

# PLANTER RESOURCE GUIDE





Planting is one of the most important operations in farming and Beck's has conducted numerous Practical Farm Research (PFR)<sup>®</sup> studies to help farmers make the best agronomic and economic decisions. We hope you will use this collection of resources as your guide during this important season. Our team is always available to help you succeed, no matter what you decide. Don't hesitate to reach out should you need assistance.

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# PLANTER ATTACHMENTS

PFR Proven™ planter attachments will help maximize your planter performance and get your crop off to the best start.

# PLANTER ATTACHMENTS - CORN

## CLOSING WHEELS

Closing the seed trench and optimizing seed-to-soil contact is essential for uniform emergence, which leads to higher yields. When planting conditions are not ideal, spiked closing wheels help crumble the sidewall and can eliminate tomahawk roots.

| CLOSING WHEEL                 | PFR PROVEN ACRES TO PAY OFF | YIELD ADVANTAGE (BU./A.) | YIELD WIN % | WEIGHT (LB.) | COMPANY                                |
|-------------------------------|-----------------------------|--------------------------|-------------|--------------|----------------------------------------|
| YETTER POLY TWISTERS          | 128 Acres                   | 5.1                      | 90%         | 5.0          | Yetter Manufacturing Company, Inc.     |
| SCHAFFERT MOHAWK™             | 137 Acres                   | 3.6                      | 78%         | 6.0          | Schaffert Mfg. Co., Inc.               |
| SCHAFFERT ZIPPER™             | 169 Acres                   | 3.1                      | 88%         | 7.6          | Schaffert Mfg. Co., Inc.               |
| COPPERHEAD AG FURROW CRUISER® | 176 Acres                   | 3.8                      | 83%         | 3.7          | Copperhead Agricultural Products, LLC. |
| SI DISTRIBUTING FINGER-TILL   | 226 Acres                   | 2.7                      | 86%         | 16.2         | S.I. Distributing, Inc.                |

PFR PROVEN ACRES TO PAY OFF = (16-Row Planter at \$5.50/Bu. Corn)

|                                                                                     |                                                                                     |                                                                                     |                                                                                      |                                                                                       |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|  |  |  |  |  |
| YETTER POLY TWISTER                                                                 | SCHAFFERT MOHAWK™                                                                   | SCHAFFERT ZIPPER™                                                                   | COPPERHEAD AG FURROW CRUISER®                                                        | S.I. DISTRIBUTING FINGER-TILL                                                         |

**WHAT WE RECOMMEND:** PFR data indicates that the proper closing wheel varies depending on soil type and planting conditions. Consider after-market closing wheels as nearly all options have performed better than the two solid rubber wheels that come standard on many planters.



Scan the QR code to watch a video on closing wheel adjustment.

# PLANTER ATTACHMENTS - CORN

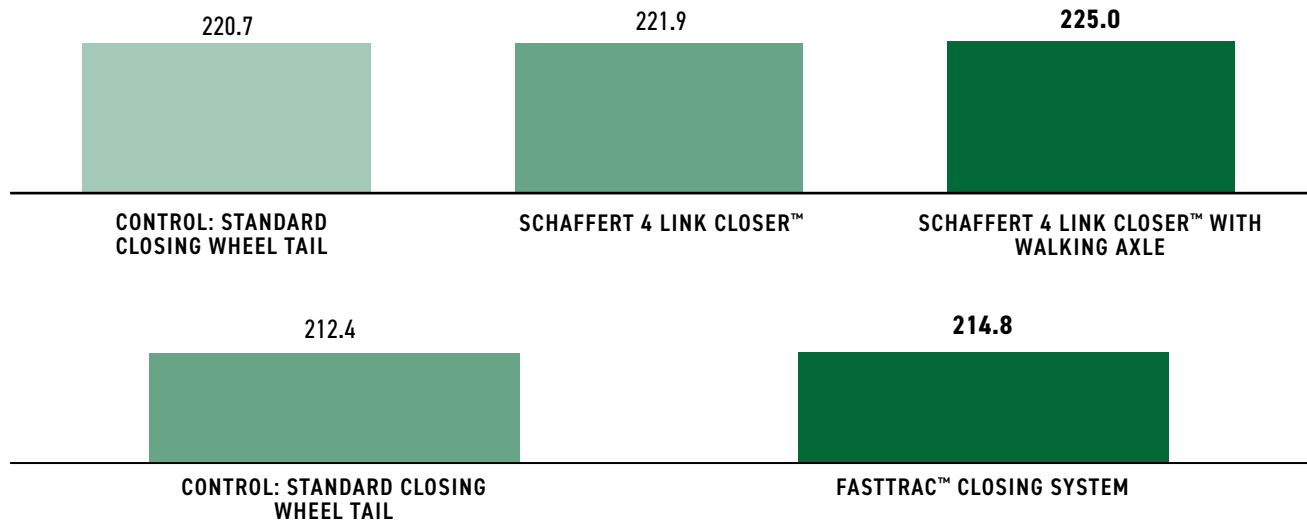
## CLOSING WHEEL SYSTEMS

Closing wheels need to maintain consistent pitch and ground contact to successfully close the furrow. Standard closing wheel tails have limited travel, so when they move up, the pitch of the closing wheels gets wider. Likewise, when they move down, they can struggle to close as they were designed.

| CLOSING WHEEL SYSTEM             | PFR PROVEN ACRES TO PAY OFF | YIELD ADVANTAGE (BU./A.) | YIELD WIN % | WEIGHT (LB.) | COMPANY                  |
|----------------------------------|-----------------------------|--------------------------|-------------|--------------|--------------------------|
| 4 LINK CLOSER™ WITH WALKING AXLE | 541 Acres                   | 4.3                      | 100%        | 29.0         | Schaffert Mfg. Co., Inc. |
| FASTTRAC™                        | 842 Acres                   | 2.4                      | 75%         | 55.0         | AgFocus LLC.             |

PFR PROVEN ACRES TO PAY OFF = (16-Row Planter at \$5.50/Bu. Corn)

### 3-YEAR MULTI-LOCATION CLOSING WHEEL SYSTEMS YIELD AVERAGE



4 LINK CLOSER™ WITH WALKING AXLE



FASTTRAC™

#### WHAT WE RECOMMEND:

Most of our plots are located on uniform, flat ground. Consider using these systems on fields with more rolling topography, as we expect the benefits would be more pronounced.

# PLANTER ATTACHMENTS - CORN

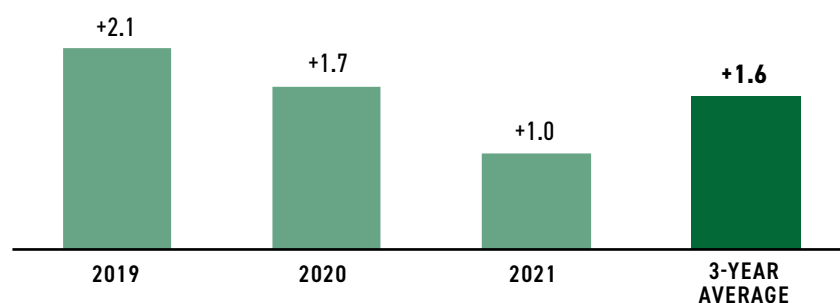
## DISC OPENERS

STP disc openers have a serrated edge; one opener is a little smaller in diameter than the other. Together, these differences provide some tillage in the seed trench and can also lift and fracture the sidewall, alleviating compaction from the gauge wheels.

| DISC OPENER      | PFR PROVEN ACRES TO PAY OFF | YIELD ADVANTAGE (BU./A.) | YIELD WIN % | COMPANY                               |
|------------------|-----------------------------|--------------------------|-------------|---------------------------------------|
| STP DISC OPENERS | 205 Acres                   | 1.6                      | 71%         | Prescription Tillage Technology, LLC. |

PFR PROVEN ACRES TO PAY OFF = (16-Row Planter at \$5.50/Bu. Corn)

### 3-YEAR MULTI-LOCATION STP DISC OPENERS BU./A. DIFFERENCE



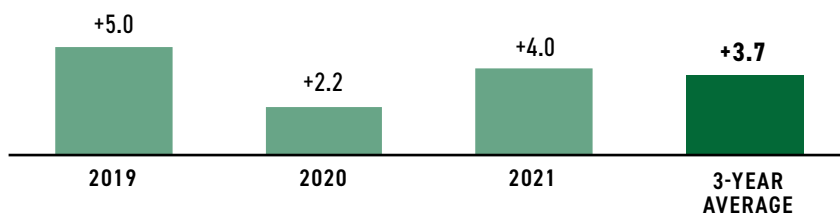
## HYDRAULIC DOWNFORCE

Installing a hydraulic downforce system is one of the best improvements you can make to your planter. DeltaForce® from Precision Planting is a row-by-row control hydraulic downforce system that adjusts quickly as conditions change. We've observed its benefits when lift pressure is required in a specific area of a field, and a spring system could not provide the lift or enough range for all conditions within that field.

| HYDRAULIC DOWNFORCE | PFR PROVEN ACRES TO PAY OFF | YIELD ADVANTAGE (BU./A.) | YIELD WIN % | COMPANY                  |
|---------------------|-----------------------------|--------------------------|-------------|--------------------------|
| DELTA FORCE®        | 1,179 Acres                 | 3.7                      | 92%         | Precision Planting, LLC. |

PFR PROVEN ACRES TO PAY OFF = (16-Row Planter at \$5.50/Bu. Corn)

### 3-YEAR MULTI-LOCATION DELTA FORCE® BU./A. DIFFERENCE



**WHAT WE RECOMMEND:** If you currently have a spring system and want to upgrade, we suggest bypassing an air system and upgrading to a hydraulic system.



# PLANTER ATTACHMENTS - CORN

## 2X2X2 SYSTEMS: FERTILITY ON BOTH SIDES OF THE ROW AT PLANTING

Feeding and building the roots on both sides of the plant will provide a more stable anchor and allow it to access more of the soil profile. In addition, there are limits on salt loading near the seed, but by utilizing this system, our data shows that farmers can increase their early-season nitrogen and increase yield.

### 4-YEAR MULTI-LOCATION STARTER PLACEMENT YIELD AVERAGE

30 Units N 2x2



215.8 Bu./A.

30 Units N 2x2x2



221.5 Bu./A.

60 Units N 2x2x2



222.8 Bu./A.

Dark green bars indicate a higher concentration of the product on each side of the seed.

### SEED SAFETY AND SALT CONTENT

Safe levels of salt (N + K<sub>2</sub>O lb./A.) to apply to corn as a function of soil texture and placement.

| PLACEMENT<br>(DISTANCE<br>FROM THE<br>SEED) | SANDY SOILS<br>(LB./A.) | LOAMY SOILS<br>(LB./A.) | CLAY SOILS<br>(LB./A.) |
|---------------------------------------------|-------------------------|-------------------------|------------------------|
| Direct Contact                              | 6                       | 8                       | 10                     |
| 0.25 - 0.5 in.                              | 10                      | 15                      | 20                     |
| 1 - 2 in.                                   | 20                      | 30                      | 40                     |
| > 2 in.                                     | 25+                     | 38+                     | 50+                    |

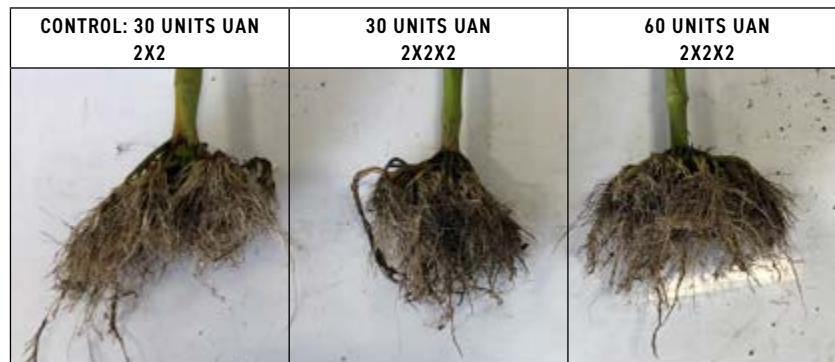
Adapted from Dr. Jessica Davis,  
Colorado State University.

