

## Seed Treatment Effects on Stand Establishment and Yield in Soybeans

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### Summary

- Experiments were conducted at 13 locations in 2008 to determine the effects of soybean seed treatments on stand establishment, early bean leaf beetle feeding, and yield.
- Fungicide seed treatments significantly improved stand establishment in early planted soybeans.
- Combined fungicide and insecticide seed treatments increased soybean yield in both early and normal plantings.
- Biological/microbial seed treatments did not provide any additional yield benefits in the 2008 study.
- Long-term data (36 site-years from 2004-2008) showed a 0.6 bu/acre yield increase for fungicide seed treatments. An additional 2.0 bu/acre increase was achieved by adding an insecticide to the seed treatment.

### Introduction

Soybean seed treatment usage has increased in many areas as growers face more difficult emergence conditions due to early planting and higher crop residue levels. And, like other crop inputs, the value of seed treatments has risen with the market value of the crop. Finally, seed treatments help protect growers' investments in today's high value seed.

Past research and grower observations have generally shown that seed treatment effects depend on the early season growing environment, including soil disease and insect pressure and other seedbed characteristics. When conditions are excellent for emergence and early growth, seed treatments may provide only a minimal yield benefit. However, early planting, no-till or reduced-till practices, cool, wet weather conditions, and heavy or compacted soils increase seedling risks. These factors tend to slow emergence and early plant development, increasing the window of vulnerability to disease and insect damage. Even minimal insect feeding allows diseases to enter, weaken or even kill the plant.



Under very adverse early conditions, plant death or poor root establishment may result in sufficient stand loss to warrant a replant. Seed treatments provide insurance against such an occurrence, potentially averting replant expenses as well as the



Seed treatments may help maximize the return on a grower's soybean seed investment.

yield penalty of a late developing crop. In some cases, seed treatments may also allow growers to safely reduce seeding rates while maintaining desired final plant population and overall yield potential, thus offsetting part of the treatment cost.

### Research Objectives

There are several potential advantages to treating soybean seed:

- improving seedling emergence and stand establishment
- enhancing early plant vigor and root development
- reducing feeding of overwintering bean leaf beetles
- suppressing soybean aphid early in the season
- managing the risk of replant
- helping to maximize yield potential

The objective of this study was to evaluate the effects of various classes of soybean seed treatments on stand establishment, early bean leaf beetle feeding, and yield.

### Study Description

Researchers established plots at 13 sites in 2008, targeting one early and one normal planting date (Table 1). Plots were planted in 30-inch rows at 160,000 seeds/acre in a split-plot arrangement of a randomized complete block design (variety as main plot and seed treatment as split plot). Treatments were replicated four times, and four commercial Pioneer® brand varieties\* were included at each location. The cropping

system was a corn-soybean rotation with conventional tillage at all locations.

**Table 1.** Locations and planting dates in 2008.

Location	Early Planting Date	Normal Planting Date
Prosper, ND	May 1	May 15
Sabin, MN	May 5	May 17
Dysart, IA	May 15	June 18
Mankato, MN	April 30	May 15
Westbrook, MN	May 14	May 28
Princeton, IL	April 24	May 22
Champaign, IL	April 24	May 21
York, NE	May 1	May 16
Alleman, IA	May 7	May 22
Tipton, IN	May 28	June 20
Windfall, IN	May 5	May 25
Proctor, AR	June 20	
Crawfordsville, AR	May 20	June 3

Six seed treatments were evaluated in the first planting date (Table 2). All of these treatments except CRMEQR were evaluated in the second planting date.

**Table 2.** Seed treatments and rates in the 2008 study.

Treatment Code	Treatment Name	Product Rates/Cwt
TRILEX	Trilex <sup>®</sup> AL	Trilex FS @ 0.32 oz + Allegiance <sup>®</sup> FL @ 0.75 oz
TRIGAU	Trilex AL + Gaucho <sup>®</sup>	Trilex FS @ 0.32 oz + Allegiance FL @ 0.75 oz + Gaucho 600 @ 1.6 oz
CRMEQR	CruiserMaxx <sup>®</sup> + ExcalibreQR <sup>®</sup>	CruiserMaxx @ 3 oz + L250 polymer @ 1 oz + ExcalibreQR @ 1.4 oz
CRMXOP	CruiserMaxx + Optimize <sup>®</sup>	CruiserMaxx @ 3 oz + L250 polymer @ 1 oz + Optimize @ 4.25 oz
TRGAYO	Trilex AL + Gaucho + Yield Shield <sup>®</sup> + Optimize	Trilex FS @ 0.32 oz + Allegiance FL @ 0.75 oz + Gaucho 600 @ 1.6 oz + Yield Shield @ 0.10 oz + Optimize @ 4.25 oz
CHECK	Check	Untreated Check

