

INTRODUCTION

- Integration of inorganic fertilizers with Humic Acid (HA) may be an effective way to improve crop yields and maintain soil health.
- However, little is known about the impacts of HA applied with nitrogen (N) fertilizer on corn (*Zea mays* L.) growth and soil properties in South Dakota.

OBJECTIVES

- To evaluate the impacts of HA applied with N fertilizer on corn yield, corn stem height and diameter, and the selected soil properties.

MATERIALS AND METHODS

- Study site: the SDSU Southeast Research Farm (43°2'32.9994" N, 96°54'14.796" W), near Beresford, South Dakota.
- Experiment: a split-plot in a randomized complete block design with 4 replications. The 12 fertilizer treatments were established in 2014 and 2015 for assessing corn growth, yield, and soils quality (Table 1).

Table 1. Fertilizer treatments under corn used for the study site in 2014 and 2015.

Treatment	Description	Amount (gal/lb ac ⁻¹) [†]
preUAN-100	UAN Preplant - 100%	50 gal UAN ac ⁻¹
preUAN-85	UAN Preplant - 85%	42.48 gal UAN ac ⁻¹
preUAN-85H	UAN Preplant - 85% with humic acid	42.48 gal UAN ac ⁻¹ + 1 gal liquid humic acid ac ⁻¹
sdUAN-100	UAN Sidedress - 100%	50 gal UAN ac ⁻¹
sdUAN-85	UAN Sidedress - 85%	42.48 gal UAN ac ⁻¹
sdUAN-85H	UAN Sidedress - 85% with humic acid	42.48 gal UAN ac ⁻¹ + 1 gal liquid humic acid ac ⁻¹
preUREA-100	UREA Preplant - 100%	326.08 lb UERA ac ⁻¹
preUREA-85	UREA Preplant - 85%	277.21 lb UERA ac ⁻¹
preUREA-85H	UREA Preplant - 85% with humic acid	277.21 lb UERA ac ⁻¹ + 40 lb dry humic acid ac ⁻¹
sdUREA-100	UREA Sidedress - 100%	326.08 lb UERA ac ⁻¹
sdUREA-85	UREA Sidedress - 85%	277.21 lb UERA ac ⁻¹
sdUREA-85H	UREA Sidedress - 85% with humic acid	277.21 lb UERA ac ⁻¹ + 40 lb dry humic acid ac ⁻¹

[†] Target N rate (100%) = 150 lb N ac⁻¹; Ratio of UAN to liquid humic acid = 42.5:1; Ratio of Urea to dry humic acid = 6.9:1.

RESULTS

Table 2. Means of corn yield and stalk diameter and height, soil organic matter (SOM) and nitrogen (SON), and water soluble ammonia (NH₃) under different fertilizer treatments in 2014 and 2015.