### SALT INDEX COMPARISONS

Commonly used starter fertilizer products expressed as pounds of salt effect/gal. relative to 10-34-0.

| PRODUCT                              | SALT<br>INDEX<br>(LB./GAL.) | VALUE<br>RELATIVE<br>TO 10-34-0 |
|--------------------------------------|-----------------------------|---------------------------------|
| Ammonium<br>Polyphosphate<br>10-34-0 | 2.28                        | 1.00                            |
| Urea Ammonium<br>Nitrate 28-0-0      | 6.75                        | 2.96                            |
| Ammonium<br>Thiosulfate<br>12-0-0-26 | 30.90                       | 13.55                           |

Adapted from SpectrumAnalytic.com

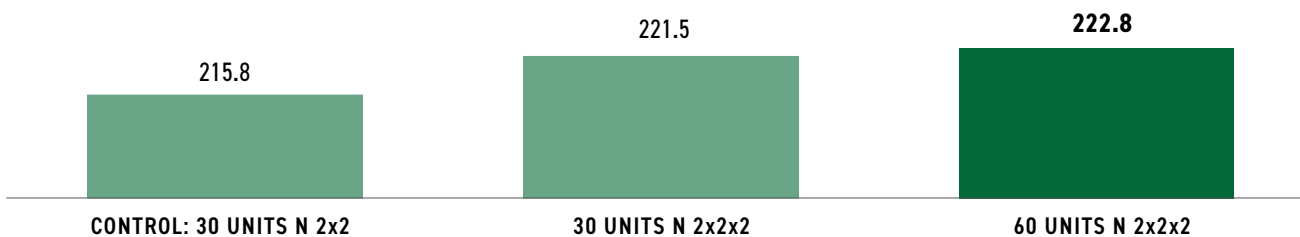




# PLANTER ATTACHMENTS - CORN

## 2X2X2 SYSTEMS

### 4-YEAR MULTI-LOCATION NITROGEN PLACEMENT YIELD AVERAGE



**WHAT WE RECOMMEND:** Banding nitrogen on both sides of the row has been one of the most consistent nitrogen practices we have tested in PFR.

| 60 UNITS UAN |
|--------------|
| YIELD WIN %  |
| 88%          |

| 2X2X2 SYSTEM            | PFR PROVEN ACRES TO PAY OFF | YIELD ADVANTAGE (BU./A.) | WEIGHT (LB.) | MOUNTING POSITION                         | COMPANY                            |
|-------------------------|-----------------------------|--------------------------|--------------|-------------------------------------------|------------------------------------|
| YETTER DUAL 2968 SERIES | 224 Acres                   | 7.0                      | 58.0         | Rear of Row Unit                          | Yetter Manufacturing Company, Inc. |
| DUAL CONCEAL®           | 429 Acres                   | 6.1                      | 26.0         | Front of Row Unit/<br>Inside Gauge Wheels | Precision Planting, LLC.           |
| MARTIN-TILL® DUAL UMO   | 430 Acres                   | 7.0                      | 90.0         | Front of Row Unit                         | Martin Industries, LLC.            |

PFR PROVEN ACRES TO PAY OFF = (16-Row Planter at \$5.50/Bu. Corn)



# PLANTER ATTACHMENTS - CORN

## HIGH-SPEED PLANTING

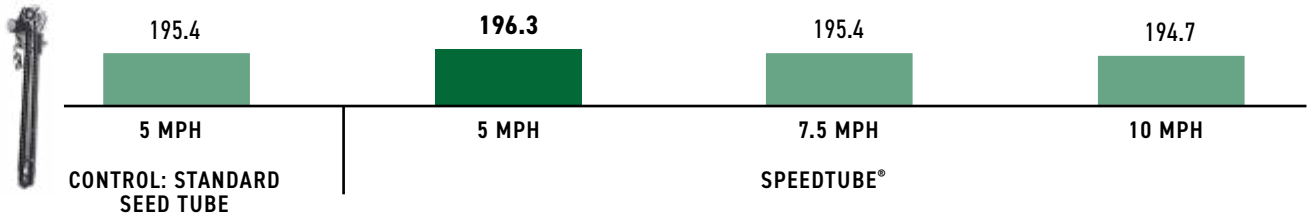
Increasing your planting speed from 5 mph to 8 mph is a cost-efficient way to cover nearly the same amount of ground as adding a second planter or buying a bigger planter.

|                     | 16-ROW | 16-ROW HIGH-SPEED | 24-ROW |
|---------------------|--------|-------------------|--------|
| Average Speed       | 5 MPH  | 8 MPH             | 5 MPH  |
| Acres/Hour          | 17     | 27                | 25     |
| Increase Acres/Hour | --     | 59%               | 47%    |

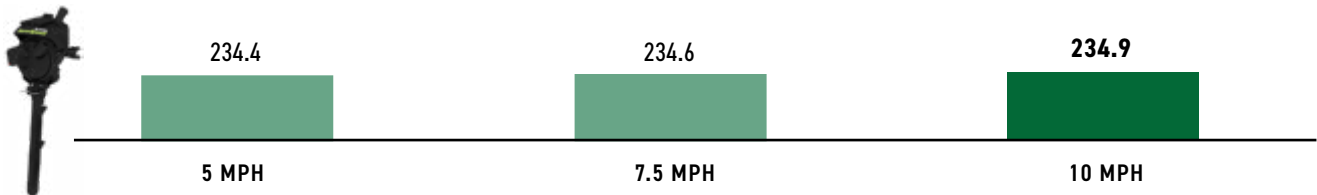
### WHAT WE RECOMMEND:

Utilize these technologies to increase your planting speed and maximize the acres covered during your prime planting window without sacrificing yield.

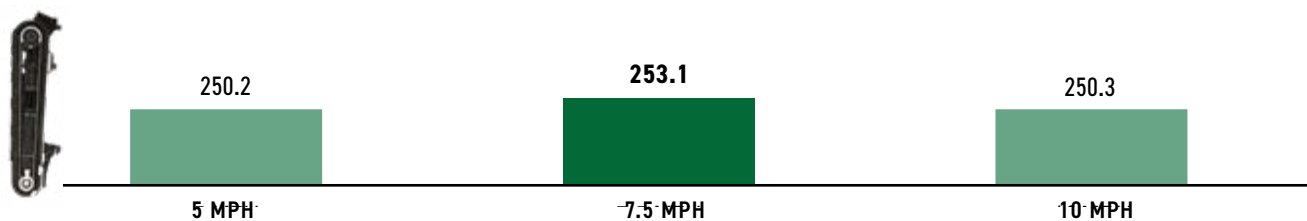
### 3-YEAR MULTI-LOCATION PLANTING SPEED - SPEEDTUBE® YIELD AVERAGE



### 3-YEAR MULTI-LOCATION PLANTING SPEED - SURESPEED® YIELD AVERAGE



### 3-YEAR MULTI-LOCATION PLANTING SPEED - EXACTEMERGE™ YIELD AVERAGE



# NO-TILL COULTER STUDY

In this study, we evaluated the impact of no-till coulters relative to planting speed. Planting conditions were excellent in 2023, but this farm is heavy and can create challenges in marginal conditions. We set the coulters for a minimum of 0.25 in. above seeding depth, the highest setting for a Kinze® planter. The final stands did not vary in either treatment.

## 2023 RESULTS

| TREATMENTS                                                                         | SPEED (MPH) | EMERGED POPULATION | POPULATION DIFFERENCE | BU./A. | BU./A. DIFFERENCE |
|------------------------------------------------------------------------------------|-------------|--------------------|-----------------------|--------|-------------------|
| Control: No-Till Coulter                                                           | 5           | 32,330             | --                    | 232.3  | --                |
| Coulter Removed                                                                    | 5           | 32,640             | +310                  | 232.4  | +0.1              |
| No-Till Coulter                                                                    | 10          | 32,210             | -120                  | 234.5  | --                |
| Coulter Removed                                                                    | 10          | 32,500             | +170                  | 235.2  | +0.7              |
| These results are based on the disclosed study parameters and participating sites. |             |                    |                       |        |                   |

## 2-YEAR NO-TILL COULTER STUDY YIELD AVERAGE



**FIELD INFORMATION** | Planted 4/29/23 | Harvested 10/23/23 | Population 33,000 Seeds/A. | Row Width 30 in. | Previous Crop Soybeans | Tillage Fall: Strip-Till, Spring: No-Till | Total Nitrogen 180 units | Field Location Lewistown, IL

# DOWNFORCE SYSTEMS STUDY

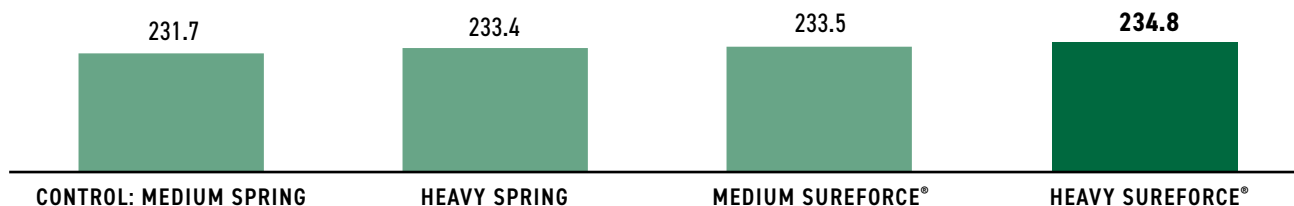
Planting with the correct downforce creates a better seedbed and leads to more uniform emergence. Although you can find the proper setting using springs, changes within a field can be better managed via a system like SureForce® from Ag Leader because it can adjust on the go. Our experience is that in dry or firm soil conditions, there is an advantage to the heavy SureForce setting.

