Trio plus 1 pt/ac BRANDT Smart B-Mo

BR	ANDT Total Acre Pole Positions	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	10 yr Avg	10 yr ROI
1	Planting Date	n/a	6.8	8.3	13.6	11.0	45.3	51.8	23.9	18.1	8.5	20.8	\$\$\$
2	Variety	25.6	14.6	19.3	17.5	7.0	12.4	23.5	16.7	12.5	11.5	16.1	\$\$\$
З	Maturity	17.0	10.2	13.0	8.5	0	12.4	23.5	16.7	12.5	5.5	11.9	\$\$\$
4	Seed Treatment	6.1	11.9	7.4	5.5	8.5	12.9	7.5	16.3	24.4	7.2	10.8	5.3
5	P&K Rate	1.6	3.5	4.0	5.2	n/a	n/a	15.4	n/a	9.0	15.4	9.0	1
6	Sulfur(ATS)	n/a	n/a	3.8	4.8	4.8	8.8	12.2	14.1	8.1	1.9	7.3	6.2
7	Strobilurin	n/a	4.0	3.1	6.5	3.2	9.1	4.2	10.0	8.7	17.1	7.3	2.9
8	BRANDT Smart B-Mo at R2-R4	n/a	n/a	1.0	7.4	n/a	2.0	10.3	6.3	5.2	12.9	6.4	9.3
9	Foliar Insecticide	3.5	5.7	4.9	3.4	n/a	2.9	5.1	n/a	n/a	3.4	4.1	5.2
10	BRANDT Smart Trio	3.2	3.9	3.4	3.3	n/a	n/a	2.0	2.8	6.5	2.0	3.4	5.9
11	Cover Crop	n/a	n/a	n/a	n/a	9.5	0	1.4	-2.0	n/a	n/a	3.0	1.6
12	Row Width 20" vs 30"	n/a	n/a	n/a	n/a	n/a	2.8	1.3	5.0	2.1	n/a	2.8	\$\$\$
13	Population	2.5	2.8	3.6	0	n/a	n/a	n/a	n/a	2.1	n/a	2.2	1.9

The ROI (Return On Investment) listed is calculated using the 2020 fall crop insurance price of \$10.55 per bushel, multiplied by the yield response per acre, minus the cost per acre of a practice. For every dollar invested per acre in a practice, the ROI factor is how many dollars you get in return. We use a symbol of \$\$\$ for practices that had no measurable cost per acre, but offer the best ROI.

With 10 Years of BRANDT Total Acre Soybean Pole Positions, We Have Determined the "Top 5" Grower Insights.

- 1. An early planting date with treated soybean seed has consistently been at the top of the leaderboard. (pg. 31)
- 2. Variety selection comes in at #2. Choosing the correct variety within the trait platform that best fits your situation will increase your chances for high yields. (pg. 28-29)
- 3. Related to the first two positions, choose the appropriate relative maturity (RM) to take advantage of full season growing conditions. (pg. 28-29)
- 4. Seed treatments rank #4 and are a must for early planted soybeans. The protection provided through early development and growth stages is critical to get the plant off to a great start. (pg. 30)

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5. P&K management is critical to achieve high yielding soybeans. It has played a larger role as we consistently surpass the 90+bu/ac mark. (pg. 27)

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Early Reproductive

Soybean P&K Rate

Soil P&K should be maintained to levels adequate for high yielding soybeans. Potassium (K) has a direct relationship in how the plant utilizes other elements. Not maintaining adequate K levels will compromise other elements, mainly nitrogen.

- It is critical to maintain proper P&K levels for future seasons. Cut backs cause long-term setbacks. It can't be made up in one season.
- K is present in every aspect of plant physiology, so other nutrients are dependent on it. K increases the efficiency of other nutrients.

One bushel of soybeans removes about 0.8 lbs of P and 1.2 lbs of K.

Soybean Yield Response to Fall P&K Application - Pleasant Plains

Soybean Yield Response to Fall P&K Application - Lexington

XtendFlex® Soybean Variety Performance

We have been fortunate to have the XtendFlex genetics on our research farms since 2018. We have gained valuable knowledge on how to best manage the varieties and their yield potential.

