Field trial: Boron in corn

Study details

Research institution: CSR Agricultural Research (CSR Home Farm LLC)
Date: 2022
Location: Gratiot, Wisconsin, USA
Soil: Ashdale silt loam, pH 6.2, buffer pH 6.8

- OM: 3.0%
- P-Bray1 19 ppm
- K: 105ppm
- Mg: 575 ppm
- Ca: 4630 ppm
- S: 3.5 ppm
- **B: 0.6 ppm**
- Mn: 20 ppm
- Zn: 3.1 ppm
- CEC: 15

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Standard Crop Management information (SGP)

Planted Population: 37,400
Tillage Practice: No-Till
Previous Crop: Soybeans

Standard fertilizer program

- Preplant fertilizer: Potash 200#/a + MESZ 150#/a + AMS 125#/a + Urea 200#/a - DuoMaxx applied on this blend at 2qt/ton of fertilizer
- Side dress: 28% UAN applied at V6 - 30 gallons/a

Pest management program

- Herbicide applied preplant: Glyphosate (Farm General-Generic 4#) 32 oz/a + Atrazine (Atrax) 0.75#/a + AMS 2#/a
- Post-herbicide V3: Glyphosate 32 oz/a + RealmQ(Corteva) 4 oz/a + NoStunt(Timac-Surfactant) 16 oz/a + AMS 2#/a
- Fungicide R2: Headline AMP(BASF) 10 oz/a + TimaUp (Timac-Foliar Micronutrient) 32oz/a

SGP application dates

- Preplant fertilizer and pre-plant herbicide applications: 05/11/22
- Post-herbicide: 6/13/22
- Nitrogen side dress 6/20/22
- Fungicide: 08/1/22

Trial application information

- Planting Date: 05/18/22
- Pre-Plant Applications: 05/18/22
- V3 Foliar Applications: 06/12/22
- V10 Foliar Applications: 07/10/22
- R2 Foliar Applications: 07/29/22
- Harvest: 11/17/22

Study overview

A. V10-V12 foliar applications of *Solubor* Flow and *Solubor* Flow $^{+}$K was conducted.
B. *Solubor* Flow applied with UAN solution and at V6, via drop hoses, within 1-1.5 inches of the row
C. Season long boron management strategies were compared and evaluated

Target: Creation of dose response curves for each product based on final yields

Metrics collected

1. Plant population: All plots had a uniform plant stand, with either 37 or 38 plants per 1/1000th of a row or 36,000-37,000 plant population per acre
2. Soil test was taken from the trial plot area prior to planting
3. Harvest data
    a. Harvest grain moisture content
    b. Grain bushel test weight
    c. Plot weight, extrapolated over the area to determine bushels/acre final yield.

