Participation in National Evaluation of Soybean Biological Seed Treatments
Progress Report to Maryland Soybean Board
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Project Objectives

The goal of this project is to participate in a national protocol to evaluate situations (specifically in Maryland) where biological seed treatments improve soybean grain yield and combine local data with the national Science for Success team.

Progress of Work

This national protocol was executed at 55 locations in 21 states in 2023. The project was executed as outlined in the proposal, evaluating the influence of nine biological soybean seed treatments and one untreated control (Table 1) on soybean grain yield. The experiment design was a randomized complete block design with six replications at two locations (Wye Research and Education Center in Queenstown, MD and Lower Eastern Shore Research and Education Center – Poplar Hill in Quantico, MD). We planted Asgrow AG 48XF3 in 10' x 20' plots on May 25, 2023 at Poplar Hill and May 10, 2023 at Wye using John Deere Maxemerge-2 four-row no-till planter with 30" row spacings at both locations. All products were applied to the seed before planting, following the specific protocol of the individual products. Soybean yield was collected via harvest of the center two rows of each plot with Almaco R1 research combine (Almaco Co., Nevada, IA) on October 26, 2023 at Wye and November 2, 2023 at Poplar Hill. Grain yield, harvest moisture, and test weight was measured for each plot. The data were collected with a Seed Spector LRX system (Almaco Co., Nevada, IA) and recorded on Microsoft xTablet T1600. Grain yield was adjusted to 13% moisture prior to data analysis. Data were analyzed using a mixed model analysis of variance by location, with treatment as fixed effects and replicates as random effects in SAS using Tukey's HSD ($P < 0.05$) for means separation.

Results

Mean soybean yield by treatment and location is presented in Figure 1. Overall soybean yields were greater at Poplar Hill than Wye in 2023, likely due to less precipitation at Wye in 2023 than the is typical for the location (data not shown). Within each location, there was no significant difference in yield across the treatments ($P=0.7153$ at Poplar Hill; $P=0.2795$ at Wye). The lack of significant treatment differences in yield results align with all but one location nationally in 2023.

Benefits to Soybean Farmers

Often, farmers are bombarded with marketing claims about biological seed treatments and other novel products. In many cases, there is little or no third-party evidence regarding the ability of these products to improve soybean yield and profitability. Trials like these, performed at the national and local scale, provide guidance to farmers on the realistic performance they could expect from novel products from an unbiased comparison.

Trt	Product Name	Active ingredients
1	BioBuild™ Soy Bio ST + R	*Azospirillum brasilense, Bacillus licheniformis, Bacillus amyloliquefaciens, Bacillus subtillis, Pseudomonas fluorescens, Rhizobium*
2	SabrEx® Soybeans PB	*Kosakonia cowanii strain SYM00028*
3	Graph-Ex®	*Bradyrhizobium spp.*
4	Vault® IP Plus	*Bacillus subtillis + Bradyrhizobium japonicum*
5	Bio-YIELD® ST	*Bacillus amyloliquefaciens* Strain PTA-4838
6	Bio-YIELD®	*Methylobacterium hispanicum*
7	LAL FIX Proyield + LAL RISE Start SC	*Bradyrhizobium elkanii, Delftia acidovorans + Bacillus velezensis*
8	Rise & Shine	*Bacillus velezensis*
9	MycoApply EndoFuse	*Glomus intraradices, Glomus mosseae, Glomus aggregatum, Glomus etunicatum*
10	Untreated control	Seeds have fungicide and insecticide only

Table 1. List of treatments (products) evaluated in 2023 as part of the national protocol.
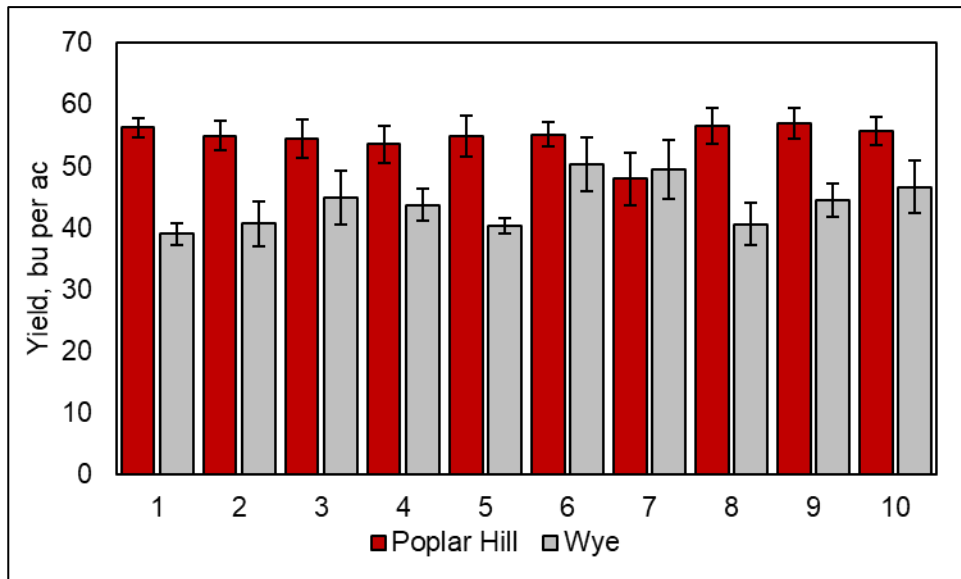

Figure 2. Mean soybean yield (plus standard error) corrected to 13% moisture by treatment and location in 2023.