Corn and Soybean Response to Humic Product Applications on the Clarion-Nicollet-Webster Soil Association

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Introduction

Humic products have been used as an amendment for crop yield enhancement for nearly a century. However, very little field research has been conducted with these products on university research farm settings in the U.S. Midwest. One of the issues that has hampered scientific progress of humic products has been their inconsistent crop responses. There are a myriad of possible reasons for crop response variability, some being environmental, some could involve variability in the humic product's integrity. The objective of this study was to examine corn and soybean growth and production responses to a humic product across enough growing seasons, to generate a database to include a range of growing conditions (i.e., drought, average and wet precipitation amounts).

Materials and Methods

The Boyd Farm, field 11, was the site for this research experiment intitiated in 2013. The field consists of Clarion, Nicollet, and Coland soil types. Soybean was planted in the field June 13, 2013; May 12, 2015; and May 16, 2017. Corn was planted in the field May 6, 2014, and May 13, 2016. Conservation tillage was used all years and fertilizers and herbicides were applied using best management practices.

Four replications of a control and two humic product application rate treatments were conducted in a randomized complete block design. Each plot consisted of six 30-in. spaced rows that were 975 ft long. In 2013 (soybean), the humic product application treatments were 34 oz/acre broadcast at the V4 foliar growth stage, and 41 oz/acre broadcast at pre-emergence. For corn in 2014, the humic product applications were 34 oz/acre broadcast at the V4 foliar growth stage, and a split application of 27 oz/acre broadcast at pre-emergence with 14 oz/acre broadcast at the V4 foliar growth stage. Following the first cycle of the soybean-corn rotation, the humic application treatments were increased due to results gained by the product vendor from multiple other sites in the Upper Midwest. In the soybean years of 2015 and 2017, the humic product application treatments were 64 oz/acre broadcast at the V4 foliar growth stage, and 128 oz/acre broadcast at pre-emergence. In the 2016 corn year, the humic product application treatments were 32 and 64 oz/acre broadcast at the V4 growth stage.

Crop rows were planted using global positioning guidance technology, and the planter rows and treatment plots were located identical from one year to another.

Results and Discussion

Corn and soybean grain yields are shown in Table 1 for the years 2013 through 2017. Across the five years of study and the two humic application treatments per year, only once did a humic treatment result in a grain yield numerically less than that of the control, and in six of the 10 comparisons the humic treatments produced statistically greater grain yields than the control at the $P = 0.05$ benchmark.

Weather patterns varied during the five-year period. 2013 had very wet conditions early and then drier than normal for the latter half of the growing season; 2014 and 2015 had very favorable temperatures and precipitation for crop production; 2016 had mild drought in the first half of the growing season; and 2017 had drought conditions from early-middle summer through grain filling. The favorable years of 2014 and 2015 did not generate statistically greater yield for the humic application treatments. The years with an appreciable duration of water deficit for optimal crop production, 2013, 2016, and 2017, showed significant yield gains with humic application compared with the controls. This parallel nature of grain yields with weather patterns supports the general observation by scientists who have conducted humic experiments elsewhere that humic products seem to benefit crop growth and production more in times of drought stress.

Although grain yield results for this experiment have shown consistent gains with humic product application in years with at least some drought stress, a corn-soybean field experiment with the same humic product located less than one mile away on coarser-textured soil (mostly Clarion and Nicollet) of the ISU Bass Farm field has found significant yield responses for only one of six treatments in two of its four years, including the favorable weather of 2014 and 2015.

Our current experiments with humic products also are examining the plant processes that may be affected by humic products, and the longer-term effects on soil health measures.

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Table 1. Corn and soybean mean grain yields 2013 through 2017.

Year	Crop	Treatment	Timing	Grain yield (bu/ac)	Control (%)	P > F[a] compared with Control
2013	Soybean	Control	N/A	45.1	-----	-----
		Humic 34 oz/ac	V4	48.5	+7.5	0.03
		Humic 41 oz/ac	Pre-Emergence	47.9	+6.2	0.05
2014	Corn	Control	N/A	182.2	-----	-----
		Humic 34 oz/ac	V4	179.4	-1.5	0.79
		Humic 27+14 oz/ac	Pre-Emergence + V4	186.3	+2.2	0.69
2015	Soybean	Control	N/A	55.2	-----	-----
		Humic 64 oz/ac	V4	56.9	+3.2	0.49
		Humic 128 oz/ac	Pre-Emergence	57.3	+3.9	0.42
2016	Corn	Control	N/A	226.6	-----	-----
		Humic 32 oz/ac	V4	233.7	+3.1	0.02
		Humic 64 oz/ac	V4	236.1	+4.2	0.003
2017	Soybean	Control	N/A	54.4	-----	-----
		Humic 64 oz/ac	V4	60.3	+10.8	<0.001
		Humic 128 oz/ac	Pre-Emergence	61.5	+13.2	<0.001

[a]Probability of greater F values are the least significant difference T-tests from mixed models statistical analyses.