## 2024 RESULTS

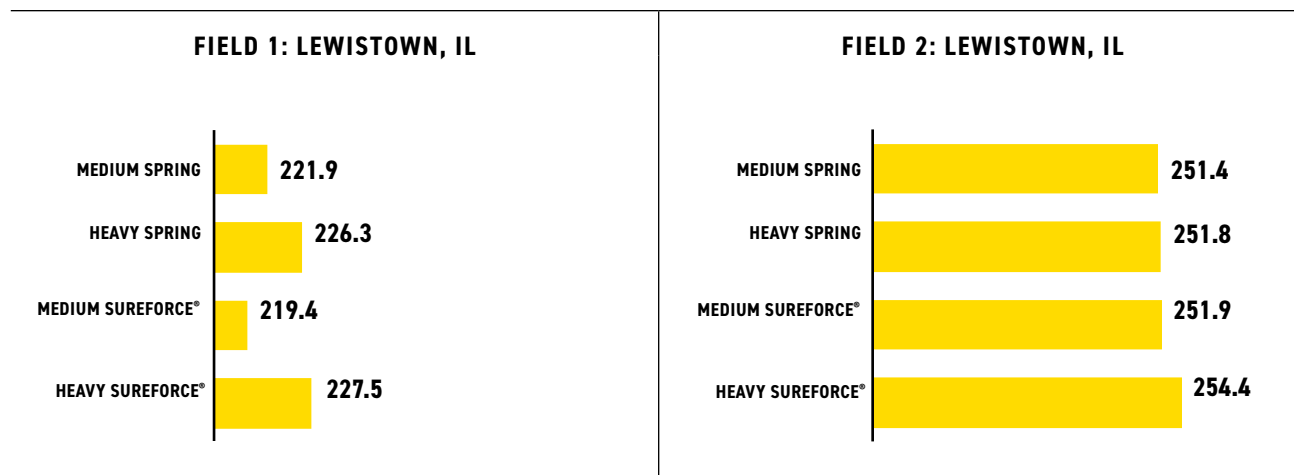
| TREATMENTS             | APPLIED DOWNFORCE (LBF) | GAUGE WHEEL LOAD (LBF) | EMERGED POPULATION | POPULATION DIFFERENCE | BU./A. | BU./A. DIFFERENCE |
|------------------------|-------------------------|------------------------|--------------------|-----------------------|--------|-------------------|
| Control: Medium Spring | 105                     | 127                    | 31,750             |                       | 236.7  | --                |
| Heavy Spring           | 207                     | 194                    | 31,782             | +32                   | 239.1  | +2.4              |
| Medium SureForce®      | 178                     | 93                     | 31,125             | -625                  | 235.6  | -1.1              |
| Heavy SureForce®       | 234                     | 145                    | 30,938             | -812                  | 241.0  | +4.3              |

These results are based on the disclosed study parameters and participating sites.

## 3-YEAR SUREFORCE® YIELD AVERAGE



## 2024 DOWNFORCE SYSTEMS YIELD AVERAGE



# PLANTER ATTACHMENTS - SOYBEANS

## CLOSING WHEELS

Tillage and soil type will play a role in determining the best wheel for your operation, but nearly all after-market closing wheels have performed better than two solid rubber wheels.

| CLOSING WHEEL                 | PFR PROVEN ACRES TO PAY OFF | YIELD ADVANTAGE (BU./A.) | YIELD WIN % | WEIGHT (LB.) | COMPANY                                |
|-------------------------------|-----------------------------|--------------------------|-------------|--------------|----------------------------------------|
| YETTER POLY TWISTERS          | 120 Acres                   | 2.5                      | 100%        | 5.0          | Yetter Manufacturing Company, Inc.     |
| SCHAFFERT MOHAWK™             | 174 Acres                   | 1.3                      | 86%         | 6.0          | Schaffert Mfg. Co., Inc.               |
| SI DISTRIBUTING FINGER-TILL   | 175 Acres                   | 1.6                      | 100%        | 16.2         | S.I. Distributing, Inc.                |
| COPPERHEAD AG FURROW CRUISER® | 180 Acres                   | 1.7                      | 100%        | 3.7          | Copperhead Agricultural Products, LLC. |

PFR PROVEN ACRES TO PAY OFF = (16-Row Planter at \$12.00/Bu. Soybeans)

**WHAT WE RECOMMEND:** Invest in after-market closing wheels. They are easy to install, have a quick payoff, and are a must-have in marginal planting conditions.

## CLOSING WHEEL SYSTEMS

In fields with more rolling topography, a closing wheel system may prove beneficial over a standard closing wheel setup.

| CLOSING WHEEL SYSTEM             | PFR PROVEN ACRES TO PAY OFF | YIELD ADVANTAGE (BU./A.) | YIELD WIN % | WEIGHT (LB.) | COMPANY                  |
|----------------------------------|-----------------------------|--------------------------|-------------|--------------|--------------------------|
| 4 LINK CLOSER™ WITH WALKING AXLE | 762 Acres                   | 1.1                      | 75%         | 29.0         | Schaffert Mfg. Co., Inc. |
| FASTTRAC™                        | 927 Acres                   | 1.0                      | 89%         | 55.0         | AgFocus LLC.             |

PFR PROVEN ACRES TO PAY OFF = (16-Row Planter at \$12.00/Bu. Soybeans)

**WHAT WE RECOMMEND:** Utilize a closing wheel system to allow for more up and down range of movement and to maintain ground contact and the ideal closing wheel pitch.

# PLANTER ATTACHMENTS - SOYBEANS

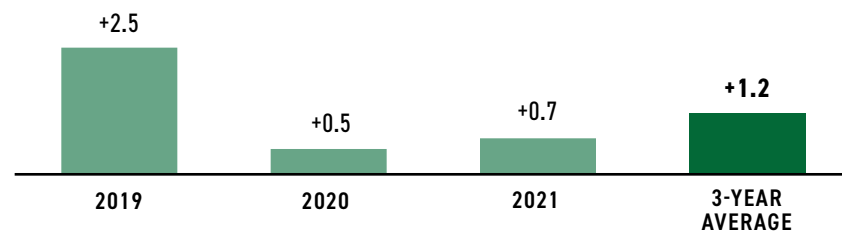
## DISC OPENERS

STP disc openers have a serrated edge, and one opener is a little smaller in diameter than the other. Together, these differences provide some tillage in the seed trench and can also lift and fracture the sidewall, alleviating compaction from the gauge wheels.

| DISC OPENER     | PFR PROVEN ACRES TO PAY OFF | YIELD ADVANTAGE (BU./A.) | YIELD WIN % | COMPANY                               |
|-----------------|-----------------------------|--------------------------|-------------|---------------------------------------|
| STP DISC OPENER | 126 Acres                   | 1.2                      | 71%         | Prescription Tillage Technology, LLC. |

PFR PROVEN ACRES TO PAY OFF = (16-Row Planter at \$12.00/Bu. Soybeans)

### 3-YEAR MULTI-LOCATION STP DISC OPENERS BU./A. DIFFERENCE AVERAGE



## HYDRAULIC DOWNFORCE

Hydraulic downforce systems help ensure that every seed is planted at the proper depth and with the correct bulk density around the seed. Hydraulic downforce is superior to spring and pneumatic downforce in its ability to respond as conditions and downforce requirements change throughout the field.

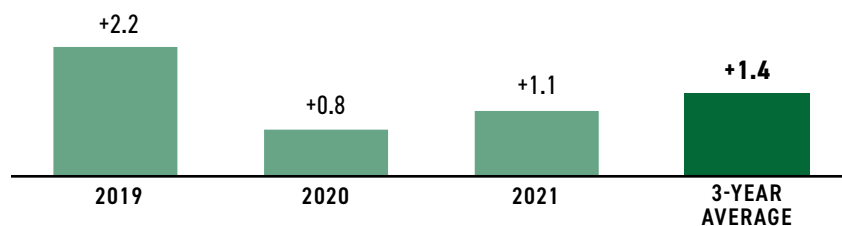
| HYDRAULIC DOWNFORCE | PFR PROVEN ACRES TO PAY OFF | YIELD ADVANTAGE (BU./A.) | YIELD WIN % | COMPANY                  |
|---------------------|-----------------------------|--------------------------|-------------|--------------------------|
| DELTAFORCE®         | 1,429 Acres                 | 1.4                      | 81%         | Precision Planting, LLC. |

PFR PROVEN ACRES TO PAY OFF = (16-Row Planter at \$12.00/Bu. Soybeans)

### WHAT WE RECOMMEND:

When upgrading your planter, hydraulic downforce should be high on the priority list, especially for farmers who no-till their soybeans.

### 3-YEAR MULTI-LOCATION DELTAFORCE® YIELD AVERAGE



| DELTAFORCE® |
|-------------|
| YIELD WIN % |
| 81%         |

# PLANTER ATTACHMENTS - SOYBEANS

## ROW CLEANER

Row cleaners move residue out of the way of the planter gauge wheels. It is also crucial that the residue is removed ahead of the seed disc openers to prevent any hair-pinning of residue.



| ROW CLEANER              | PFR PROVEN ACRES TO PAY OFF | YIELD ADVANTAGE (BU./A.) | YIELD WIN % | COMPANY                            |
|--------------------------|-----------------------------|--------------------------|-------------|------------------------------------|
| YETTER 2967 ROW CLEANERS | 800 Acres                   | 1.0                      | 67%         | Yetter Manufacturing Company, Inc. |

PFR PROVEN ACRES TO PAY OFF = (16-Row Planter at \$12.00/Bu. Soybeans)

**WHAT WE RECOMMEND:** Install a system that allows quick and easy row cleaner adjustment from the tractor cab to ensure proper setting and performance as field conditions change.

## SINGULATION

Singulation creates the space each plant needs to branch to its fullest genetic potential. This allows for uniform stand establishment, maximizing sunlight collection, and driving increased yield potential.

| SEED PLATE               | PFR PROVEN ACRES TO PAY OFF | YIELD ADVANTAGE (BU./A.) | YIELD WIN % | COMPANY                  |
|--------------------------|-----------------------------|--------------------------|-------------|--------------------------|
| SINGULATED 56-CELL PLATE | 71 Acres                    | 1.0                      | 83%         | Precision Planting, LLC. |

PFR PROVEN ACRES TO PAY OFF = (16-Row Planter at \$12.00/Bu. Soybeans)

NON-SINGULATED 80-CELL SOYBEAN PLATE



SINGULATED 56-CELL SOYBEAN PLATE



# STARTER PRODUCTS

(DRY PLANTER BOX ADDITIVES, IN-FURROW, 2X2X2)

Starter products applied with the planter can help provide early-season nutrition or protection to get your crop off to a healthy start. Several factors such as weather, disease pressure, and fertility level will impact how these products perform and should be considered when selecting what products to use.

## CORN PRE-PLANT

Products and practices that eliminate barriers to emergence or assist the seed in achieving a healthy, uniform start can play an important role in reaching your maximum yield potential.

### PRODUCTS

| PRE-PLANT       | PFR PROVEN ROI | ROI WIN % | YIELD ADVANTAGE (BU./A.) | YIELD WIN % | APPLICATION RATE & TIMING        | APPLICATION METHOD & USE                      | COMPANY                      |
|-----------------|----------------|-----------|--------------------------|-------------|----------------------------------|-----------------------------------------------|------------------------------|
| AMPLIFY-D®      | \$13.56        | 83%       | 3.7                      | 83%         | 2 oz./unit of Seed at Planting   | Planter Box Additive - Nutrition              | Conklin Company, Inc.        |
| GROPAK™         | \$8.87         | 70%       | 1.8                      | 70%         | 4.5 oz./unit of Seed at Planting | Planter Box Additive - Replaces Talc/Graphite | AgXplore International, LLC. |
| SEED+™ GRAPHITE | \$8.77         | 70%       | 2.1                      | 70%         | 4 oz./unit of Seed at Planting   | Planter Box Additive - Replaces Talc/Graphite | Verdesian Life Sciences      |

## SOYBEAN PRE-PLANT

### PRODUCTS

| PRE-PLANT                 | PFR PROVEN ROI | ROI WIN % | YIELD ADVANTAGE (BU./A.) | YIELD WIN % | APPLICATION RATE & TIMING        | APPLICATION METHOD & USE                      | COMPANY                      |
|---------------------------|----------------|-----------|--------------------------|-------------|----------------------------------|-----------------------------------------------|------------------------------|
| VAULT® SP                 | \$10.92        | 71%       | 1.4                      | 71%         | 2.8 oz./unit of Seed at Planting | Planter Box Additive - Inoculant              | BASF                         |
| TERRAMAX DRY™             | \$10.90        | 60%       | 1.3                      | 60%         | 2 oz./unit of Seed at Planting   | Planter Box Additive - Inoculant              | TerraMax, Inc.               |
| GROPAK™                   | \$9.74         | 73%       | 0.9                      | 73%         | 4 oz./unit of Seed at Planting   | Planter Box Additive - Replaces Talc/Graphite | AgXplore International, LLC. |
| GRAPH-EX SA™ FOR SOYBEANS | \$3.44         | 50%       | 0.8                      | 79%         | 0.5 oz./unit of Seed at Planting | Planter Box Additive - Inoculant              | Agrauxine Corp.              |

**WHAT WE RECOMMEND:** Utilize a planter box additive due to their low cost and ease of use. When choosing products, consider which products contain talc and graphite that can replace your current flowability agent.

