Mississippi Corn Promotion Board
2022 Progress Report

Project
Title: Corn Nitrogen Use Efficiency Across Mississippi

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Project Summary (Issue/Response)

Nitrogen fertilizer is one of the most expensive inputs that corn producers use to improve or sustain yields in Mississippi. Generally, N inputs have doubled since 1961, receiving an average rate of 145 lb ac^{-1} (Sumner et al., 2021). This is further complicated by uncertainties of future projections for commodity and fertilizer prices. Uncertainty in N fertilizer prices has increased interest in newer or alternate N sources such as biological products. These products are protruded to improve crop growth, increase the availability of other nutrients, nutrient uptake efficiency, and improve crop yields (Woodward, 2020).

Nonetheless, the metric to measure the efficiency of different N sources, namely, nitrogen use efficiency (NUE), has not improved in corn. Omara et al. (2019) noted that globally only half of the total N applied is recovered, and the rest is lost to the environment through numerous pathways. Thus, improving NUE is not only the solution to economic and environmental stability, but also allows maximizing production with minimal N losses. Lassaletta et al. (2014) suggested agronomic practices to be an efficient strategy to improve yield and NUE. Furthermore, the NUE of biological products is unknown and needs to be evaluated.

Project Results/Outcomes

In 2022 experiments testing different nitrogen (N) rates and six different biologicals plus a check plot with no biological were established in Starkville and Stoneville, MS. Four different N rates were included at Starkville, whereas an additional rate of 200 lb. N ac^{-1} was included at Stoneville. At Starkville none of the two factors tested resulted in any yield differences. Grain yield at this location ranged from 149 to 164 bu ac^{-1} and no differences were seen with application of biologicals (Table 1).

At Stoneville grain yield ranged from 140 to 187 bu ac^{-1}. Both N rate and biological treatments significantly affected grain yield, however, no interaction was noted between N rate and biological application (Table 1). Specifically, yield increased with application of 80 lb. N ac^{-1} over check plot where no N was applied (Fig 1B). Grain yield plateaued around 80 lb. N ac^{-1} and no significant differences were noted between 80, 160, 200, and 240 lb. N ac^{-1}. Significant differences were noted within biologicals, where Source N had significantly higher yield than Envita. However, this was not statistically different from the check plot where no biological was applied (Fig 1A).

Project Results

Table 1: Mean grain yield as affected by nitrogen and biological applications at Starkville and Stoneville, MS 2022. P-values associated with source of variation and mean values for main effects are provided

Variable	Starkville	Stoneville
	----------p-values----------	
Nrate (N)	0.68	0.001**
Biologicals (B)	0.81	0.001**
NxB	0.92	0.17
N rate lb N ac^{-1}	----------Mean grain yield bu ac^{-1}----------	
0	149	140b[†]
80	151	173a
160	138	187a
200	--	175a
240	164	179a
Biologicals	----------Mean grain yield bu ac^{-1}----------	
None	150	173ab
Envita	148	163b
iNvigorate	151	166ab
Micro AZ	163	170ab
Biolevel	147	172ab
Source	142	177a
Blue N	154	174ab

[†]Within column, means followed by the same letter are not statistically different (P ≤ 0.05). ** values are significant at P ≤ 0.05

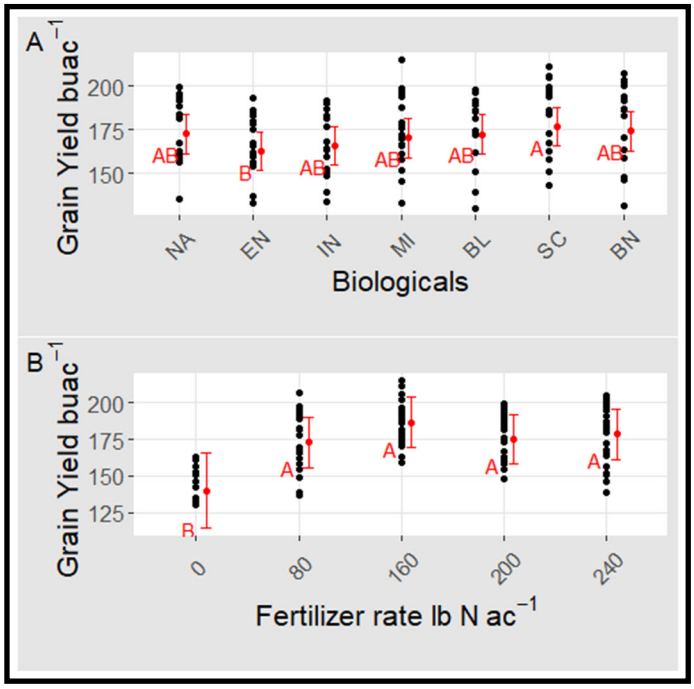

Figure 1: The effect of different biologicals (A) and variable N rate (B) on grain yield in Stoneville, MS.

Project Impacts/Benefits

Overall, based on this one-year we could not infer any advantage of applying any of the biologicals included in this study. However, we should not be so hurried in discarding biologicals as worthless, and experiments must be repeated for an additional year.

Project Deliverables

Results from first year of this study will be presented at Southern Agronomy Society of America Meeting and Mississippi Academy of Science annual meeting in February 2023.