ApronMaxx<sup>®</sup> (fludioxonil and mefenoxam) and Trilex (trifloxystrobin and metalaxyl) are seed treatment fungicides. Mefenoxam and metalaxyl are similar to each other in chemistry with the same site of action for control of *Phytophthora sojae*. Gaucho (imidacloprid) and Cruiser (thiamethoxam) are seed treatment insecticides.

ExcalibreQR (Advanced Biological Marketing) is an encapsulated inoculant that contains three strains of *Bradyrhizobium japonicum*, an extender that increases the on-seed planting window to 120 days, and QuickRoots<sup>™</sup> soil inoculant. QuickRoots is a biological seed treatment containing two common bacteria to promote root growth – *Bacillus subtilis* and *Trichoderma virens*.

Optimize (EMD Crop Bioscience) is lipo-oligosaccharide (LCO) in a Cell-Tech<sup>®</sup> liquid inoculant carrier. Cell-Tech inoculant contains dual strains of rhizobia. Optimize is commonly referred to as a growth promoter or an LCO technology treatment. Nitrogen fixation occurring in soybean nodules is a temperature dependent process. According to the manufacturer, Optimize accelerates and enhances nodulation and early season growth and vigor, making these processes less temperature dependent.

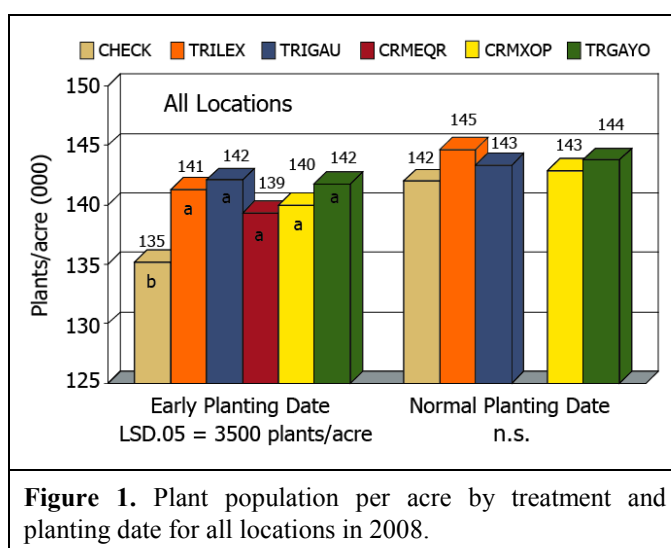
Yield Shield is a biological fungicide containing a naturally occurring soil bacterium, *Bacillus pumilis*. When applied to seed, it colonizes the developing root system and provides protection against disease organisms such as Rhizoctonia and Fusarium that attack the root system, according to the label.

Percent defoliation due to bean leaf beetle was recorded at the unifoliolate to V1 (first trifoliolate) stage for the insecticide-treated plots and the untreated check. Stand counts were taken approximately four weeks after planting. Plots were combine-harvested for grain yield. Data were analyzed by planting date at each location using an ANOVA for a split-plot arrangement. Data were combined from locations by variety set and early and normal planting date, and analyzed using a split-split plot design.

## Applied Questions

### Did seed treatments improve stand establishment?

Yes, all treatments improved stand establishment in the early planting dates (Figure 1).

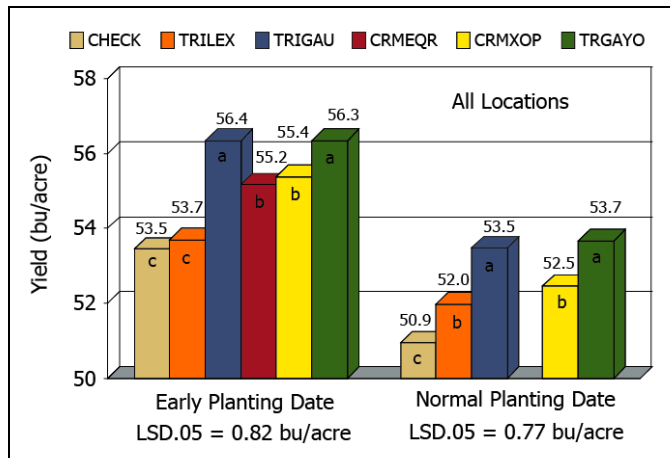


**Figure 1.** Plant population per acre by treatment and planting date for all locations in 2008.

In the later plantings, treatments tended to have slightly higher stand counts than the untreated check but the differences were not statistically significant.