# CORN STARTER FERTILIZER & ADDITIVES

Phosphorus (P) availability in cold, wet conditions can be limited. No-till acres and early planted fields are prime candidates for an increased likelihood of response to in-furrow nutrient applications, especially those containing P. Target acres with low P tests or coarse-textured soils.

## PRODUCTS

| STARTER FERTILIZER | PFR PROVEN ROI | ROI WIN % | YIELD ADVANTAGE (BU./A.) | YIELD WIN % | APPLICATION RATE & TIMING | ANALYSIS/ COMPONENTS   | COMPANY                  |
|--------------------|----------------|-----------|--------------------------|-------------|---------------------------|------------------------|--------------------------|
| NACHURS® IMPULSE®  | \$17.67        | 57%       | 9.5                      | 86%         | 5 gal. In-Furrow          | 10-18-4/Bio-K® Acetate | NACHURS ALPINE SOLUTIONS |
| PUREGRADE® DIAMOND | \$12.78        | 60%       | 8.2                      | 90%         | 5 gal. In-Furrow          | 6-24-6                 | The Andersons, Inc.      |

| STARTER FERTILIZER ADDITIVE | PFR PROVEN ROI | ROI WIN % | YIELD ADVANTAGE (BU./A.) | YIELD WIN % | APPLICATION RATE & TIMING                    | COMPONENTS                               | COMPANY                              |
|-----------------------------|----------------|-----------|--------------------------|-------------|----------------------------------------------|------------------------------------------|--------------------------------------|
| P-MAX® LFS                  | \$18.46        | 100%      | 4.6                      | 100%        | 1 gal./ton of Phosphate Fertilizer In-Furrow | Poly Amino (L-Aspartic) Acid             | Rosen's Inc.                         |
| NANON+®                     | \$17.54        | 91%       | 4.0                      | 91%         | 4 oz. 2x2x2                                  | Nanoparticles                            | Aqua Yield Operations, LLC.          |
| MICROCARB®                  | \$11.44        | 73%       | 4.0                      | 82%         | 1 qt. In-Furrow                              | Fulvic Acid + Trace Amounts of Zn, Mn, B | The Andersons, Inc.                  |
| FEED GRADE DEXTROSE         | \$6.50         | 56%       | 2.2                      | 56%         | 4 lb. In-Furrow                              | Sugar                                    | International Ingredient Corporation |
| SYNTOSE FA®                 | \$5.78         | 57%       | 1.7                      | 71%         | 1 pt. In-Furrow                              | Sugars, Molasses, Fulvic Acid            | Conklin Company, Inc.                |
| FEAST® BORON 10%            | \$5.68         | 64%       | 2.8                      | 73%         | 1 qt. 2x2                                    | Boron                                    | Conklin Company, Inc.                |
| EXCEED™ NANO BROWN SUGAR    | \$2.69         | 56%       | 1.2                      | 69%         | 8 oz. In-Furrow                              | Brown Sugar, Humic Acid, Molybdenum      | Max Systems, LLC.                    |

**WHAT WE RECOMMEND:** The best responses to in-furrow sugar applications tend to occur when soils are warmer at planting. This often coincides with the increased biological activity in the soil. Use sugar in-furrow when planting later into warmer soils.

# CORN STARTER PROTECTION

Rainfall patterns are changing, resulting in heavier downpours, and these heavy rain events keep soils saturated longer. Heavier or poorly drained soils are more likely to benefit from additional protection on early planted or no-till fields.

## PRODUCTS

| STARTER PROTECTION | PFR PROVEN ROI | ROI WIN % | YIELD ADVANTAGE (BU./A.) | YIELD WIN % | APPLICATION RATE & TIMING | FUNGICIDE TYPE         | INSECTICIDE TYPE        | COMPANY         |
|--------------------|----------------|-----------|--------------------------|-------------|---------------------------|------------------------|-------------------------|-----------------|
| XYWAY® LFR®        | \$28.36        | 85%       | 8.0                      | 100%        | 10.5 oz. 2x2x2            | Synthetic              | --                      | FMC Corporation |
| CAPTURE® LFR®      | \$10.80        | 63%       | 4.8                      | 88%         | 3.4 oz. In-Furrow         | --                     | Synthetic               | FMC Corporation |
| CAPTURE® VGR®      | \$2.61         | 63%       | 3.5                      | 88%         | 3.4 oz. In-Furrow         | --                     | Synthetic               | FMC Corporation |
| ZIRONAR™           | \$2.41         | 75%       | 2.4                      | 83%         | 6 oz. In-Furrow           | Biological             | Biological (Nematicide) | FMC Corporation |
| XANTHION®          | \$0.71         | 58%       | 3.8                      | 75%         | 7.2 oz. In-Furrow         | Biological & Synthetic | --                      | BASF            |



**WHAT WE RECOMMEND:** Try these products if you're planting early into cooler soils or no-till fields, and there is a high likelihood of seeing a positive return.

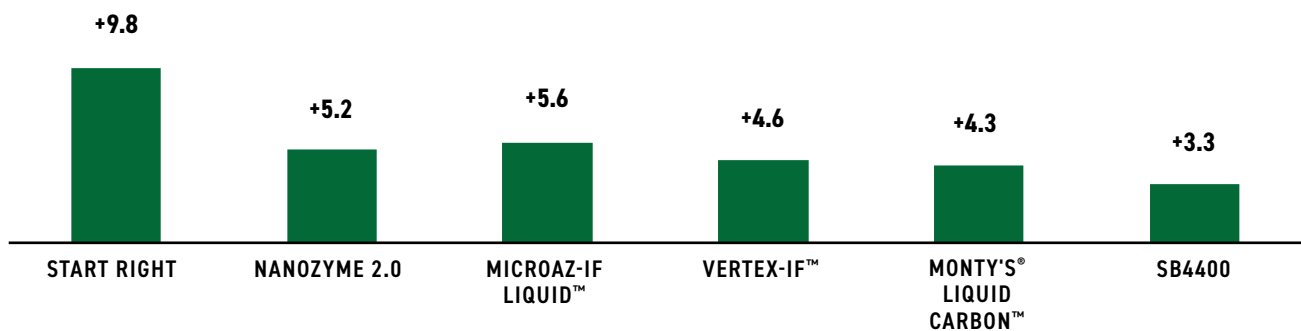
# CORN BIOLOGICALS

The best opportunity for an economic return from biologicals and bio-stimulants likely comes from soils and situations where the native biology may be limited.

## PRODUCTS

| BIOLOGICAL              | PFR PROVEN ROI | ROI WIN % | YIELD ADVANTAGE (BU./A.) | YIELD WIN % | APPLICATION RATE & TIMING | COMPANY            |
|-------------------------|----------------|-----------|--------------------------|-------------|---------------------------|--------------------|
| START RIGHT             | \$39.66        | 86%       | 9.8                      | 86%         | 1 qt. 2x2                 | AgBio Logic, LLC.  |
| NANOZYME 2.0            | \$16.67        | 92%       | 5.2                      | 92%         | 1 pt. In-Furrow           | Max Systems, LLC.  |
| MICROAZ-IF LIQUID™      | \$15.61        | 90%       | 5.6                      | 100%        | 12.8 oz. In-Furrow        | TerraMax, Inc.     |
| VERTEX-IF™              | \$10.90        | 82%       | 4.6                      | 91%         | 1 pt. In-Furrow           | TerraMax, Inc.     |
| MONTY'S® LIQUID CARBON™ | \$6.56         | 60%       | 4.3                      | 90%         | 2 qt. 2x2                 | Monty's Plant Food |
| SB4400                  | \$3.97         | 67%       | 3.3                      | 83%         | 1 pt. In-Furrow           | Soil Biotics       |

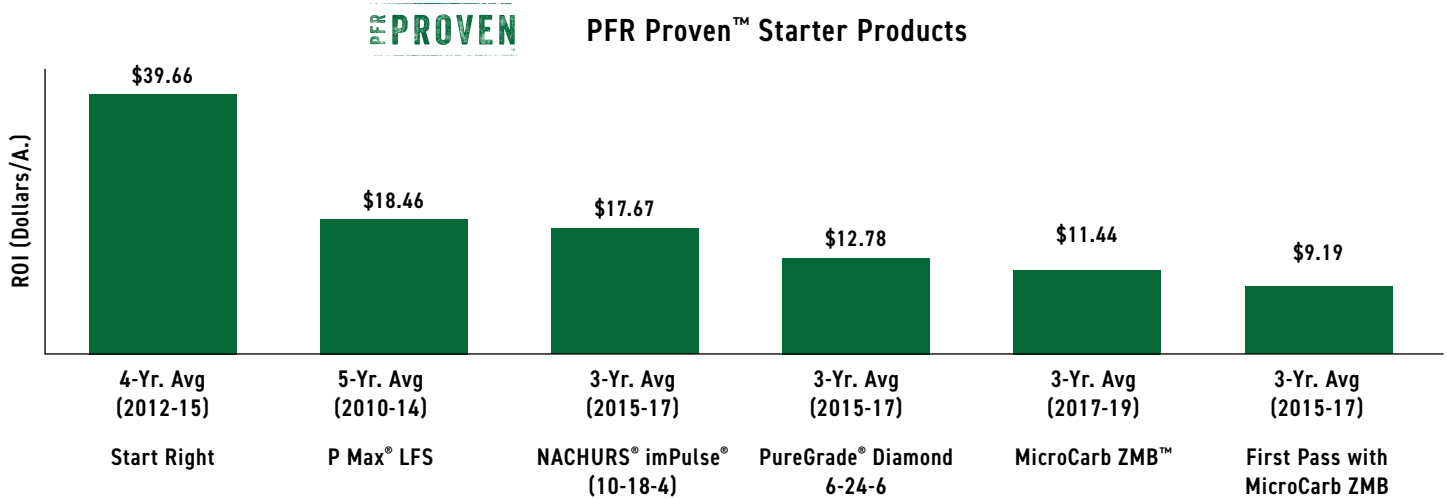
### PFR PROVEN™ BIOLOGICALS YIELD ADVANTAGE (BU./A.)



**WHAT WE RECOMMEND:** When testing biologicals on your farm, try them first on lower organic matter/CEC soils.

# CORN STARTER FERTILIZERS

For many years, research has been conducted on starter fertilizers and placement, either in the row or near the row. The visual observations of the response to a starter often do not necessarily match up with the data at the end of the season. As we continue to learn and develop new products and application technologies, the results seem to be more promising and the responses more consistent. Beck's PFR continues to investigate some of the new application technologies and products that may provide a benefit.



