Continuous Corn Nitrogen Fertilizer Rates by Humic Product Application

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Objective

To examine the grain yield effects of a humic product application on continuous corn at varied nitrogen (N) fertilizer rates.

Introduction

While humic products for agronomic production are still not a common production input, the number of available products and vendors have increased substantially in recent years and are readily available to farmers. Our earlier research has shown that humic product application can significantly increase crop yields on a statistical basis, but that these cases are not consistent and the degree of plant and yield effect does vary by environmental conditions. Typically, our data and those of researchers world-wide have shown increases to crop yield are most often associated with forms of crop growth stress, especially those of water-limiting conditions. Some humic product and other biostimulant advocates have purported that humic product applications may allow for farmers to reduce their N fertilizer rates with the application of a humic product that would equal economic optimum corn grain yields with higher N fertilizer rates. Given that optimal corn N fertilizer rates vary regionally and by weather patterns, our objective is to determine if there is a benefit of applying a humic product to continuous corn production in central Iowa and to quantify the impacts across a wide range of N fertilizer rates.

Materials and Methods

Our experiment is located in the northern portion of the Boyd 32 field, near the AERC farm. The soil type for the entire plot area is a Clarion soil type, being well-drained with a fine-loamy texture. The row spacing is 30 inches and the corn was planted at 34,000 seeds/a. The experiment was initiated in 2020 and has continued with 2023 being fourth year corn. The herbicide and fertility management (other than N) were done as normal practices for continuous corn management. The five N fertilization rates selected were as follows: 0, 62.5, 125, 187.5 and 250 lb N/a, which were applied as 32% urea-ammonium-nitrate (UAN). The plot design was a that of a split-plot, with then pairings of the same N rate with and without the humic product. The humic product was applied as per the vendor's recommended rate of 32 oz/a, broadcast sprayed on the crop at the V4 growth stage.

Results and Discussion

Corn yields in the first year (2020) showed no significant effects of the humic product on corn grain yield across the 5 N rates ($P=0.78$), but the results were mixed across those rates. This pattern existed in each year

with yield losses at sub-optimal agronomic N fertilizer rates for continuous corn production, and usually yield gains at optimal agronomic N fertilizer rates and above (Table 1). As expected, with each successive year of continuous corn production the amount of N fertilizer to achieve optimal yields increased. When the yield data are graphed across the five N rates, the intersection point of with and without humic treatment has steadily increased year by year. This indicates that in continuous corn production. to achieve a yield increase with a humic product application will require added N fertilizer compared to the first year of continuous corn production.

Conclusions

Some humic products vendors have claimed that their products' main mechanism of action is that the humic product makes crop nutrients in the soil more available for crop uptake, and thus allows a farmer to reduce their fertilizer rates. In this experiment at this location, it is clear that the humic product did not improve N availability to the corn plants. If it had, there would not be yield losses at the N rates lower than optimal for continuous corn production. Instead, yield gains were observed at the highest N rates with humic product application. These results tell us that, 1) the humic product does not make N more plant-available, 2) the mechanism or mode of action of a humic product seems to be more of a biostimulant – encouraging plant growth even in the presence of a form of stress, and 3) that continuous corn yield gains at sufficient N fertilizer rates are possible with the application of a humic product.

Table 1. 2020-2023 continuous corn grain yields with and without application of a humic product for five nitrogen fertilizer rates.

Mean Corn Grain Yield (Bu/a)					
Year	**N Rate (lb N/a)**	**Without Humic**	**With Humic**	**% Diff (Humic-No Humic)**	**P Value**
2020	0	34.6	34.4	-0.8	0.97
	62.5	75.2	64.3	-14.6	0.12
	125	138.6	149.2	7.6	0.14
	187.5	170.3	178.6	4.8	0.24
	250	169.0	165.9	-1.8	0.65
2021	0	42.8	42.1	-1.7	0.92
	62.5	93.8	73.9	-21.3	**0.01**
	125	165.7	160.0	-3.5	0.43
	187.5	189.8	198.8	4.7	0.22
	250	204.0	211.3	3.5	0.32
2022	0	69.0	64.3	-6.9	0.70
	62.5	114.3	107.7	-5.8	0.43
	125	168.7	164.8	-2.3	0.64
	187.5	171.4	179.7	4.8	0.33
	250	182.7	191.6	4.9	0.29
2023	0	32.0	31.2	-2.3	0.90
	62.5	66.7	57.4	-14.0	0.11
	125	148.3	146.2	-1.4	0.71
	187.5	191.1	184.7	-3.3	0.26
	250	189.2	200.2	5.8	**0.06**