Micronutrients, Biostimulants and PRGs to Increase Yields in Soybeans

Brian Haschemeyer
2019 Soybean Summit

Brandt Specialty Division
Omission Trials - Standard Treatment

<table>
<thead>
<tr>
<th>Fall NH₃</th>
<th>Spring NH₃</th>
<th>Total Nutrition</th>
<th>Planting Date</th>
<th>Population</th>
<th>Harvest Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>150 Units</td>
<td>150 Units</td>
<td><strong>Corn:</strong> 190-50-150-20S</td>
<td>4/23/18 - 4/25/18</td>
<td><strong>Corn:</strong> 42,000</td>
<td>9/4/18 - 10/1/18</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Soybeans:</strong> 15-50-150-20S</td>
<td></td>
<td><strong>Soybeans:</strong> 120,000</td>
<td></td>
</tr>
</tbody>
</table>

**Fungicide/Insecticide/Nutrition Application**
- **Corn:** Hero®, BRANDT® Smart B-Mo, Delaro®
- **Soybeans:** Hero, BRANDT Smart Trio®, BRANDT Smart B-Mo & Quadris®

**Herbicide/Nutrition Application**
- **Corn:** (Pre-emergent) Resicore®; (Post-applied) BRANDT Smart Trio & BRANDT Smart B-Mo
- **Soybeans:** (Pre-emergent) Boundary®; (Post-applied) Glyphosate, BRANDT Smart Trio & BRANDT Smart B-Mo
## Omission Trials - Standard Treatment

<table>
<thead>
<tr>
<th>Total Nutrition</th>
<th>Planting Date</th>
<th>Population</th>
<th>Harvest Date</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Fall NH&lt;sub&gt;3&lt;/sub&gt;</th>
<th>Preplant 28%</th>
<th>At Plant Nutrition</th>
<th>Side Dress 28%</th>
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</thead>
<tbody>
<tr>
<td>Corn: 140 Units - with N-Serve</td>
<td>60</td>
<td>0</td>
<td>0</td>
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</tbody>
</table>

### Fungicide/Insecticide/Nutrition Application
- **Corn**: Trivapro®, Warrior II with Zeon Technology®, Lorsban®, BRANDT Smart Trio, BRANDT Smart B-Mo
- **Soybeans**: Trivapro, Warrior II with Zeon Technology, Lorsban, BRANDT Smart Trio, BRANDT Smart B-Mo, N-Boost® 5

### Herbicide/Nutrition Application
- **Corn**: (Pre-emergent) Acuron® (Post-applied) Halex® GT, BRANDT Smart Trio & BRANDT Smart B-Mo
- **Soybeans**: (Pre-emergent) Boundary (Post-applied) Engenia®, Roundup WeatherMax®, BRANDT® Smart Sulfur Plus
BRANDT Total Acre 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 the parts of the system.

- 15-50-150 suspension in fall
- 120,000 population
- 7 gal/ac ATS at plant (2x0)
- BRANDT Elite seed treatment
- Conventional tillage
- Boundary burn down prior to plant - 4/12/2018
- Post applied herbicide tank mixes + BRANDT Smart Trio or Brandt Smart Quatro Plus + BRANDT Smart B-Mo at 3rd trifoliate
- Foliar insecticide at R1 plus 1 qt/ac BRANDT Smart Trio + 1 pt/ac BRANDT Smart B-Mo
- Strobilurin at R3/insecticide + 1 pt/ac BRANDT Smart Trio + 1 pt/ac BRANDT Smart B-Mo
BRANDT Total Acre Pole Positions

1. Planting Date
2. Variety
3. Maturity
4. Seed Treatment
5. Sulfur (ATS)
6. P&K Rate
7. Strobilurin
8. BRANDT Smart B-Mo at R2-R4
9. Foliar Insecticide
10. BRANDT Smart Trio
11. Cover Crop
12. Population
BRANDT Total Acre Pole Positions