**Did adding an insecticide (IST) to the seed treatment provide an additional yield benefit?**

Yes. This can be determined by comparing the Trilex® / Gaucho® treatments to the Trilex only treatment. The average yield response (all locations) for TRIGAU and TRGAYO over TRILEX was 2.7 bu/acre in the early planting and 1.6 bu/acre in the later planting dates (Figure 2). These differences were statistically significant.



**Figure 2.** Average grain yield by treatment and planting date for all locations in 2008.

**Did the insecticide seed treatments (ISTs) increase yield by reducing bean leaf beetle feeding?**

No advantage for early bean leaf beetle feeding management could be determined from this study. Only three locations reported significant bean leaf beetle feeding in their early planting date. The yield response from ISTs at these locations was not higher than the yield response for ISTs across all locations.



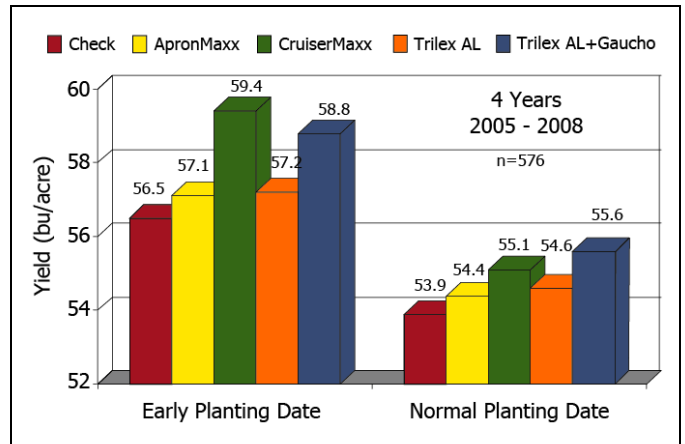
**Did adding a biological / microbial product to the fungicide / insecticide seed treatment boost yields?**

No, not in 2008. There was not a significant yield difference between the Trilex AL + Gaucho and the TrilexAL + Gaucho + Yield Shield® + Optimize® treatment (Figure 2).

**Were 2008 results different from long-term results?**

Yes, in that the Trilex AL+Gaucho treatments were slightly higher yielding than the Cruiser®Maxx® treatments in 2008.

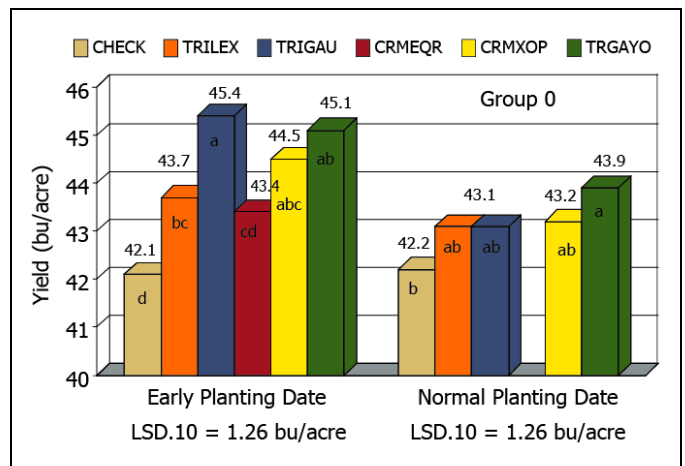
Long-term averages show that CruiserMaxx yield is similar to Trilex-Gaucho yield (Figure 3).



**Figure 3.** Average grain yield by treatment and planting date for all locations, 2004 to 2008. Results include 36 site-years with four replications and four varieties per location.