We have experienced good results with varieties in all of the trait platforms when managed properly. Having a sound strategy in place for each field will help produce a desired outcome for 2021 soybean production.

- XtendFlex soybeans allow for additional herbicide flexibility to manage weed resistance.
- Xtendflex soybeans are tolerant to glyphosate, glufosinate and approved dicamba formulations for soybeans.

XtendFlex Soybean Variety Trial - Pleasant Plains

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Early Reproductive

Soybean Trait Performance

Similarly to the soybean variety trial, we test new and existing trait platforms for soybeans. We look at a variety of variables to determine how the trait performs under different conditions.

The variables we consider are:

- Yield performance.
- Weed control of the herbicide(s) associated to the trait.
- Traits response to other management practices, such as soil and foliar applied nutrition.

We have had success on our research farms with XtendFlex, Enlist E3 and LibertyLink GT27 soybean varieties and associated trait packages. Our BRANDT seed team is trained to help place the right genetics and traits on your farm.

Soybean Yield by Product and Trait - Pleasant Plains

Previous Crop: Soybeans

Soybean Seed Treatment Trial

In 2020, we introduced BRANDT Battleground seed treatments to our portfolio. The carefully selected products are designed to proactively protect and enhance development to get the crop off to a fast, healthy start to achieve its full potential.

- Soybean seed treatments are an integral part of our high yield programs at the research farm and with our growers.
- The 5 year average shows a yield advantage over 10 bu/ac, which calculates to a positive ROI for the grower.
- Soybean seed treatment technologies have been a main focus of research and development. The importance of early season plant development and protection from use of seed treatments has been realized through higher yields.

In both 2019 and 2020 we experienced cool and wet spring conditions where the seed remained unemerged in the soil for over 20 days and still were among the highest yielding on the research farm. Soybean seed treatments played a critical role producing these high yields.

Soybean Yield Response to BRANDT Battleground Seed Treatments

Tier	Fungicide	Biological	Insecticide	Nematicide	SDS	Seed Finisher
BRANDT Battleground Platinum						
BRANDT Battleground Gold						

5 Year Average Untreated Soybeans vs Treated Soybeans - Pleasant Plains

Untreated Treated (F, I & N)

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Soybean Planting Date Trial

- Variety AG36X6 was used in this trial.
- The 5 year trend points to early planted soybean being the highest yielding when treated.
- Planting in the month of April, on average, produces the highest soybean yields.
- The 2020 soybean seed treatment was BRANDT Battleground Platinum.
- The first planting date was April 3 and emergence was April 23.
- The average yield loss per day in 2020 was 0.14 bushels and the 5 year average is 0.4 bushel per day.

We get this question a lot: Should I plant corn or soybeans first? We suggest planting when the soil conditions are right on a field by field basis. Both can be planted early and in the same time frame if the soybeans are treated.

Figure 1: Photo of soybean emergence on April 23, 2020. They were planted on April 3. - BRANDT Research Farm, Pleasant Plains, IL

Soybean Yield Response to Planting Date - Pleasant Plains

Soybean Yield Response to Ammonium Thiosulfate (ATS)

Our recommended source for sulfur is ATS, which contains both elemental and sulfate sulfur. Sulfur plays a critical role in the nitrogen fixation process in legumes. Therefore, what could appear as nitrogen deficiency or stress could actually be a sulfur deficiency.

- Since sulfur is so closely tied to nitrogen in legumes it is critical to achieve high yields.
- Manage sulfur: 200 bu/ac corn removes 16 lbs of sulfur, 75 bu/ac soybeans removes 13.5 lbs of S.
- Our 4 year average shows a significant advantage to sulfur applications. It will continue to play a major role as yields increase.
- Sulfur can be lost through the soil profile. It is important to use the correct source and timing to optimize performance.