<table>
<thead>
<tr>
<th>BRANDT Total Acre Pole Positions</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>8 yr Avg</th>
<th>8 yr ROI</th>
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<tbody>
<tr>
<td>1 Planting Date</td>
<td>n/a</td>
<td>6.8</td>
<td>8.3</td>
<td>13.6</td>
<td>11.0</td>
<td>45.3</td>
<td>51.8</td>
<td>23.9</td>
<td>23.0</td>
<td>$$$</td>
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<tr>
<td>2 Variety</td>
<td>25.6</td>
<td>14.6</td>
<td>19.3</td>
<td>17.5</td>
<td>7.0</td>
<td>12.4</td>
<td>23.5</td>
<td>16.7</td>
<td>17.1</td>
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<tr>
<td>3 Maturity</td>
<td>17.0</td>
<td>10.2</td>
<td>13.0</td>
<td>8.5</td>
<td>0</td>
<td>12.4</td>
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<td>16.7</td>
<td>12.7</td>
<td>$$$</td>
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<tr>
<td>4 Seed Treatment</td>
<td>6.1</td>
<td>11.9</td>
<td>7.4</td>
<td>5.5</td>
<td>8.5</td>
<td>12.9</td>
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<td>16.3</td>
<td>9.5</td>
<td>5.3</td>
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<tr>
<td>5 Sulfur (ATS)</td>
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<td>n/a</td>
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<td>4.8</td>
<td>4.8</td>
<td>8.8</td>
<td>12.2</td>
<td>14.1</td>
<td>8.1</td>
<td>6.2</td>
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<tr>
<td>6 P&amp;K Rate</td>
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<tr>
<td>7 Strobilurin</td>
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<td>3.2</td>
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<td>4.2</td>
<td>10.0</td>
<td>5.7</td>
<td>2.9</td>
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<tr>
<td>8 BRANDT Smart B-Mo at R2-R4</td>
<td>n/a</td>
<td>n/a</td>
<td>1.0</td>
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<td>6.3</td>
<td>5.4</td>
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<tr>
<td>9 Follar Insecticide</td>
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<td>5.7</td>
<td>4.9</td>
<td>3.4</td>
<td>n/a</td>
<td>2.9</td>
<td>5.1</td>
<td>n/a</td>
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<td>5.2</td>
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<tr>
<td>10 BRANDT Smart Trio</td>
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<td>3.9</td>
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<td>3.3</td>
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<td>n/a</td>
<td>2.0</td>
<td>2.8</td>
<td>3.1</td>
<td>5.9</td>
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<tr>
<td>11 Cover Crop</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>9.5</td>
<td>0</td>
<td>1.4</td>
<td>-2.0</td>
<td>3.0</td>
<td>1.6</td>
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<tr>
<td>12 Population</td>
<td>2.5</td>
<td>2.8</td>
<td>3.6</td>
<td>0</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>2.2</td>
<td>1.9</td>
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</tbody>
</table>

The ROI (Return On Investment) listed is calculated using the 2018 fall crop Insurance price of $8.60 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.

8 Year Average Yield Advantage

The chart shows the 8 year average yield advantage for each practice compared to a control. The practices are ranked from highest to lowest yield advantage, with the highest yield advantage being 23.0 bu/acre for Planting Date.
$8.60/bu.

Bu/ac

Corn

BRANDT®
Soybean Planting Date Trials - 2017

<table>
<thead>
<tr>
<th>Date</th>
<th>Yield (Bu/ac)</th>
<th>Price ($/ac)</th>
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<tbody>
<tr>
<td>22-Mar</td>
<td>111.7</td>
<td>$1089</td>
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<tr>
<td>12-Apr</td>
<td>102.9</td>
<td>-$85.80</td>
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<tr>
<td>25-Apr</td>
<td>99.9</td>
<td>-$115</td>
</tr>
<tr>
<td>09-May</td>
<td>81.2</td>
<td>-$297</td>
</tr>
<tr>
<td>26-May</td>
<td>71.2</td>
<td>-$395</td>
</tr>
<tr>
<td>07-Jun</td>
<td>59.9</td>
<td>-$505</td>
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</table>
Green Stem Syndrome-INSECTS
2018 Soybean Grower Insights to Increasing Yields

Soybeans throughout central Illinois were really good in 2018. We witnessed more growers hit 100+ bu/ac than ever before and overall averages for our trade area were among the best in the country, again. We will do our job on the research farms to continue to push the genetics as far as we possibly can.