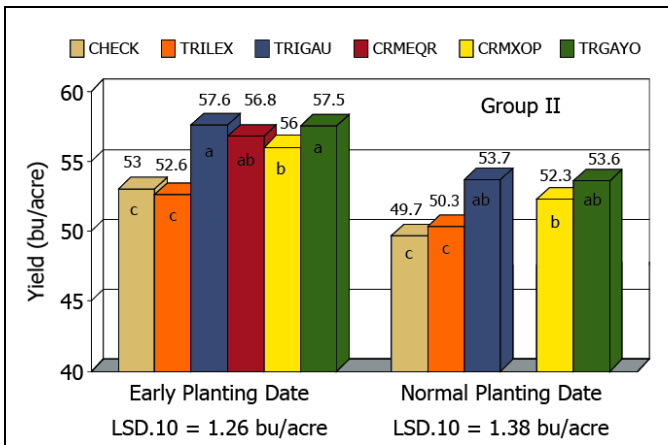
**Appendix – 2008 Results by Maturity Group**

**Group 0:** Group 0 locations were Prosper, ND and Sabin, MN. The four Pioneer® brand varieties included in the study were 90M40, 90M60, 90M80, and 90M92. The average yields of the two Gaucho treatments were 3.0 to 3.3 bu/acre over the untreated check in the early planting dates (Figure 4).



**Figure 4.** Average grain yield by treatment and planting date at the Group 0 locations in 2008.

**Group II:** Group II locations were Dysart, IA; Princeton, IL; Mankato, MN; and Westbrook, MN. The four varieties included in the study were 92M21, 92M32, 92Y30, and 92M40. The average yield of the IST treatments was 4.0 bu/acre and 3.5 bu/acre over the untreated check in the early and normal planting dates, respectively (Figure 5).

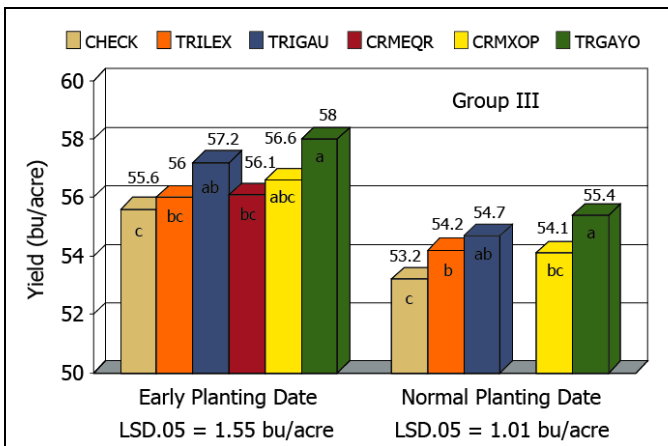


**Figure 5.** Average yield by treatment and planting date at the Group II locations in 2008.



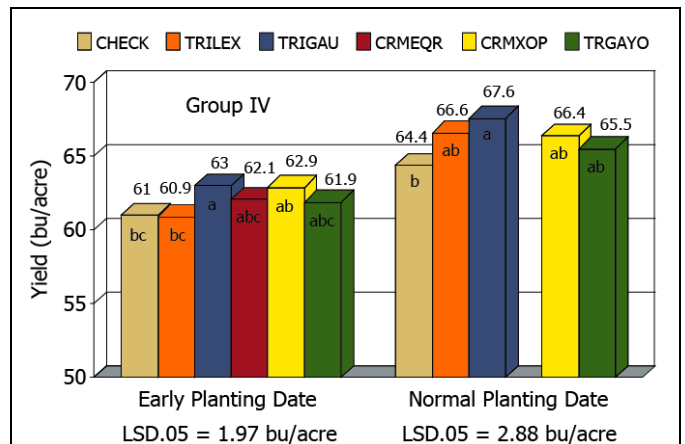
The greatest yield response to soybean seed treatments was with early planted soybeans at Maturity Group II locations.

**Group III:** Group III locations were Champaign, IL; Windfall, IN; Tipton, IN; York, NE; and Alleman, IA. The four Pioneer® brand soybean varieties included in the study were 93M11, 93M42, 93M43, and 93M61. The average yields of the two Gaucho® treatments were 2.0 bu/acre and 1.7 bu/acre over the untreated check in the early and normal planting dates, respectively (Figure 6).



**Figure 6.** Average yield by treatment and planting date at the Group III locations in 2008.

**Group IV:** Group IV locations were Proctor and Crawfordsville, AR. The four varieties included in the study were 94M50, 94Y60, 94B73, and 94M80. There was a single planting date at Proctor; therefore, the normal planting date represents only one location, Crawfordsville. The average yield of the IST treatments was 1.5 bu/acre over the untreated check in the early planting date (Figure 7). The Trilex®-Gaucho treatment was the only treatment significantly higher than the check at Crawfordsville for the second planting date.



**Figure 7.** Average yield by treatment and planting date at the Group IV locations in 2008.

\* All soybean varieties used in the study were Pioneer varieties with the Roundup Ready® trait.

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