Treatment	Corn Yield		Corn Diameter		Corn Height		SOM		SON		NH ₃	
	2014	2015	2014	2015	2014	2015	2015	2014	2015	2014	2015	
	bu ac ⁻¹		mm		m		g kg ⁻¹	mg kg ⁻¹		mg L ⁻¹		
<i>Fertilizer100%</i>												
preUAN-100	147.0 ^{a†}	193.9 ^a	23.5 ^a	27.3 ^a	2.48 ^a	2.88 ^a	32.8 ^a	3.55 ^b	2.85 ^b	2.60 ^b	1.50 ^a	2.00 ^a
sdUAN-100	120.3 ^b	189.8 ^a	21.6 ^b	25.8 ^b	2.38 ^b	2.77 ^b	32.0 ^a	3.43 ^b	4.40 ^{ab}	2.10 ^b	1.25 ^a	1.43 ^{ab}
preUREA-100	144.5 ^a	193.3 ^a	23.5 ^a	26.4 ^{ab}	2.50 ^a	2.86 ^a	36.5 ^a	7.48 ^a	6.60 ^a	5.20 ^a	1.25 ^a	1.00 ^b
sdUREA-100	145.7 ^a	191.3 ^a	24.6 ^a	25.8 ^b	2.39 ^b	2.77 ^b	35.3 ^a	3.40 ^b	3.23 ^b	2.83 ^b	1.75 ^a	1.50 ^{ab}
<i>Fertilizer85%</i>												
preUAN-85	151.1 ^a	185.8 ^a	23.2 ^b	27.6 ^a	2.49 ^a	2.89 ^b	35.8 ^a	4.58 ^a	4.67 ^a	1.50 ^b	1.75 ^a	0.73 ^b
sdUAN-85	129.9 ^b	190.7 ^a	20.9 ^c	27.1 ^{ab}	2.39 ^b	2.74 ^c	37.0 ^a	5.45 ^a	2.13 ^a	2.58 ^{ab}	1.25 ^a	1.60 ^a
preUREA-85	140.0 ^b	189.9 ^a	22.6 ^b	26.8 ^{ab}	2.50 ^a	2.94 ^a	37.0 ^a	3.48 ^a	4.23 ^a	2.45 ^{ab}	1.25 ^a	1.00 ^{ab}
sdUREA-85	150.7 ^a	180.5 ^a	25.0 ^a	26.3 ^b	2.43 ^{ab}	2.88 ^b	38.0 ^a	5.35 ^a	3.78 ^a	3.98 ^a	0.78 ^a	1.50 ^{ab}
<i>Fertilizer85%+HA</i>												
preUAN-85H	149.5 ^a	193.3 ^a	23.2 ^{ab}	27.6 ^a	2.44 ^a	2.88 ^a	34.5 ^{ab}	7.33 ^a	4.65 ^b	2.25 ^b	2.13 ^{ab}	1.00 ^b
sdUAN-85H	124.4 ^b	181.3 ^a	20.9 ^c	27.0 ^{ab}	2.41 ^a	2.74 ^c	36.0 ^{ab}	2.43 ^b	3.10 ^b	2.63 ^b	1.25 ^b	1.38 ^b
preUREA-85H	145.4 ^a	196.8 ^a	22.3 ^b	26.1 ^b	2.45 ^a	2.92 ^a	30.0 ^b	4.43 ^{ab}	4.93 ^b	2.60 ^b	1.50 ^b	2.50 ^a
sdUREA-85H	139.6 ^a	183.0 ^a	23.8 ^a	27.0 ^{ab}	2.33 ^b	2.81 ^b	40.3 ^a	3.60 ^b	8.95 ^a	4.57 ^a	3.13 ^a	1.00 ^b
<i>PrePlantUAN</i>												
preUAN-100	147.0 ^a	193.9 ^a	23.5 ^a	27.3 ^a	2.48 ^a	2.88 ^a	32.8 ^a	3.55 ^b	2.85 ^a	2.60 ^a	1.50 ^a	2.00 ^a
preUAN-85	151.1 ^a	185.8 ^a	23.2 ^a	27.6 ^a	2.49 ^a	2.89 ^a	35.8 ^a	4.58 ^{ab}	4.67 ^a	1.50 ^a	1.75 ^a	0.73 ^b
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<i>SidedressUAN</i>												
sdUAN-100	120.3 ^b	189.8 ^a	21.6 ^a	25.8 ^b	2.38 ^a	2.77 ^a	31.0 ^a	3.43 ^a	4.40 ^a	2.10 ^a	1.25 ^a	1.43 ^a
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<i>PrePlantUREA</i>												
preUREA-100	144.5 ^a	193.3 ^a	23.5 ^a	26.4 ^a	2.50 ^a	2.86 ^b	36.5 ^a	7.48 ^a	6.60 ^a	5.20 ^a	1.25 ^a	1.00 ^b
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sdUREA-85H	139.6 ^b	183.0 ^a	23.8 ^b	27.0 ^a	2.33 ^b	2.81 ^b	40.3 ^a	3.60 ^a	8.95 ^a	4.57 ^a	3.13 ^a	1.00 ^a

[†]Means within same column followed by different small letters are significantly different at P<0.10 for different fertilizer levels.

- Most treatments of the HA applied with N fertilizer significantly influenced corn yield and stem diameter and height. HA significantly impacted SOM, SON, and NH₃ in soils under some treatments (Table 2).
- The treatments did not significantly impact wet aggregate stability, carbon to nitrogen ratio, and bulk density of soil (data not shown).

CONCLUSIONS

The appropriate fertilization of HA applied with N fertilizer may increase corn yield and reduce the cost of fertilizer application, and improve soil quality.