- Sulfur at planting on soybeans creates bigger root nodules = more yield
- Foliar applications of BRANDT Smart B-Mo makes nitrogen “behave” in the plant
- Plant early with a seed treatment to maximize yield and profit
- Lower populations provided better yields and improved standability
- The number one management to consider is fungicide, BRANDT Smart B-Mo and insecticide at R4
Population Study

The population trial at our Lexington location was designed to identify the ideal planting population for early planted soybeans. Factors to consider when changing the population are planting date, management, fertility, soil and row width.

- A population that is too high will have issues with nutrient availability and late season standability
- A population that is too low will not achieve maximum yield
- Consider a higher population as the planting window closes
- It is essential that seed treatments are used with lower populations and early planting dates

Use field data, variety selection and planting date to determine the correct population for your fields. Keep in mind that populations will vary from field to field.
Planting Date

The 2018 soybean planting date trial confirmed that early planting will yield higher than later planting. This year we added an additional variable to the trial by having a treated and untreated seed at each planting date. This trial proves the importance of soybean seed treatments.

- For the 4th consecutive year, earlier planted soybeans were the yield winners
- The comparison of treated vs untreated soybeans demonstrates the importance of treatment technologies protecting yield at early planting date
- Seed variety selection and treatment rank among the highest ROI in soybean production
- Early planting typically means a longer reproductive period

Data from both Pleasant Plains and Lexington, IL confirm the trend we have seen for consecutive years. Early planted soybeans have a greater chance to achieve higher yields.
This soybean trial looks at two variables: sulfur (ATS) applied at planting and tillage. Sulfur is important in facilitating chlorophyll development. This is why soybeans lacking sulfur will appear a lighter shade of green than those with sufficient sulfur. Soybeans also utilize sulfur during the process of nitrogen fixation.

- Ammonium thiosulfate (ATS) significantly increased yields across all tillage practices.
- ATS was applied at planting in a 2x0 placement at a rate equal to 20 lbs of sulfur per acre.
- ATS is our preferred source of sulfur due to its combination of elemental and sulfate forms.
- The ROI is very favorable for sulfur applications.
Soybean Post Application Trips

Pleasant Plains

- **Application 1:** 32 oz/ac Roundup®, 10 oz/ac Outlook®, 1 pt/ac BRANDT Smart Trio, 1 pt/ac BRANDT Smart B-Mo
- **Application 2:** 5 oz/ac Hero, 1 pt/ac BRANDT Smart Trio, 1 pt/ac BRANDT Smart B-Mo
- **Application 3:** 8 oz/ac Delaro, 5 oz/ac Hero, 1 pt/ac BRANDT Smart Trio, 1 pt/ac BRANDT Smart B-Mo
- **Application 4:** 5 oz/ac Hero, 1 pt/ac BRANDT Smart Trio, 1 pt/ac BRANDT Smart B-Mo
- **Application 5:** 5 oz/ac Hero, 1 pt/ac BRANDT Smart Trio, 1 pt/ac BRANDT Smart B-Mo, 1 qt/ac N-Boost 5

Yield Response to Multiple Foliar Post Applications

Pleasant Plains, IL

Soybeans

Foliar Applications
Soybean Post Application Trips

Boundary

1. 32 oz Roundup, 10 oz Outlook, 1 pt BRANDT Smart Trio, 1 pt BRANDT Smart B-Mo

2. 5 oz Hero, 1 pt BRANDT Smart Trio, 1 pt BRANDT Smart B-Mo

3. 8 oz Delaro, 5 oz Hero, 1 pt BRANDT Smart Trio, 1 pt BRANDT Smart B-Mo

4. 5 oz Hero, 1 pt BRANDT Smart Trio, 1 pt BRANDT Smart B-Mo

5. 5 oz Hero, 1 pt BRANDT Smart Trio, 1 pt BRANDT Smart B-Mo, 1 qt N-Boost 5

V3, V8, R1, R2, R3, R4, R5, R6
11 Year Response to Fungicide, Insecticide and BRANDT Smart B-
Mo

Soybean yields have accelerated in central Illinois over the last five years. Driven by economics, increased management is being applied to soybean production on increased acreage. Fungicide/insecticide/boron applications have played a key role in the increased yields.

