



On-Farm Trials – 2023 Biological Product Evaluation Results
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Background of the On-Farm Trials Program

The On-Farm Trials Program at University of Maryland was established in 2023 by Dr. Nicole Fiorellino, Extension Agronomist, through funding provided by Maryland Grain Producers Utilization Board, to systematically execute research protocols on private farms throughout Maryland to supplement research performed by Dr. Fiorellino at University of Maryland Research and Education Centers. The protocols executed through the On-Farm Trials Program are tailored specifically for farmers to perform the trial and collect data with their equipment so as to gain experience with a product or practice, while executing a trial designed appropriately to utilize statistics to analyze data. Some protocols are paired, where similar protocols are executed on private farms and at University Research and Education centers in the same growing season, to allow for collection of data from a wider range of geographical conditions. Protocols are developed annually through communication and collaboration with Maryland Grain Producers Utilization Board members and collaborating researchers at nearby Mid-Atlantic Land Grant institutions. The UMD On-Farm Trials Program has one full time On-Farm Trials Coordinator who supports participating farmers with all aspects of the trials, from study design, to plot flagging, to treatment prescription development and application, to harvest and data collection. By 2025, we aim to have application equipment added to our fleet to aid with treatment application for farmers whose participate is limited by equipment availability.

Biological Product Evaluation Project Purpose and Objective

Farmers are often sold “new” products with a claim of performance that has either not been realized in any location or may be present in other regions of the country. Novel biological fertilizer enhancements are available in the Mid-Atlantic region promising utilization of nitrogen-fixing bacteria present in the soil to provide N to growing crops. In turn, there is a decreased need for N fertilizer. As good stewards of their land, Maryland farmers, in times of high fertilizer prices, are obviously interested in products that claim to reduce the quantity of fertilizer needed to produce high-yielding corn. While companies make convincing claims, and these products may work in other regions of the country, there is a need for local validation of product claims. While the project investigators believe the product producers should bear the expense of field-testing their product claims, we understand the interest from the Board in evaluating the performance of these novel products for immediate use. The objective of this study is to determine the impact of biological fertilizer enhancement products on corn yield. By performing this study on multiple private farms across Maryland, we aim to identify if there are conditions where these products are more likely to increase yield.

Results and Discussion

In 2023, we executed this project through the On-Farm Trials Program. While the specific products tested varied across the three locations in 2023 (Figure 1), the general treatment layout was similar: one treatment was farmer practice, meaning the typical N management for corn in that field. The second and third treatment were farmer practice but subtracting the quantity of N that the biological products claimed to provide (typically either 25 or 40 lb N). Finally, the fourth and fifth treatments were farmer practice, plus the product, subtracting the amount of N the product claimed to provide. We anticipated observing



the highest yield with the farmer practice then decreasing yield as N was subtracted from the treatments. We anticipated the product treatments (fourth and fifth) would result in corn yield between the gradient of yield established with the first three treatments. The evaluation was performed in field length strips, with all treatments replicated at least four times and a randomized complete block design was utilized (Figure 1).

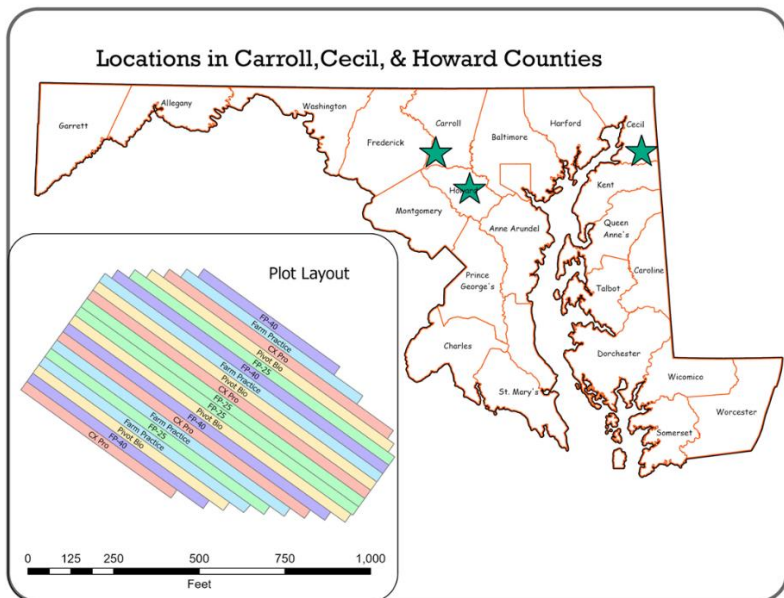


Figure 1. 2023 Trial locations and example plot layout.

The On-Farm Trials Coordinator assisted the participating farmers with study design and layout, treatment application, and harvest coordination. Corn yield data was collected via yield monitor, with On-Farm Trials Coordinator assisting with yield monitor calibration immediately before data collection. Yield data was cleaned by the On-Farm Trials Coordinator to remove any carryover from turnrows or areas of the field not representative of general field conditions (i.e. edges of grassed waterway). Yield data were analyzed using a mixed model analysis of variance to determine effect of treatment on corn yield by location, with Tukey’s HSD utilized for means separation where treatment effect was significant ($P < 0.05$).

At the Carroll County location (Figure 2), Pivot Bio and CX Pro products were evaluated. The Pivot Bio product claims to provide 40 lb N while the CX Pro product does not claim to provide any N, therefore the fourth treatment at this location was farmer practice with 40 lb less N and Pivot Bio added, and the fifth treatment was farmer practice with CX Pro added.