## WHAT NUTRIENT SHOULD WE CONSIDER FIRST?

In all likelihood, the best place to start is with phosphorus (P). First, available P is typically found in lower concentrations in soil water, usually between .01 and 3 ppm. Secondly, it moves into the plant mainly through a process called diffusion. This process moves the nutrient only millimeters each day. The plant takes up P in the orthophosphate form which is either the  $H_2PO_4^-$  or  $HPO_4^{2-}$  molecule (the predominant form present is determined by pH).

As a result, the best way to help mitigate P deficiency to increase the concentration of it in the orthophosphate form and improve placement, since it moves so little in the soil. Other nutrients such as zinc, will also likely benefit from placement due to their low mobility in the soil and the fact that smaller amounts are required to grow a crop. Beck's PFR has tested, and will continue to test, a number of products that attempt to solve both the concentration and placement question.

## ARE THERE OTHER WAYS TO HELP WITH P UPTAKE?

The other way to help increase P uptake could be through the development of mycorrhizae. These fungal "arms" attach to the root and help extend the reach of the root hairs, increasing surface area and therefore aiding in uptake of nutrients like P that have limited soil mobility and are found in low concentrations in soil water. The word mycorrhizae means "fungus root." Beck's is testing various biological products that may aid in creating a favorable environment for mycorrhizal development.



# CORN STARTER FERTILIZERS

## HOW DO YOU GROW MYCORRHIZAL FUNGI TO HELP THE ROOT?

Certain practices can either increase or decrease the presence of mycorrhizal fungi. Heavy tillage can reduce the levels of mycorrhizal colonization, so if tillage is part of your operation, perhaps the use of a product or practice promoting mycorrhizal fungi has merit. Certain crops, such as cover crops in the mustard family, can inhibit mycorrhizae the following year. If you use a mustard species as a cover crop, consider promoting mycorrhizal fungi in another way.

## WHAT ABOUT THE ISSUE OF PLACEMENT?

Beck's PFR has tested 2x2x2 systems Yetter Dual 2968 Series and Precision Planting's Conceal system over three years and witnessed consistent yield gains of 7.0 Bu./A. more when placing nutrients on both sides of the plant. Instead of using one coulter, we now have two. Fertilizer is applied in the same amount in the 2x2x2 as the 2x2 system, but with a reduced salt load on the plant. Nutrients can be more evenly applied to the plant in a 2x2x2 system, resulting in improved root and plant health, as well as root uniformity. An unintended result of placing nutrients only on one side of the row is preferential root growth. Roots proliferate in the direction of higher nutrient concentrations, leaving the other side of the row relatively underdeveloped.

YETTER DUAL 2968 SERIES



### Starter Placement Yield Average

4-Year Multi-Location Nitrogen Placement Yield Average

30 Units N 2x2



215.8 Bu./A.

30 Units N 2x2x2



221.5 Bu./A.

60 Units N 2x2x2



222.8 Bu./A.

Darker bars indicate a higher concentration of the product on each side of the seed.

## HOW DOES THIS IMPACT MY HYBRID SELECTION OR PRODUCT PLACEMENT?

It is challenging to draw direct correlations to a product as it relates to starters and micronutrients. More than likely, the benefits will be driven more by cultural factors such as planting date and soil temperature, or your tillage system and fertility levels in the field. However, in some circumstances, we have observed differences in hybrid response to starter fertilizers based on differences in early-season root growth.

Martin-Till® is a registered trademark of Martin Industries, LLC. P Max® is a trademark of Midtech R&D, Inc. (Manufactured for: Rosen's, Inc.).

NACHURS® is a registered trademark of NACHURS ALPINE SOLUTIONS. PureGrade® is a trademark of The Andersons, Inc.

FurrowJet™ is a trademark of Precision Planting. Seed-Squirter® is a registered trademark of Capstan Ag



# SOYBEAN STARTER FERTILIZER

## NUTRITION

Many growers have added planter systems to apply starters on their corn acres and are interested if they can be profitable in soybeans. While we continue testing many starter products and systems in soybeans, they tend to be less consistent than on corn.

| STARTER NUTRITION           | PFR PROVEN ROI | ROI WIN % | YIELD ADVANTAGE (BU./A.) | YIELD WIN % | APPLICATION RATE & TIMING | ANALYSIS/ COMPONENTS      | COMPANY                  |
|-----------------------------|----------------|-----------|--------------------------|-------------|---------------------------|---------------------------|--------------------------|
| UAN                         | \$11.01        | 56%       | 2.6                      | 88%         | 30 units 2x2x2            | Varies                    | Varies                   |
| FIRST PASS® WITH MICROCARB® | \$9.19         | 60%       | 2.7                      | 80%         | 2 gal. In-Furrow          | 3-5-15/Fulvic Acid, Mn, B | The Andersons, Inc.      |
| THIO-SUL®                   | \$7.85         | 75%       | 1.1                      | 75%         | 2 gal. 2x2x2              | 12-0-0-26S                | Tessenderlo Kerley, Inc. |

**WHAT WE RECOMMEND:** If you want to try starter products, test them on lower organic matter, low CEC soils, or in early-planted no-till systems first.

## PROTECTION

| STARTER PROTECTION | PFR PROVEN ROI | ROI WIN % | YIELD ADVANTAGE (BU./A.) | YIELD WIN % | APPLICATION RATE & TIMING | FUNGICIDE TYPE | INSECTICIDE TYPE | COMPANY         |
|--------------------|----------------|-----------|--------------------------|-------------|---------------------------|----------------|------------------|-----------------|
| CAPTURE® LFR®      | \$15.35        | 71%       | 2.4                      | 86%         | 3.4 oz. In-Furrow         | --             | Synthetic        | FMC Corporation |
| CAPTURE® VGR®      | \$1.97         | 50%       | 0.9                      | 58%         | 3.4 oz. In-Furrow         | --             | Synthetic        | FMC Corporation |
| SERENADE® ASO      | \$1.24         | 43%       | 0.6                      | 64%         | 1 pt. In-Furrow           | Biological     | --               | Bayer Group     |

# SOYBEAN BIOLOGICALS

The best opportunity for an economic return from biologicals and bio-stimulants comes from soils and situations where the native biology may be limited. This includes coarse-textured or lower organic matter soils. Soils with poor health (limited drainage, compaction, etc.) may also benefit from a biological product.

| BIOLOGICAL          | PFR PROVEN ROI | ROI WIN % | YIELD ADVANTAGE (BU./A.) | YIELD WIN % | APPLICATION RATE & TIMING | COMPANY                  |
|---------------------|----------------|-----------|--------------------------|-------------|---------------------------|--------------------------|
| TERRAMAX LIQUID-IF™ | \$13.07        | 67%       | 1.4                      | 92%         | 12.8 oz. In-Furrow        | TerraMax, Inc.           |
| ENVITA™             | \$1.99         | 43%       | 1.1                      | 71%         | 3.2 oz. In-Furrow         | Azotic North America LTD |

# PLANTER MAINTENANCE

Proper planter maintenance and adjustment are critical in maximizing planter performance.

# PLANTER PREPARATIONS

The planter pass is the most important pass of the growing season. Proper maintenance and adjustments are critical in maximizing performance. Always reference the owner's manual for exact specifications and recommended settings.

**PARALLEL LINKAGE:** When the parallel arm components become worn, the row unit can move excessively, increasing meter chatter (causing skips/doubles), leading to erratic seed placement, open seed trenches, and air pockets within the furrow.

**+ With the planter raised while holding on to the rear of the row unit, check for:**

- » Up/down and side-to-side movement
- » Ideally, you want less than 0.5 in. play in the row unit

**+ Ensure bolts, bushings, and arms are tight and not worn**

**+ Check arms and bushings:**

- » Typically, arms are softer than the bushing
- » Upgrading to a kit that has a bushing pressed into the arm for longer life is recommended

**+ After-market kits:**

- » [precisionplantersolutions.com](http://precisionplantersolutions.com)
- » [gbgiusa.com/precision-planting#parallel-arms](http://gbgiusa.com/precision-planting#parallel-arms)
- » [solidrockag.com/parallel-arm-rebuilding](http://solidrockag.com/parallel-arm-rebuilding)
- » [precisionplanting.com/products/planter/durawear#parallel-arms](http://precisionplanting.com/products/planter/durawear#parallel-arms)
- » [shop.integratedagsolutions.com/products/bearingforce-planter-parallel-arms](http://shop.integratedagsolutions.com/products/bearingforce-planter-parallel-arms)
- » To purchase this kit contact your Kinze dealer: [kinze.com/planter-performance/row-units/3005seriesrowunit/](http://kinze.com/planter-performance/row-units/3005seriesrowunit/)

**+ It's unlikely that just replacing the bushings will solve the problem long-term, therefore, regular inspection is recommended.**



Blade to blade contact

"W" Seed Trench

**DISC OPENERS, NO-TILL COULTERS, ROW CLEANERS:** Clearing residue and creating a proper V-shaped seed trench promotes uniform planting depth, seed-to-soil contact, and emergence.

**+ Check the condition and wear of disc openers:** A new 15 in. opener should be replaced at 14.5 in. or when the bevel is at 1/2 of its original measurement. See planter brand chart.

**+ Adjust disc openers so that the contact is within the range listed in the operator's manual:** Make sure the opener is set to the range listed at several contact points around the opener; never set an opener outside of that range. If you have changed to a different thickness of openers, follow this chart for contact ranges.

| PLANTER BRAND    | NEW SPEC   | REPLACE: |
|------------------|------------|----------|
| Kinze/John Deere | 15 in. New | 14.5 in. |
| Cash IH 1200     | 14 in. New | 13.5 in. |
| Cash IH 2000     | 15 in. New | 14.5 in. |
| White 8000       | 15 in. New | 14.0 in. |
| White 9000       | 16 in. New | 15.0 in. |

| CONTACT RANGES |               |
|----------------|---------------|
| 3.0mm Blade    | 2.0 - 2.5 in. |
| 3.5mm Blade    | 1.5- 2.0 in.  |
| 4.0mm Blade    | 1.0 in.       |

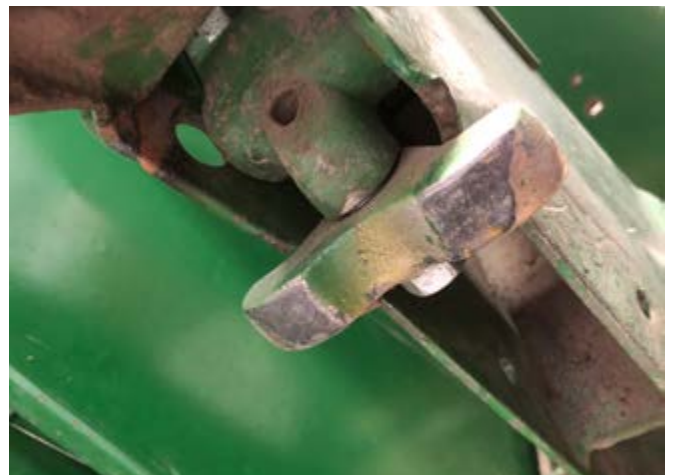
# PLANTER PREPARATIONS

## DISC OPENERS, NO-TILL COULTERS, ROW CLEANERS, CONT.

- ✦ **Too tight of blade-to-blade contact will generate excessive side load on the bearings:** This can lead to premature wear and failure.
- ✦ **Too loose of blade-to-blade contact can cause a "W" shaped trench:** This can result in inconsistent seed depth and uneven emergence.
- ✦ **If replacing seed disc openers, replace the seed tube guard if it is out of spec. Normally when they are worn to less than 5/8".** : An in-spec guard will help form the bottom of the seed trench by reducing opener flex. This also helps reduce excessive side load on opener bearings. The seed tube guard also protects the seed and high-speed seed tubes.
- ✦ **No-till coulters should maintain 0.25 in. clearance above the disc openers depth**
- ✦ **Properly adjusted row cleaners should move residue and clods and not soil:** Adjust them to where they do not dig a trench but rather provide a smooth and clean environment for the seed trench and gauge wheels.