- 2018 showed the highest yield response to fungicide and BRANDT Smart B-Mo in our 11 year data set. This was the experience throughout most of central Illinois.
- Fungicide application timing is ideal for the addition of BRANDT Smart B-Mo. Boron and molybdenum play key physiological roles in soybeans.

Multi-Year Yield Advantage
Yield Advantage with Fungicide Application

[Graph showing yield advantage with fungicide application]

Pleasant Plains, IL
Soybeans
Foliar Applications
Foliar Iron – Effects on Cercospora Leaf Blight

- Effects of Iron on Cercospora Leaf Blight of Soybeans

**Figure 7.** Relationship between severity of blight leaf symptoms (percentage of leaf area affected), and iron concentration in leaves (mg/kg dry matter). Bars indicate standard error between four replications.

**Figure 8.** Nontreated
The number one contributing factor for increased revenue in 2018 was great yields. The prices used to calculate revenue were $3.68/bu for corn (+$.19/bu vs 2017) and $8.60/bu for soybeans (-$1.15/bu vs 2017). Good weather, product selection and placement, and proper management of each acre gives growers the best chance for increased profitability at harvest.
2018 On Farm High Yield Programs
Brandt High Yield Tissue Tests

![Bar chart showing nutrient levels for different elements and time periods.](image-url)
Soybean Post Application Trips

**Soybeans**

**Foliar Applications**

Pleasant Plains, IL

1. **EAL**
   - 32 oz Roundup, 10 oz Outlook, 1 pt BRANDT Smart Trio, 1 pt BRANDT Smart B-Mo

2. **ATR1**
   - 5 oz Hero, 1 pt BRANDT Smart Trio, 1 pt BRANDT Smart B-Mo

3. **ATR3**
   - 8 oz Delaro, 5 oz Hero, 1 pt BRANDT Smart Trio, 1 pt BRANDT Smart B-Mo

4. **AT R4**
   - 5 oz Hero, 1 pt BRANDT Smart Trio, 1 pt BRANDT Smart B-Mo, 1 qt N-Boost 5

5. **AT R5**
   - 5 oz Hero, 1 pt BRANDT Smart Trio, 1 pt BRANDT Smart B-Mo, 1 qt N-Boost 5

At Plant – Key Products

<table>
<thead>
<tr>
<th>Product</th>
<th>Type</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>EnzUp Zn</td>
<td>Enzymes – Nutrient uptake enhancer</td>
<td>1 qt/acre</td>
</tr>
</tbody>
</table>
Soybean management has increased to boost yields and profitability. One area we have seen sizable yield increases is in early season nutrition.

- BRANDT EnzUp is a patented enzyme technology that increases nutrient availability and uptake
- Early nutrition sets the foundation for plant health and late season yield

There are several viable fertilizer solutions that benefit plant yield in soybean production. Early nutrition is an important part of a high yield soybean program.
Product Spotlight: BRANDT EnzUp Zn

Contains a High Concentration of Mannanase and Lipase Enzymes That Boost Nutrient Availability and Uptake

**Mannanase enzyme** - its primary function is to break down starches in the exudate that surrounds the outermost layer of the root tips. This chemical reaction creates a draw of water and nutrients to the root zone and releases sugars to the plant. This in turn boosts root growth and increases microbial activity.