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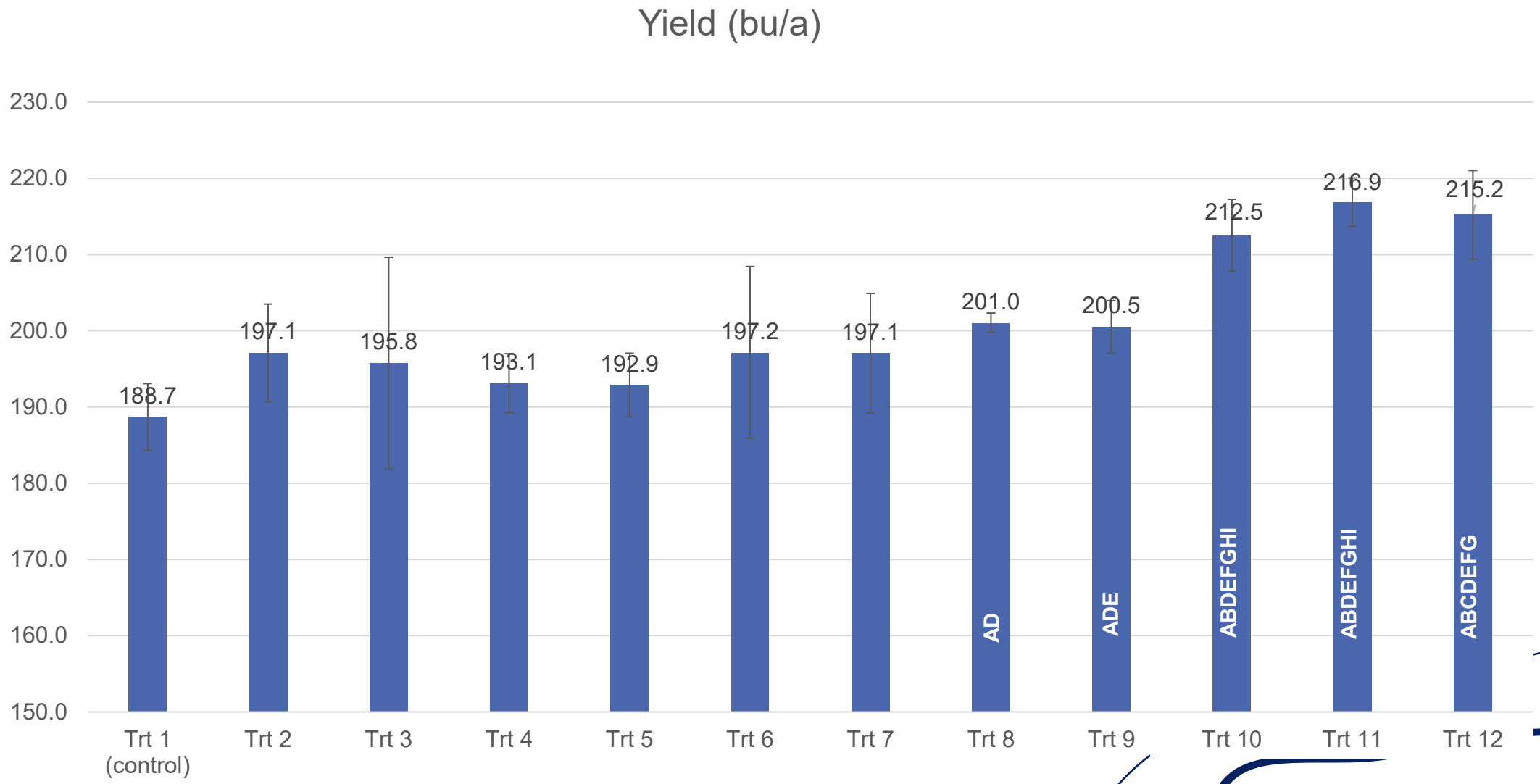
Experimental research design

Treatment	Product	Application method	Crop stage application timing	Rate per acre	General Purpose
1 (control)	Standard grower practice (control)				
2	*Solubor Flow*	Foliar application	V10-V12 (about 10-14 days pre-tassel)	1 qt/a	Application rate curve
3	*Solubor Flow*	Foliar application	V10-V12 (about 10-14 days pre-tassel)	2 qt/a	Determine economic response rate
4	*Solubor Flow*	Foliar application	V10-V12 (about 10-14 days pre-tassel)	4 qt/a	
5	*Solubor* Flow $^{+}$K	Foliar application	V10-V12 (about 10-14 days pre-tassel)	1 qt/a	Application rate curve
6	*Solubor* Flow $^{+}$K	Foliar application	V10-V12 (about 10-14 days pre-tassel)	2 qt/a	Determine economic response rate
7	*Solubor* Flow $^{+}$K	Foliar application	V10-V12 (about 10-14 days pre-tassel)	4 qt/a	
8	*Solubor Flow*	In UAN solution	V6-V7 w/nitrogen side dress	1 qt/a	Application rate curve
9	*Solubor Flow*	In UAN solution	V6-V7 w/nitrogen side dress	2 qt/a	Determine economic response rate
10	*Solubor Flow*	In UAN solution	V6-V7 w/nitrogen side dress	4 qt/a	This is a common application timing for B
11	*Granubor*	Broadcast	Pre-plant	6 lbs/a	Boron management program
	Solubor Flow $^{+}$K	Foliar application	V3-V4 + V10-V12	1 qt/a per app	
12	*Granubor*	Broadcast	Prep-lant	6 lbs/a	Boron management program
	Solubor Flow $^{+}$K	Foliar application	V3-V4 + V10-V12	1 qt/a per app	
	Solubor Flow	In UAN solution	V6-V7 w/nitrogen side dress	2 qt/a	