Sulfur is an essential building block in chlorophyll development and protein synthesis. Sulfur is required by the rhizobia bacteria in legumes for nitrogen fixation. In soybean plants there are two key amino acids that contain sulfur, cysteine and methionine. In general, soybeans utilize about as much sulfur as they do phosphorus. *Reference: (https://www.ilsoyadvisor.com/onfarm/ilsoyadvisor/optimizing-soybean-production-sulfur)*

Soybean Yield Response to ATS Rate - Lexington

Soybean Yield Response to Sulfur (ATS) - Pleasant Plains

Late Vegetat Early Reproductive

Soybean Herbicide Foliar Trial with BRANDT Smart System

BRANDT Smart System foliar nutrition products are designed for superior tank mix compatibility with current soybean herbicide programs. The delivery of micronutrients specific to the plant's demands has made BRANDT Smart System products a consistent ROI program since its inception in 2008.

The two products in this trial are:

BRANDT Smart B-Mo

5.0% B 0.5% Mo

BRANDT Smart Sulfur Plus

5-0-0 5.0% S 0.5% B 1..5% Mn 0.05% Mo 1.5% Zn

- Boron: provides structural integrity and flexibility to the primary cell walls. It also improves vegetative and reproductive growth.
- Manganese: aids in herbicide metabolism, chlorophyll formation and plant respiration. It is also critical to photosynthesis.
- Molybdenum: promotes root nodulation growth and enhances nitrogen utilization.
- Sulfur: aids in protein and enzyme synthesis.
- Zinc: promotes root and shoot growth; helps plants withstand environmental stress.

Soybean Yield Response to BRANDT Smart System Foliar Treatments @ V4 - Lexington

Much like the addition of a BRANDT Smart System product at the fungicide timing. These products also have excellent performance history and consistency at the herbicide timing. Each nutrient plays a role individually and as a whole system to maximize yield.

Soybean Post Application Trip Trial

The objective of this trial is to push the limits of yield through multiple applications of crop protection and nutritional products. Then analyze the correlation between yield and return on investment for each application.

- Not only did each additional application increase yield, it also increased the return.
- The timing of applications is critical to meet seasonal nutrient demand, but also to alleviate stresses caused by pests.
- Four, or even five, applications across a field after emergence is not common practice, but can be profitable under the right conditions.

Soybean genetics are continuously improving. Crop protection and nutritional programs need to be improved simultaneously with them. We need to manage soybeans for 100 bu/ac.

Soybean Yield Response to Multiple Applications of BRANDT Smart B-Mo at Various Growth Stages - Lexington

Soybean BRANDT Smart System with Fungicide Foliar Trial

We are in the 13th consecutive year of testing a BRANDT boron formulation with a fungicide application at our Pleasant Plains research farm. The boron formulations have evolved and improved over the years and this year we introduced BRANDT Smart K B on the research farm. These products are an important component in high yield soybean production.

BRANDT Smart K B

2.0% N 16.0% K 2.5% B 0.2% Mo

- This year BRANDT Smart K B plus fungicide produced 15.2 bu/ac yield increase.
- Collectively, over the 13 years of testing a BRANDT Smart System product in the trial has produced an average yield increase of 6.4 bu/ac and a ROI of \$2.90 for every \$/spent.
- BRANDT Smart K B is a new formulation that is showing great results as we learn and understand the role K and B both play in N utilization.
- Fungicide products have evolved and improved tremendously. The greater yield increases have come in years where we had adequate moisture and sunshine resulting in the fungicide protecting and advancing the yield.

A BRANDT Smart System product at the fungicide timing is a great place to find a return on investment. Its performance history and ease of use makes it a perfect companion with a fungicide program.

13 Year Soybean Yield Advantage with Fungicide, Insecticide and BRANDT Foliar Boron Product @ R3 - Pleasant Plains

Early /egetative

Soybean Foliar Fungicide Trial

Fungicide treatments on soybeans has been a key part of producing high yields on our research farm and our customer's acres. The ability of fungicide to protect yield has been well documented. We consistently see higher yields in seasons with ideal growing conditions, but have observed a greater yield advantage in season where the crop is under a lot of stress.

- New fungicide products have a longer residual, therefore adding the length of protection.
- Products used on the BRANDT Research Farms this year were Revytek and Priaxor[®].
- No foliar nutrition product were used in this trial.