**Lipase enzyme** - its primary function is to break down lipids in root exudates and organic residue in the soil allowing for better water flow and nutrient uptake by the roots.
Foliar – V Stages – Zn, Mn and B key micronutrients

<table>
<thead>
<tr>
<th>Product</th>
<th>Type</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brandt Smart Trio /</td>
<td>Micronutrient Zn + Mn + S</td>
<td>1 qt/acre</td>
</tr>
<tr>
<td>Brandt Smart Quatro</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brandt Smart B Mo</td>
<td>Micronutrient B + Mo</td>
<td>1 pt/acre</td>
</tr>
</tbody>
</table>
Over 50% of total Zn utilization occurs during seed development, a good portion is translocated from the pod and leaf.

**Soybean Zinc Uptake**

- Seed
- Pod
- Stem
- Leaf


**Grain Zn Removal (lb/acre)**

- Zinc

Mallarino, J., Iowa State University, 2011. Nutrient Uptake by corn and soybeans, removal and recycling with crop residue
Boron Utilization in Soybeans

- The demand for boron shows very clear peaks in the key growth stages and reproductive stages.

![Soybean Boron Uptake Graph]


Mallarino, J., Iowa State University, 2011. Nutrient Uptake by corn and soybeans, removal and recycling with crop residue
The Effect of Stress on Vegetative Soybeans

- **Effects of Stress at Vegetative Stage**
  - Growth on soybean during drought is diminished.
  - Root growth increase as plant carbohydrates are shifted downward to roots.

- **Effects on Soybeans during grain fill**
  - Flower and pod abortion
  - Drought can reduce pod # by 20% as a result of flower and pod
  - Early maturity and shortening of grain fill periods
  - Nodule health can be affected by lack of carbohydrate supply

*Figure 1: D-deficient soybean pods, Station, U. of Arkansas, 2000.*
Location of Superoxide Dismutases (SODs)

Expression of SODs genes is up-regulated in response to environmental stresses. In some species low zinc status can negatively affect Cu-Zn SOD expression.

- **Mitochondrion**: Mn SOD
- **Chloroplast**: Fe SOD, Cu-Zn SOD
- **Cell Wall**: Cu-Zn SOD
- **Cytosol**: Cu-Zn SOD
- **Peroxisome**: Cu-Zn SOD, Mn SOD
Role of Micronutrients in Plant Health
Superoxide Dismutase (SOD)

$O_2^-$ generation
(enhanced by abiotic stresses)
(enhanced under Zn, Mn, Fe or Cu deficiency)

$O_2^-$ generation
(-Zn) (-Mn) (-Fe) (-Cu)

$O_2^-$ detoxification
(decreased under Zn, Mn, Fe or Cu deficiency)

$O_2^-$ detoxification
(+Zn) (+Mn) (+Fe) (+Cu)

Enhanced oxidation processes

Lipid peroxidation, Chlorophyll degradation
(numerous types of cell damage)

IAA degradation
(via oxidative degradation)

Membrane leakage

Chlorosis, necrosis

Inhibition of shoot growth

Increased susceptibility to pathogens

Decrease in Photosynthesis

Less tolerant to abiotic stresses

Yield Loss

Cakmak and Marschneer, 1988a, b and Cakmak, et al., 1989
Table 4. Interaction effect of water stress and foliar application in yield physiological traits and seed vigor of two soybean cultivars

<table>
<thead>
<tr>
<th>Stress level</th>
<th>Foliar application levels</th>
<th>Superoxide dismutase</th>
<th>Peroxidase</th>
<th>Catalase</th>
<th>Chlorophyll a</th>
<th>Chlorophyll b</th>
<th>Chlorophyll a + b</th>
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<tbody>
<tr>
<td></td>
<td>F₀</td>
<td>3.62 b</td>
<td>3.32 a</td>
<td>136 a</td>
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<td>I₁</td>
<td>F₁</td>
<td>3.63 b</td>
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<td>170 b</td>
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<td>1.83 a</td>
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<table>
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<th>Foliar application levels</th>
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<th>Soluble carbohydrates</th>
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<th>Rate of germination</th>
<th>Grain yield</th>
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<td>F₀</td>
<td>3.68 a</td>
<td>16529 a</td>
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<td>0.530 b</td>
<td>21.38 b</td>
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<td></td>
<td>F₂</td>
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<td>0.540 a</td>
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<td>I₂</td>
<td>F₀</td>
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<td></td>
<td>F₂</td>
<td>6.94 b</td>
<td>17597 b</td>
<td>0.430 a</td>
<td>22.44 a</td>
<td>3215 a</td>
</tr>
<tr>
<td>I₃</td>
<td>F₀</td>
<td>62.31 a</td>
<td>22922 a</td>
<td>0.452 b</td>
<td>14.49 b</td>
<td>2011 b</td>
</tr>
<tr>
<td></td>
<td>F₁</td>
<td>61.85 a</td>
<td>22824 a</td>
<td>0.460 b</td>
<td>14.94 b</td>
<td>2030 b</td>
</tr>
<tr>
<td></td>
<td>F₂</td>
<td>6.17 b</td>
<td>17283 b</td>
<td>0.509 a</td>
<td>20.44 a</td>
<td>3082 a</td>
</tr>
</tbody>
</table>