**GAUGE WHEEL:** Gauge wheels should be set so that they lightly contact/scrub the seed disc openers.

- ✦ **If set too loose in dry planting conditions, dry soil can be dropped from the inside of the gauge wheels into the seed trench.**
- ✦ **If set too tight, premature wear will be caused to the gauge wheel tires.**
- ✦ **Make sure the gauge wheel arms and studs are not worn. Follow these links for aftermarket gauge wheel kits:**
  - » [gbgiusa.com/precision-planting#parallel-arms](http://gbgiusa.com/precision-planting#parallel-arms)
  - » [copperheadag.com/product/gauge-wheel-arm-repair-kit/](http://copperheadag.com/product/gauge-wheel-arm-repair-kit/)
  - » [sidist.com/index.cfm?fuseaction=category.display&category\\_ID=222](http://sidist.com/index.cfm?fuseaction=category.display&category_ID=222)
  - » [coyotemachining.com/products/coyote-gauge-arm-1](http://coyotemachining.com/products/coyote-gauge-arm-1)
  - » [www.precisionplanting.com/products/planters/durawear#gauge-wheel-arms](http://www.precisionplanting.com/products/planters/durawear#gauge-wheel-arms)



**ABOVE:** Worn gauge wheel arm (left) and a worn depth equalizer that makes contact to the gauge wheel arm (right).

# PLANTER PREPARATIONS

**INDEXING THE ROW UNIT:** This vital step will find any row-to-row variance with depth settings

✚ **Lower the planter on a smooth level surface. If you don't have a concrete floor, sheets of plywood can be used.**

- » S-Set all T-Handles to the deepest setting.
- » Slide 2"x2" square tubing or similar under the gauge wheels of one row.
- » Shallow the row unit until the T-handle will no longer move.
- » Repeat steps for the remaining rows.
- » Label the calibrated depth position on every row for future depth adjustments.
- » Now that the planter is uniform from row to row, check the planting depth and adjust accordingly in the field.
- » Here is a link to a video demonstrating this procedure: [youtube.com/watch?v=huxKPNEuBTk](https://youtube.com/watch?v=huxKPNEuBTk)

✚ **Parts to check and replace if an extreme variance is found:**

- » Planter manufacturers use different depth mechanisms, and these parts will wear/can cause variance in planting depth from row to row. Parts include gauge wheel arms, d-rings, depth equalizers, and more.
- » Follow this link for a kit to fix gauge wheel arms if they are worn at the depth stop: [copperheadag.com/product/gauge-wheel-clip/](https://copperheadag.com/product/gauge-wheel-clip/)



ABOVE: Worn seed tube

**METERS AND SEED TUBES:** Meter calibration is essential to get a picket fence stand. Worn/broken seed tubes will cause poor spacing and erratic seed placement in the furrow.

✚ **Seed tubes:**

- » No cracks, dog ears, or uneven wear
- » Scarring on the sides of the seed tube is typically caused by a worn seed tube guard. Replace them if you see scarring.

✚ **Finger pickup unit:**

- » Run these meters on a stand each year to check for wear and ensure they are calibrated.

✚ **Vacuum meters:**

- » Seals around the meter can become worn and will prevent an airtight seal.
- » Brushes can also wear out.
- » If you are having singulation issues with vacuum meters, check the above parts for wear. You can have them run on a stand if needed.

✚ **Meter ground units:**

- » Shafts align and spin true and freely.
- » Check for rough spinning bearings and failures.
- » Inspect meter drive chains for wear and movement on the sprockets (worn sprockets or chains can cause the meter to jump).

✚ **At the end of the season, make sure to remove seed discs for storage.**

✚ **Speed tubes:** Certain brands of speed tubes require removing the belt or brush for storage. Check your owner's manual for instructions.

# PLANTER PREPARATIONS

**CLOSING WHEELS:** Properly closing the seed trench provides good seed-to-soil contact without causing sidewall compaction. Follow the manufacturer's recommendations for proper spacing.

- + **Ensure the wheels are centered directly over the seed trench:** Adjust to get the closing wheels positioned correctly.
  - + **Make sure closing wheels are spaced per manufactures recommendations.**
  - + **Check the closing wheel pivot for wear:** If worn, here is a link to an updated kit that can prevent wear in the future:  
[copperheadag.com/product/closing-wheel-frame-repair-kit-worn-tailpiece](https://copperheadag.com/product/closing-wheel-frame-repair-kit-worn-tailpiece)  
[precisionplantersolutions.com/product-page/john-deere-1700-series-closing-wheel-kit](https://precisionplantersolutions.com/product-page/john-deere-1700-series-closing-wheel-kit)
- 

**BULK DELIVERY SYSTEMS:** Bulk seed systems are great for quick fill and easy seed handling, but if not properly serviced, they can cause numerous planting issues.

- + **Check the hopper and seal for wear or cracks that would cause a lack of tank pressure.**
  - + **Check that the agitator inside is functioning properly to avoid seed bridging in the tank.**
  - + **Ensure the manifold and seed delivery hoses are clear of debris and connect/seal properly.**
    - » **Ensure that seed delivery hoses do not sag too much:** When filling a bulk-fill planter for the first time each season, use a higher rate of graphite/talk mix so there will be enough distributed in the tank, hoses, row units, and meters.
- 

## GENERAL MAINTENANCE:

- + **Inspect the hydraulic system for leaks and wear on hoses, valves, and remotes.**
  - + **Check the hydraulic cylinders for wear and leaks and ensure that the planter raises and lowers smoothly.**
  - + **Set the tractor and planter tires to the proper PSI: Consult your operator's manual for the correct specs.**
  - + **Check the overall condition of the toolbar, hitch, markers, etc., for cracks and worn parts:** Repair or replace when necessary.
- 

**TECHNOLOGY/MONITORS:** Monitor and technology issues have quickly become the number one cause of delays on the first day of planting.

- + **Update all software to the latest version.**
- + **Connect all technology systems and make sure everything is communicating properly.**
- + **Clear out last year's information to avoid confusion when planting the new crop.**
- + **Upload new prescriptions and test before the first day of planting if possible.**
- + **Keep consistent client/farm/field names from different passes throughout the season. This will ensure easier access and analysis of data.**



# PLANTER PREPARATIONS

## IN-FIELD ADJUSTMENTS:

- + Check the depth of each individual row to ensure they are planting at a consistent depth.
- + Check and adjust the downforce settings for the conditions in the field:
  - » Chain up the closing wheels and plant around 100 ft. without seed
  - » Check the open seed trench quality
    - If it has already collapsed, the downforce is too low; if the trench is extremely compact, then the downforce is too high.
    - You want to set it somewhere between these two observations and then check it again.
- + Check closing wheel pressure and performance: Take a paint scraper and place it in the seed trench perpendicular to it. Then dig away from the scraper, then remove the scraper. Check for air pockets and good seed-to-soil contact. Adjust if needed.
- + Check that the seed population matches what the monitor is displaying.



Adequate downforce



Too little downforce

**FRAME:** A level planter bar will allow the row units and equipment to operate as engineered.

- + **Leveling the bar should be the first adjustment made in the field:** This adjustment might require a second person because the toolbar needs to be leveled while planting.
  - » **Planters running nose-down will:**
    - Cause the row cleaners to plow
    - Cause no-till coulters to run deeper than disc openers
    - Not allow the closing system to function properly
    - A planter running nose-up will cause similar but opposite problems.

## ADDITIONAL RESOURCES:

[https://sidist.com/index.cfm?fuseaction=category.display&category\\_ID=2221&CFID=243256358&CFTOKEN=6dad054a833d1b5c-1D26C327-F719-E47F-A0606BC-56528C80A&jsessionid=08A04110C6CA75D3269DED0219929B88.cfusion](https://sidist.com/index.cfm?fuseaction=category.display&category_ID=2221&CFID=243256358&CFTOKEN=6dad054a833d1b5c-1D26C327-F719-E47F-A0606BC-56528C80A&jsessionid=08A04110C6CA75D3269DED0219929B88.cfusion)

<https://coyotemachining.com/products/coyote-gauge-arm-1>

<https://coyotemachining.com/products/customer-rebuilt-coyote-gauge-arm>

<https://www.precisionplanting.com/products/planters/durawear#gauge-wheel-arms>



# AGRONOMIC PLANTING TIPS & REMINDERS

Making sound agronomic decisions at planting includes choosing the best planting depth, plant population, and targeting ideal soil conditions will have season-long impacts.

# CORN AND SOYBEAN PLANTING REMINDERS

As you head to the field, here are a few reminders to help you fine-tune your planting operations to ensure the best chance of success with your corn and soybean crops.

## **HYBRID/VARIETY PLACEMENT**

It is important to make sure that you plant corn hybrids and soybean varieties in fields that they are suited for to maximize your yield potential. During the rush of planting season, it's easy to want to grab the bags at the front of the shed or not take the time to switch hybrids as you change fields. While several of our Beck's products are very versatile and will be successful in nearly any situation, some products have placement requirements that are more specific and will reward you at harvest if you place them correctly at planting.

Most likely, you already have a plan in place for which corn hybrids and soybean varieties you are going to plant in each field.

## **PLANTING POPULATION**

Picking the right population can be very important to helping your crop establish a good stand and achieve its top yield potential. In corn, the ideal population can vary based on productivity of the soil and hybrid. Even if you don't have a planter with variable-rate capabilities, you can still change populations based on productivity of the field and the hybrid you are planting. The corn placement sheet linked above gives the recommendations that the Beck's product team makes on ideal population ranges for each hybrid in our lineup.

The ideal soybean population is less dependent on variety and more dependent on row spacing, planter type, soil productivity, planting date, and potential for stand establishment challenges. The following graph shows our PFR results for soybean populations:

You will notice that 100,000 seeds per acre provided the best return-on-investment over 6 years of testing at multiple locations. However, it is only a small number of acres where we would actually recommend planting that low. Here are some thoughts to consider when using these results:

Most of our PFR testing was done in high-yielding environments with little risk of stand establishment issues. In fields with risk of drought stress or saturated soils, or in fields with soils that have a high potential to crust, you'll want to plant higher rates.

All of this testing was in early-planted soybeans. After May 15, we recommend increasing your planting populations by 10,000 seeds per acre to account for the shorter growing season and less vegetative growth potential.

This testing was done with a planter in 15-inch rows. If you are planting with a drill, you'll want to increase your population by at least 20,000 to account for less consistency in spacing and depth.

The take-home message is that low populations work when planted early, with a planter, and on high productive soils. Any time those factors start to change, you'll need to increase your population.