There is a lot of genetic potential for yield in the new varieties of soybeans. They need to be managed appropriately for that potential to be realized. A fungicide application, especially paired with BRANDT Smart System product, is a winning combination, as the technologies have improved in recent years.

Soybean Yield Response to Fungicide Applications at R1 - Lexington Variety: AG36X6

Soybean Yield Response to Fungicide Applications at R3 - Lexington Variety: AG36X6

Soybean Management

This season we took a set of varieties and measured the response of each to a R1 application of fungicide, insecticide, BRANDT Smart Trio and BRANDT Smart B-Mo. This is a common application among high yield growers and has performed successfully for many years. We also measured the same set of varieties' response to conventional tillage vs. a no-till system.

- All varieties responded positively to the R1 application with the average across the full set at +17.1 bu/ac.
- This application is part of our high yield program recommendation that has produced several 100+ bu/ac outcomes.
- The longer relative maturity varieties of 3.6 or higher had a higher return to the application.

Soybean Yield Response to Application of Fungicide, Insecticide, BRANDT Smart Trio, BRANDT Smart B-Mo - Pleasant Plains No Application E Full Application at R1

2007-2020 Yield & Revenue

High yields combined with good prices have contributed to increased revenue on the research farm. We used the fall crop insurance prices of \$3.99/bu for corn and \$10.55/bu for soybeans to calculate revenue figures throughout the book. Many growers are realizing better pricing this fall and that is great news. These revenue numbers are a collective effort of implementing practices to achieve the most out of every acre. Refer back to the BRANDT Total Acre Pole Positions to identify products and practices that will help increase revenue on your farm.

Our agronomy team continues to use the research farm as a means to provide local data that is relevant to your operation. While we continue to learn more with our multi-year data, we also continue to push the limits with new industry trends and proprietary developments from our Discovery and Innovation team.

Summary

On behalf of BRANDT we want to thank you, our customers, for your business. We also wish for your good health and prosperity through the rest of this pandemic. We hope you have enjoyed and benefited from the 2020 BRANDT Research Farm book.

This is the 16th year for the Pleasant Plains farm and the 9th year for Lexington. We continue to build on a solid foundation of multiyear data that you can apply to your own operation. 2020 has certainly been an unusual year. However, for agriculture it had its upsides. Yields were better than expected after some weather challenges and improved grain prices gave us a boost.

Covid prevented us from having our annual Agronomy Days this past summer. Many private and small group tours were held and virtual tours are available on our website. On the BRANDT website you can view these research farm results, community seed trial results and many educational videos on agronomy topics. Give it a look! Join us next summer as we resume Agronomy Days with lunch!

As your agronomy partner and supplier, our goal is to provide you with unbiased local information. Early trial data can evolve into Best Management Practices. A good example are foliar fungicides on both corn and soybeans. The 15 year average results show a 24.1 bushels/acre advantage in corn and 5.7 bushels/acre in soybeans. BRANDT was on the leading edge of testing and verifying these values. Today most growers agree in the value and use fungicides on their farms as a standard practice.

Occasionally the yield numbers from the trials seem too good! Don't get too hung up on the absolute numbers but rather focus on the multiyear trends. Like Ed says in the preface, "no two years are the same and no locations are the same." You can calculate your own ROI.

We encourage you to contact your local BRANDT advisor to discuss these results and how you can implement them on your farm. We stand ready to help you.

BRANDT has a great team to organize and implement the farms and the publication of the data. Ed Corrigan is the manager of the Pleasant Plains Research Farm and the primary author of this book. Dan Froelich is the manager of the Lexington farm. Rod Riech organizes and edits the book and keeps it on track. They are joined by many other BRANDT employees. Thanks to all.

As we head into 2021 I want to say that I have enjoyed my association with BRANDT customers. We are all blessed to work in this industry with such fine people. Here's to farming for success and profit in 2021 and beyond!

Tim McArdle General Manager

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Fisher	217 897 6920
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Galesville	217 489 2141
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Greenview	217 968 5589
Gridley	309 747 2233
Lexington	309 365 7201
Lincoln	217 735 2571
Mt. Auburn	217 676 3231
New Berlin	217 488 3125
Niantic	217 668 2228
Oakford	217 635 5765
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