At each stress level, surface treatments with the same letters are shown, with no significant difference.

- I₁ = control / well watered / not stressed
- I₂ = stressed by skipping irrigation (V₅ to R₁)
- I₃ = stressed by skipping irrigation (R₁ to R₃)
- F₀ = no foliar application
- F₁ = foliar application of distilled water
- F₂ = foliar application of zinc sulfate
Herbicide Stress
1 day after application (Roundup plus Resource plus Smart Trio)
Herbicide Stress
3 days after app. (Roundup+Resource plus Smart Trio)
Herbicide Stress
10 days later
### Foliar – R Stages - PGRs and Biostimulants

<table>
<thead>
<tr>
<th>Product</th>
<th>Type</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>N-Boost 5</td>
<td>Nitrogen Metabolism &amp; Usage at Cellular Level</td>
<td>1 to 2 qts/acre</td>
</tr>
<tr>
<td>Ascend SL</td>
<td>Cytokinin, Gibberillic Acid, Auxin</td>
<td>3.4 fl oz/acre split: V3 to V5 and R1 to R3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.7 fl oz/acre between between R1 to R3</td>
</tr>
</tbody>
</table>
Ascend® SL Overview

- Ascend® SL is an EPA registered Plant Growth Regulator

- Comprised of 3 main plant hormones
  - Cytokinin
  - Gibberellic Acid
  - Auxin

- Label use recommendations for soybeans
  - Foliar application between 3rd and 5th trifoliate leaf followed with an application between R1 and R3 both at a 3.4 fl oz/A rate
  - OR
  - Foliar application between R1 and R3 at a 6.7 fl oz/A rate
Ascend® SL improved soybean plant height on average 15.17 cm

P-Value < 0.001
N = 13
LSD = 5.12

Untreated

Ascend® SL

Plant Height (cm)
On average, Ascend® SL improved soybean pod count by 29.89

Pod count

Untreated

Ascend® SL

A

B

P-Value < 0.001
N = 13
LSD = 11.35
On average, Ascend® SL increased soybean nodes by 1.38
Data Insights

Average Yield (bu/A)

- **2015**: +5.83 bu/A
- **2016**: +5.55 bu/A
- **2017**: +4.21 bu/A

**Yearly Yield Averages**

©2016. WinField is a registered trademark and WinField United is a trademark of Winfield Sol.
Summary

• A foliar application of Ascend® SL provided yield increases to soybeans in on-farm trials

• Ascend® SL provided multiple agronomic benefits
  – Increased stem diameter
  – Taller plant height
  – Greater number of nodes
  – More pods per plant

• Over the three years of testing, the average yield response was +5.2 bu/A
## Foliar – R Stages - PGRs and Biostimulants

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N-Boost and the Role of Fermented Sugarcane Extract

Guaranteed Analysis

<table>
<thead>
<tr>
<th>Component</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Nitrogen (N)</td>
<td>5.0%</td>
</tr>
<tr>
<td>5.0% Urea Nitrogen</td>
<td></td>
</tr>
</tbody>
</table>

Also contains nonplant food ingredients.