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Statistical analysis

- The yield data was put into a data analysis template to isolate and remove any outliers, calculate standard deviation and error, and determine statistical differences to p=0.05 (95% confidence). The P-value for each treatment can be located within the yield data tab labeled Block B2 Yield.
- The results of this trial block, showed no statistical differences (p=0.05) between untreated control for any of the V10-V12 foliar treatments. And, further, did not demonstrate any statistical differences between 1, 2, or 4 quarts per acre. The mean yield of every treatment was better than the untreated, based upon averages of the 4 qt/a rate, this rate was not beneficial over lower rates.
- Statistically it is interesting to note that *Solubor* Flow at the 1 qt/a rate did have a p-value = 0.07 (93% confidence), the other rates showed 2qt p=0.36, 4 qt p=0.18.
- Statistically *Solubor* Flow $^{+}$K p-values, were 1 qt p=0.21, 2 qt p=0.21, and 4 qt p=0.11.
- *Solubor* Flow exhibited a regression in average yield as the rate was increased from 1 to 2 to 4 qt rates.
- *Solubor* Flow $^{+}$K exhibited a slight increase in mean yield from 1 to 2 qts, but regressed ever so slightly from 2 to 4 qts.
- *Solubor* Flow applied with side dress UAN at V6 as statistically significant over the untreated control. There was no statistical advantage for 2 qts over 1 qt, however 4 qts applied lead to significance over every other single application treatment evaluated in this trial. Four (4) qts *Solubor* Flow $^{+}$K with UAN at V6 had statistical yield advantage of 23.8 bushels/acre or +12.6% yield advantage.

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Conclusions

Two management programs evaluated:

1. *Granubor* applied at a rate of 6#/a pre-plant + *Solubor* Flow foliar applied at a rate of 1 qt/a at both V3 and V10. In total, application of 1.4165# B for the season.
2. Same as #1 plus 2 qt/a applied with side dress UAN. In total, 1.933#/a B for the season.

Both resulted in statistical significance over the untreated in and over most single treatments in this trial block.

#1 Yield advantage: +28.2 bu/a or +14.9%

#2 Yield advantage: +26.5 bu/a or +14.0%

While actual bu/a and % are slightly different between these two programs based upon averages, they are statistically the same. Foliar applications of 1 qt/a of 10% *Solubor* Flow or *Solubor* Flow $^{+}$K should be considered the maximum single application rate foliar, higher rates are not beneficial—and may be detrimental. Additional rate studies of foliar applications at lower rates should be evaluated, potentially consider 8, 16, and 32 oz/a rates.

Side dress nitrogen with the addition of *Solubor* Flow was statistical at all rates, suggesting soil applications of boron is the more desired application method for the crop. The highest yielding single application was 4 qts per acre with the UAN at V6. This was about 1.03# B per acre which was statistically better than the 2 qt/a (0.515#/a B) or 1 qt (0.2575#/a B).

Considering the program approaches, which both gave significant yield advantages, supply a larger amount of B to the soil (via *Granubor*, 0.9#/a B) comparable to the side dress of 1 gal of *Solubor* Flow w/ UAN (1.03#/a B), suggests soil applications around 1# of B per acre are instrumental in maximizing crop yield. Foliar applications, while convenient, alone may not be the best route to supply adequate boron to meet the crop's needed amount of boron.

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