# CORN AND SOYBEAN PLANTING REMINDERS

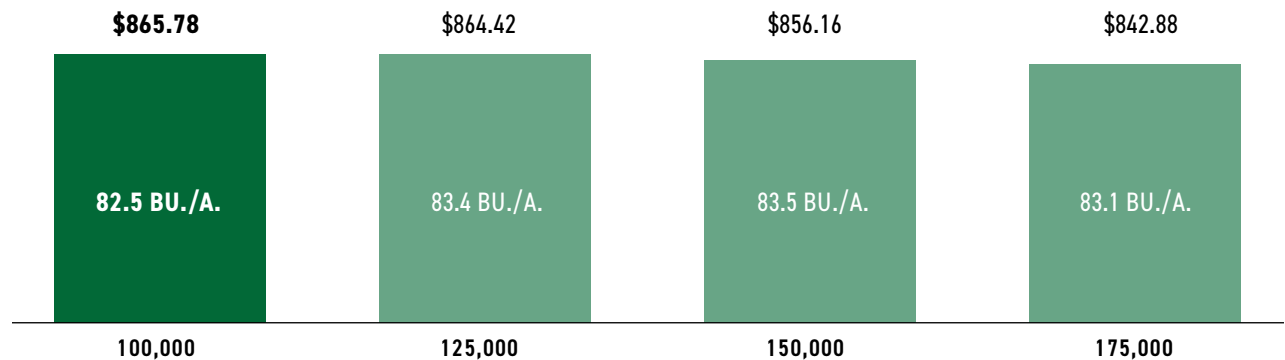
## PLANTING DEPTH

Planting depth is one of the easiest factors to overlook on the day of planting. Here are our PFR results on planting depth in corn:

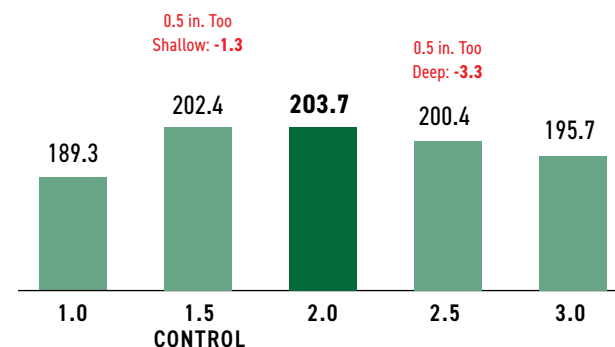
Most of us know that two inches is the ideal depth to plant corn. However, pay attention to the yield penalty if depth is off by just a half-inch. It only takes a few minutes to get out of the tractor and check planting depth in each field. Also, if you feel the need to adjust the depth setting on your planter, be sure to check your down pressure setting as well. Many times, if the planter is not planting deep enough, the issue might actually be that the down-pressure setting is too light instead of the depth setting being too shallow. As farmers, we're always looking for ways to get a few extra bushels: using in-furrow fertilizer, applying foliar feeds, spoon-feeding nitrogen, etc. But don't forget that the basics such as planting depth can get us a nice yield bump as well, if we just invest a little time to ensure it is correct.

In soybeans, PFR has shown that 1.5 inches is the ideal planting depth. This might be a bit deeper than most of us are used to planting. In our observations at the PFR sites, we have noticed more consistent temperatures and moistures when the soybeans are planted deeper, and we also noticed that many of a soybean's nodules form at the same depth at which the beans were planted. Soil is cooler throughout the summer at lower depths, and if the nodules are cooler, they will tend to be more productive, providing more nitrogen to the plant.

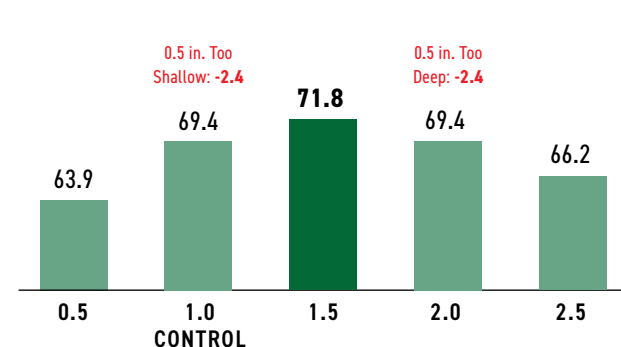
## 6-YEAR, MULTI-LOCATION SOYBEAN POPULATION ROI & YIELD (EARLY PLANTING)



## 3-YEAR, MULTI-LOCATION CORN PLANTING DEPTH



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# IMPACT OF SATURATED SOILS IN COLD CONDITIONS

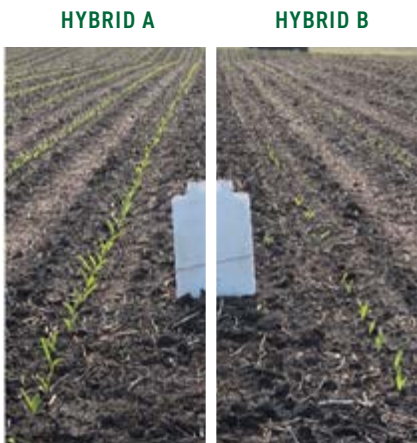


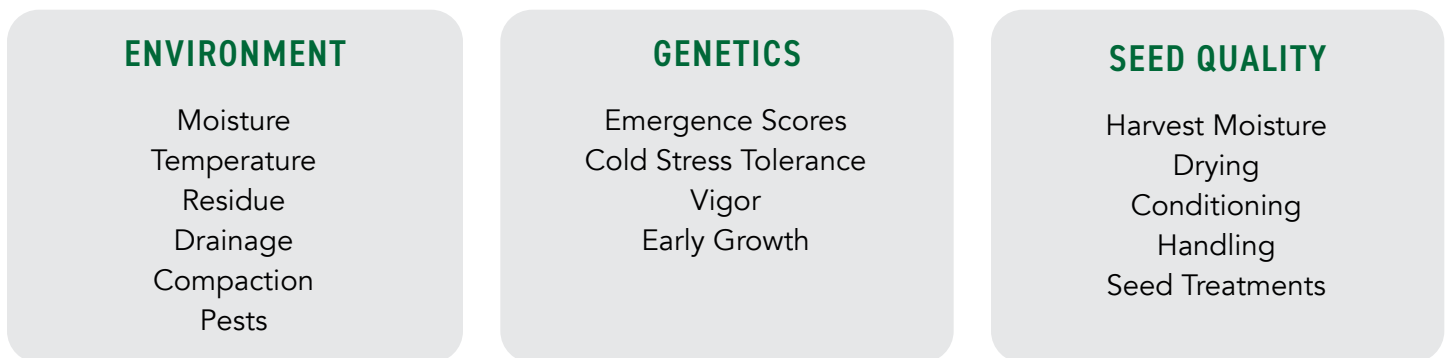
FIGURE 1: Genetic impact of emergence

The following aspects of “planting” will help to mitigate cold and saturated soils following planting:

- Avoid tillage and planting when soils are saturated at the seeding zone
- Soils, when worked wet, can affect seed-to-soil contact and increase compaction at the depth of tillage – impeding natural moisture, temperature, and air movement
- Soils planted wet can create compaction in the seed furrow – impeding both seed-to-soil contact and air exchange, and ultimately root development
- Planting depth should always be maintained for corn and soybeans respectively – we can’t predict the weather

Corn and soybean stand establishment are both dependent on successful germination and emergence and interaction of three key independent factors – environment, genetics, and seed quality as described in Figure 2. Each factor can influence the net stand established. When two or more factors are adverse or stressful, stand establishment will often be less than acceptable. Nebraska Extension provides an in-depth discussion on **Factors Influencing Cold Stress in Corn and Soybean**<sup>1</sup>.

## FIGURE 2. FACTORS THAT AFFECT NET CORN STAND ESTABLISHMENT



Genetically, there are emergence differences amongst corn hybrids and soybean varieties, and they are rated accordingly. Figure 1. depicts a found field difference. Seed size and shape (grade size in corn) are not correlated to germination, vigor, or yield. Please reference Beck’s Agronomy Brief, **Seed Size and Crop Establishment**<sup>2</sup>, for a complete review of this topic.

From a seed quality perspective, both seed corn and soybeans, respectively, are tested for their *warm germination* on a percentage basis – required by Federal Seed Labeling laws. In addition, seed corn may also undergo a Cold Germination test and, potentially, a Saturated Cold Test. These tests are intended to analyze seed quality characteristics and do not speak to genetics nor environmental factors. In Beck’s Agronomy Brief, **Planting Into Cold Soils**<sup>3</sup>, there is a description of the germination process.

1. <https://cropwatch.unl.edu/factors-influencing-cold-stress-corn-and-soybean#:~:text=Cold%20soil%20delays%20the%20time,thrive%20in%20water%2Dsaturated%20soil.>

2. <https://www.beckshybrids.com/Portals/0/SiteContent/Becks-Blog/Atwood/Kernel%20Size-041019-V3.pdf>

3. <https://www.beckshybrids.com/Portals/0/SiteContent/Becks-Blog/Samantha%20Miller/Planting%20into%20Cold%20Soils-AgronomyWhitePaper-030419.pdf>

# IMPACT OF SATURATED SOILS IN COLD CONDITIONS

## Key conditions for the germination process include:

- Corn requires approximately 110 to 120 growing degree units (GDUs – 50°F base) from planting to emergence and should be calculated from soil temperatures, not air temperatures<sup>4</sup>.
- Corn seed is particularly susceptible to cold stresses during the imbibition of cold water, often referred to as imbibitional chilling.
- Warm, moist soil conditions for the first 24 to 48 hours after planting can lessen the impact of cold stress.
- Soybean germination is driven by soil temperature, with 55°F being the recognized base. Data indicates 130 GDUs are needed.

Under both cold and saturated seedbed conditions, not only is the germination > emergence process thwarted because of lack of growth-inducing temperatures (accumulating GDU's) but, saturated soils deprive the seed of oxygen. The lack of oxygen will delay both germination and emergence and put the seeds at risk of rotting.



**FIGURE 3:** Emergence impacted by disease



**FIGURE 4:** Emergence impacted by wireworm



**FIGURE 5:** Emergence impacted by soil crusting – saturated at planting



**FIGURE 6:** Emergence impacted by cold soils and soil crusting – leafing out underground

In Figure 3., this seed corn was subject to both prolonged cold (<45°F) and saturated soil conditions. The prolonged germination > emergence process (> 25 days) negated the value of fungicide seed treatments. In this case, *Pythium* infected the seedling roots and the coleoptile prior to emergence.

In Figure 4., several seeds [from the same field as Figure 3.] were found to have insect (wireworm) damage in addition to seedling diseases. Ultimately, the severely delayed germination > emergence process prolonged seed respiration [ $\text{CO}_2$  attracts insects] and resulted in a weak seedling and dilution of the protectant seed insecticide.

A delayed germination > emergence not only increases the exposure of the seed and young seedlings to soil-borne insects and diseases but surface crusting of a saturated seedbed, seen in Figure 5. Slow germination and mesocotyl elongation increase the risk of underground leafing out due to soil crusting, seen in Figure 6. Until nodal roots develop, corn seedlings are extremely vulnerable to saturated soils and continued seed or mesocotyl damage from disease pathogens and soil-borne insects. Although seedbed conditions can become cold and/or saturated after planting, avoiding planting into these soil conditions has been proven to be more important toward a successful stand.

4. Nielsen, R.L. 1999. Soil Temperature, Corn Emergence and Stand Problems. Chat 'n Chew Café. Online at <http://www.agry.purdue.edu/ext/corn/news/articles.99/990414.html>

## IMPACT OF SATURATED SOILS IN COLD CONDITIONS

In soybeans, a cold, saturated seedbed tends to be just as detrimental following germination. Where the plant needs to establish a radical root and elongation of the hypocotyl must occur to bring the photosynthesizing cotyledons above the soil surface. In Figures 7. and 8., these soybean seeds experienced cold, saturated soil conditions. In both cases, the seed imbibition process began, but radicle root development was impeded by low temps and lack of oxygen. Malformed growth and poor emergence resulted.