General Information

N-Boost 5 is recommended for use on field, row and vegetable crops listed below as part of a balanced fertility program.

Rate Recommendations

- Leafy Vegetables (including potatoes, sugar beet, sweet potatoes, carrots, etc.): Apply 2-3 qta at tuber initiation and repeat 3 weeks later.
- Bulb Vegetables (including onions, garlic, leeks): Apply 1-2 qta at first bulb leaf and repeat 4 weeks later.
- Cucurbits Vegetables (including melons, squash, cucumbers): Apply 1-2 qta at flowering and repeat 4 weeks later.
- Corn and Soybeans: Apply 2-3 qta between 66 to 85 days.
- Cereal Grain: (including rice, wheat): Apply 2-3 qta at end of tillering or at early stem extension.
- Cotton: Apply 2-3 qta at first flowering and repeat 2 weeks later.
- Pasture (grass and legumes): Apply 1-2 qta 3-5 days after each cutting and/or grazing.

Sugarcane: Apply 1-2 qta at 20 inch cane height and repeat 30 days later.

Mixing and Handling Instructions

Put 1/3 to 2/3 of desired water volume in tank. Add adjuvant(s) and pesticide(s) if desired and agitate until thoroughly mixed. Add desired amount of N-Boost and agitate until thoroughly mixed. Fill tank with remainder of desired water. A jar test is a good field practice for evaluating compatibility of multiple chemical mixtures.

Helps Soybeans Maintain Nitrogen from R3 to R7

N-Boost is a registered trademark of Donaghys Industries Ltd.
N-Boost 5 – Improves Nitrogen Metabolism

N-Boost 5
R3 timing

bu/acre

2015 2016 2017 2018
0 1 2 3 4 5 6
## Foliar – R Stages - Key Brandt Products

<table>
<thead>
<tr>
<th>Product</th>
<th>Type</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brandt Smart Trio</td>
<td>Micro Zn + Mn + S</td>
<td>1 pt/acre</td>
</tr>
<tr>
<td>Brandt Smart B Mo</td>
<td>Micronutrient B + Mo</td>
<td>1 qt/acre</td>
</tr>
</tbody>
</table>
BRANDT® Smart B-Mo™
High Performance Foliar Boron

- New boron and molybdenum formulations in BRANDT Smart System foliar nutrient line
- Designed for compatibility and efficiency
- Up to 8x more efficient than 10% boron
- Compatible with other micro’s, such calcium and zinc; and crop protection products with very specific pH use ranges
- Allows greater tank mix flexibility and peace of mind
BRANDT® Smart B-Mo™
High Performance Foliar Boron

Soybeans, like all legumes, have a high Boron requirement.

- Increased root nodule development for nitrogen fixation
- Increased branching and flowering
- Increased bloom retention
- Increased pod number

Nitrate reductase activity, vitamin synthesis

\[ \text{NO}_3^- \rightarrow \text{NH}_2 \]

Root-nodule bacteria also requires Mo

Brandt Smart B Mo – Research Farm

- 2017 Pleasant Plains Research Farm
- 1 application – at pre-bloom

Treatments:
1. 10% Boron (32 oz/acre)
2. BRANDT Smart B Mo (8oz/acre)
What Makes BRANDT’s Proprietary Smart Boron More Mobile

- When traditional boron fertilizers are applied, only a portion of the applied boron will get inside plant growing points. This is because of boron’s natural tendency to bind and affix to other elements inside the plant.

- In contrast, BRANDT’s proprietary boron is “shielded” to prevent binding and tie up as the boron travels to plant growing points
  - BRANDT’s boron is cross-linked, which gives it a molecule structure that mimics natural cross linking structures in plants

- This provides exceptional mobility of BRANDT Smart B in the plant and outstanding tank mix with crop protection and fertilizers
A Visual Illustration of BRANDT Smart Boron Mobility vs. Conventional Boron Fertilizers

BRANDT Smart B Superior Mobility

Convention Boron Tie Up Inside Plant
This year thousands of Farmers will die from stubbornness. NO WE WON'T
Thank you

www.brandt.co