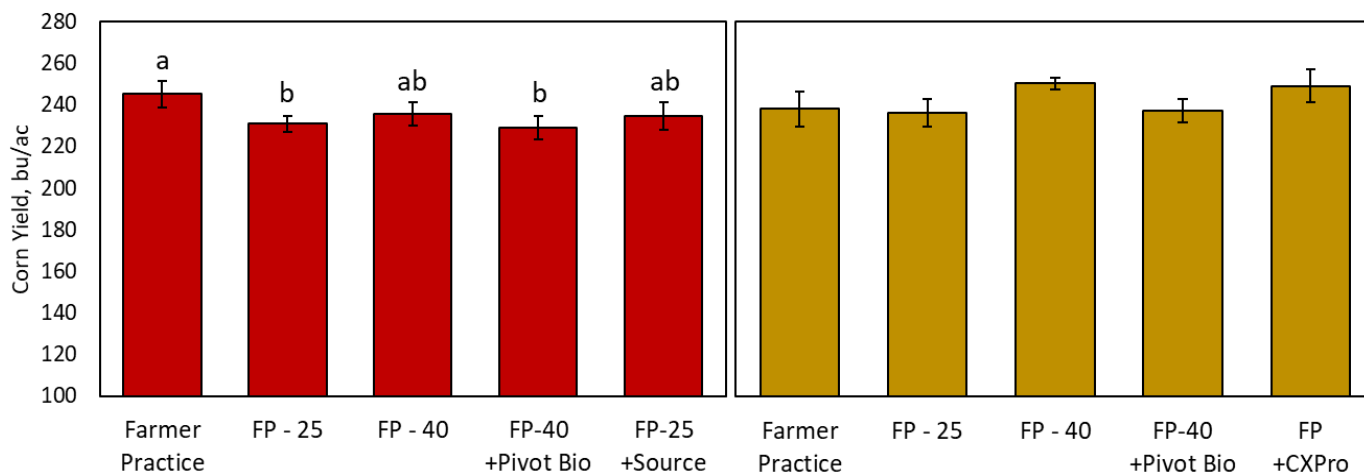


Figure 2. Mean corn yield by treatment at two locations in 2023, Cecil County (red) and Carroll County (gold). Different letters indicate significantly different corn yield within location at $P < 0.05$.



Corn yielded well at this location despite decreased precipitation in this area in 2023. There was no significant effect of treatment on corn yield at this location, generally indicating that the overall N rate at this location could possibly be decreased and may not impact yield.

At Cecil County location (Figure 2), where Pivot Bio and Source products were evaluated, there was a significant effect of treatment on corn yield. While corn yielded well at this location, we did not observe a sequential decrease in corn yield with the first three treatments (sequential N application decrease) as anticipated. The Pivot Bio treatment yielded similarly to the farmer practice less 25 lb N but significantly less than the farmer practice. The Source treatment yielded statistically similar to the farmer practice and

the farmer practice less 25 lb N, indicating there may be potential for this product to increase yield at this location.

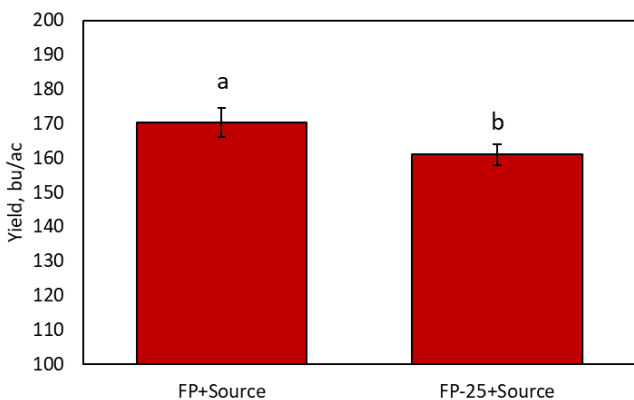


Figure 3. Mean corn yield at Howard County location by treatments. Different letters indicate significantly different corn yield ($P < 0.05$).

At the Howard County location (Figure 3), there was a treatment application error that resulted in all plots receiving the Source product, which left two treatments: farmer practice plus Source and farmer practice plus source with 25 lb less N, resulting in a significant treatment effect. In this field, the subtraction of 25 lb of N did decrease corn yield.

Conclusions

While limited in space, the evaluation successfully produced important conclusions. First, fields selected in 2023 for the biological evaluation were likely not deficient in N fertility, thus did not provide an opportunity for the biological products, which should be considered a N fertilizer replacement product, to supplement N in the system, resulting in a corn yield increase. Participating farmers may consider decreasing their N fertilizer application in the future and possibly replacing some of the applied N with a biological product to observe a yield benefit from the use of the products.

Second, the 2023 evaluation provided a learning opportunity for both participating farmers and the On-Farm Trials team at UMD. We experienced the difficulties of logistics considerations with both private farmers and commercial applicators and plan to develop more streamlined communications practices. We are looking to invest in application equipment to assist farmers with participation if they are limited by equipment available to apply prescribed treatments. We anticipate this will increase future participation in the program.

Finally, we plan to continue the evaluation of biological products through the On-Farm Trials Program, as we feel this is the ideal method for this type of product evaluation. We hope to continue assisting farmers with executing these types of trials on their operation to aid their decision-making abilities in a lower-risk scenario.