**FIGURE 7:** Soybean Seed from Cold, Saturated Seedbed



**FIGURE 8:** Soybean Radicle Root Struggling in Cold, Saturated Soils



**FIGURE 9:** Influence of Residue on Soil Temperatures - Reduced Growth on Left vs. Right with Less Residue

As Mother Nature has the final say on growing conditions following planting, attention to the management of the planting action must occur. Pre-plant tillage and planting operations are the most critical actions that dictate the development of the crop for the rest of the year. Manage to get the most out of the genetic potential in every seed.

- Plant only if the soils are truly “fit,” regardless of your tillage system. The advantages of early planting are negated if the seeds are forced into unfit soils.
- Both seed furrow compaction and compaction above the seed interfere with critical air exchange and capillary movement of water.
- Protect against stand (and yield) loss by delaying planting until soils approach 50°F with a warming trend in the forecast.
- Seedling emergence is reduced when seeds are planted into colder soils or when planting is followed by a cold front that chills the soil water within 24 to 72 hours of planting.
- Seed that imbibes cold rain or snow-melt water in the first few days after planting often is injured, causing loss of stand or poor seedling development.
- Saturated soils can inhibit root growth, leaf area expansion, and the photosynthetic process. In addition, roots may die due to lack of oxygen.
- Residue management in the seed furrow not only affects seed-to-soil contact but, the residue can act as a sponge pulling in excess moisture or as a chimney pulling away heat from the seed.
- Residue management above and on the row not only affects soil temperature, but managing it will give every seed the opportunity to germinate and emerge at a similar time.



# PLANTING INTO COLD SOILS

The first step in initiating seed germination is imbibition of water. As the seed takes on water (up to 30 percent of its own weight for corn and 50 percent for soybeans!), enzymes within the seed start converting starch from storage forms into forms that will help feed the newly awakened embryo. Cell membranes in the seed have to rehydrate to re-initiate growth; that process can go awry in cold temperatures.

## Post-Planting Plant Processes:



After the seed imbibes water, the radicle (first root) emerges from the seed and the coleoptile elongates toward the soil surface.



Coleoptile emerging in a flat in the greenhouse. Imbibing cold water can make the coleoptile corkscrew instead of growing straight.

### 1. Imbibition: Seed takes up water over a 48 hour period

- Taking in cold water (<50°F) damages cell membranes and deforms seedlings.

### 2. Elongation: The hypocotyl and radicle emerge and elongate

- Cold temperatures slow down this process, leaving seedlings vulnerable to abiotic stress and seedling diseases.

### 3. Germination

- Corn: The coleoptile emerges from the soil surface. Cold temperatures slow the plant down, but the growing point is protected below ground until the V5 to V6 growth stage.
- Soybeans: The hypocotyl arch pushes up through the soil, taking the growing point with it. The growing point is exposed to frost after emergence (VE).

## Monitor Soil Temperatures: Use a Meat Thermometer

1. Check soil temperature at planting depth (typically 1.5 to 2 inches).
2. Check the temperature early in the morning before the soil warms up. Soil temperatures regularly swing 10 to 20 degrees throughout the day.

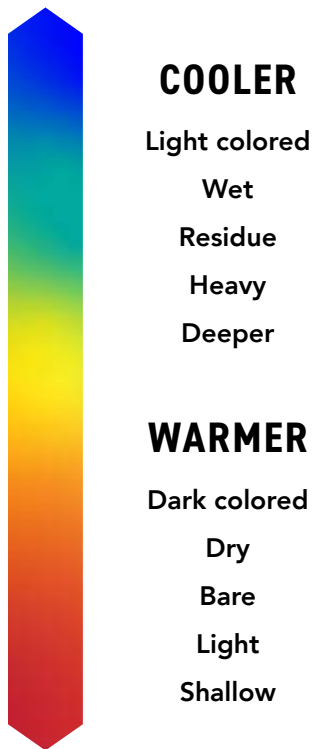
Many state extension services or weather services offer soil temperature monitors that are accessible online.

Cool temperatures after the initial imbibition period may slow the plant down and delay emergence, but won't be as dangerous as chilling in the first 48 hours. The emerging plant is vulnerable to fungi and disease, so using a comprehensive seed treatment like Escalate® powered by Nemasect™ can help to protect seedlings.



Corkscrew-shaped seedling at emergence can be caused by cold water damage. Photo: Travis Burnett





### COOLER

Light colored

Wet

Residue

Heavy

Deeper

### WARMER

Dark colored

Dry

Bare

Light

Shallow

### Decision Making:

In a wet spring, you may be tempted to plant sandier soils first because they are the first to dry out. This can be problematic if there is a cold snap after planting, because the sandy soil has less 'insulating' effect and the seeds will be exposed to colder temperatures than those planted in heavier soils at the same time.

As you look at the forecast, think about it this way: will the plant have a "cold drink" or a "warm drink" immediately after planting? If it is a "cold drink," consider delaying planting.

Soil variability affects soil temperature — be confident about the soil temperature of the coldest part of the farm before planting.

Beck's Practical Farm Research (PFR)<sup>®</sup> has shown that early planting pays over time, but in specific years there can be a risk to being too aggressive getting into the fields. If soil temperature conditions are borderline and the forecast calls for a cool spell, you're better off waiting to plant. If the forecasts show that the weather will be warmer, you may see a benefit from early planting. Typically, there is more to lose with late planting than early planting.

### Pictured:

A healthy plant and adjacent seed damaged by imbibitional chilling. The plant to the left likely germinated under slightly warmer conditions.



Photo credit: Denny Cobb

## SEED SIZE AND CROP ESTABLISHMENT

For a crop to become established, the seeds must germinate and emerge uniformly. Seed size and shape (also called grade size) is not correlated to germination, vigor, nor yield. If planting conditions are good, all grades have equal quality and the size and health of the embryo within the seed does not change with grade size.

GRADE SIZE is determined by genetics and the relative position of the kernel on the seed ear. All kernels on the same seed ear have the same genetic yield potential. Pollination typically begins at the base of the ear and the resulting kernels are larger. When seed ears don't completely pollinate, the fewer kernels result in an overall larger kernel size on that seed ear. Smaller grade sizes come from the tip of the ear. Market grade size is determined by the three-dimensional shape of the kernel, together with seed weight and other factors. Kernels within one grade size are sufficiently similar to ensure consistent plantability.

GERMINATION is the physiological process of the seed imbibing water, reconstituting dehydrated cells, and initiating growth. Germination ends with the plant developing root and shoot tissue and breaking through the soil surface. Warm germination testing is required by law, and the results are published on the seed tag.

EMERGENCE is the plant breaking through the soil surface. Some seeds may germinate but fail to emerge due to poor soil conditions, disease or insect feeding. Hybrid-specific emergence ratings published by Beck's are the result of comparing one hybrid relative to others in the same environment.

VIGOR is a somewhat subjective term that typically pertains to the speed and uniformity at which the seed germinates and emerges.

Uniform germination is a product of good seed-to-soil contact, consistent soil temperature, and even soil moisture. Corn seeds must imbibe 30% of the seed's weight in water to initiate germination; for soybeans, it's 50%. This is a function of seed weight, so under very dry conditions, it can be a slight advantage to smaller seeds, which require less water to germinate.

The period between germination and emergence is a vulnerable time for the crop. Corn requires 100 to 120 Growing

Degree Days (GDDs) to emerge; soybeans require upwards of 130 GDDs. In that time, plants rely on energy from the

seed to push leaves up and establish the root system. If there is an extended cool, wet period between germination and emergence, a larger seed has greater energy reserves. Planting into warm soil, at least 50°F, is more important than seed size in determining uniform emergence.

A comprehensive seed treatment package ensures the health of the young plant. Beck's Escalate® powered by Nemasect™ seed treatment provides protection from a wide range of soil-borne pathogens and includes helpful biologicals and growth promoters that help the young plant get off to a good start.

## AGRONOMIC PLANTING TIPS & REMINDERS

The graph to the right demonstrates the GDDs required for soybeans to emerge across multiple seed sizes. Corn behaves similarly with respect to seed size and GDDs to germination.

### Management Considerations:

Seed size (seeds/lb.) and minimum germination percentage are found on the seed tag. All Beck's seed meets stringent quality parameters.

Kernel grade size does not impact silking date or grain yield.

Wait until soils are at least 50°F to plant. Cold soils can cause plants to leaf out underground.

Adjust your planter for each grade size. Be sure to follow the manufacturer's recommendations and readjust if switching from one grade size to another.

The fitness of your soil is as critical as the planting operation for seed-to-soil contact and minimizing emergence difficulties from open seed slots or crusting.

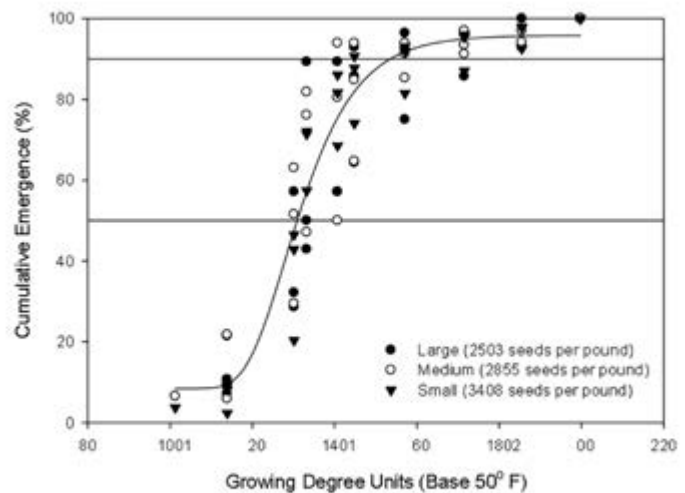
### FOR ADDITIONAL INFORMATION:

<https://crops.extension.iastate.edu/corn/production/management/planting/kernel.html>

<https://www.agry.purdue.edu/ext/corn/news/articles.96/p&c9606.htm>

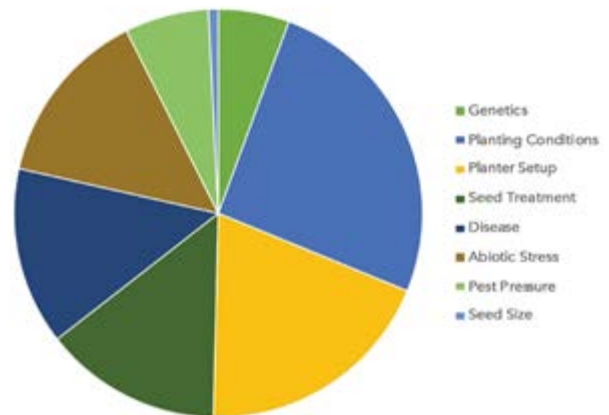
[http://www.coolbean.info/pdf/soybean\\_research/early\\_season/Predicting\\_soy\\_emergence.pdf](http://www.coolbean.info/pdf/soybean_research/early_season/Predicting_soy_emergence.pdf)

### CUMULATIVE SOYBEAN EMERGENCE BASED ON SOIL TEMPERATURE GROWING DEGREE UNITS (BASE 50° F)



**RIGHT:** Soybean emergence is driven by soil temperature more than seed size. The same holds true for corn. Chart adapted from the University of Wisconsin

### INFLUENCE ON EARLY-SEASON CROP ESTABLISHMENT



### ACTUAL SIZE AND SHAPE COMPARISON OF BECK'S GRADE SIZES AND RELATIVE POSITION ON A SEED EAR.

