SUGAR CROPS PRODUCTION MANAGEMENT RESEARCH AT THE IBERIA AND SUGAR RESEARCH STATIONS

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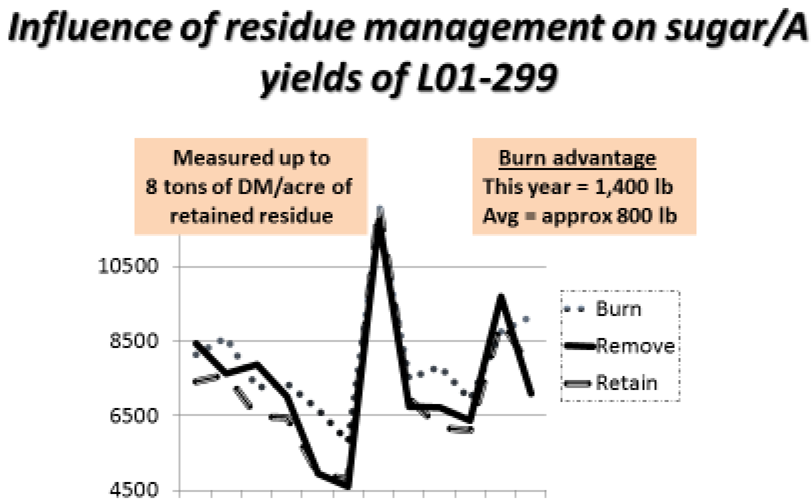
Summary:

Field trials consisted of **1)** continuing evaluation of the long-term effects of post-harvest residue management on sugarcane; **2)** assessing the efficacy of the nutritional products, HM-0938-A, HM-9310 and HM-9827A, Helena® Chemical foliar-applied products; **3)** evaluation of source and amount of sulphur fertilizer; and **4)** assessing the efficacy of fallow land applications of a mixture of filter press mud (FPM) and bagasse. The long-term residue management study was in the first stubble crop of the fifth production cycle. Burning continues to show a yield advantage compared to residue retention. Helena® Chemical’s foliar-applied nutritional product, HM-0938-A, applied to L01-299 at different times and rates, produced more sugar than the check only for the 1 pt/June application, as an average of four years. Applying 3 gal/A of HM-09310 or HM-9827-A on plant cane L01-299 did not result in yield increases. Neither source nor rate of sulfur fertilizer applied to second stubble L 01-299 resulted in significant increases in tonnage or TRS at the P = 0.05 level. All application rates and sources of S tended to increase sugar yield, except for the 25 lb S90 treatment. A field trial was initiated to evaluate the efficacy of applying to fallow land a mixture of FPM/bagasse.

I. Long-term Residue Management Study:

A post-harvest residue management study was initiated in 1997 and has continued through the first stubble crop of production cycle number five. The study has clearly confirmed what other investigations have found, that retention of post-harvest residue generated from green cane harvesting under Louisiana conditions has a negative effect on the cane and sugar yield of ratoon crops within a production cycle.

Generally, burning produces higher cane yield than retaining the residue, with sweeping the residue to the middles producing intermediate yields. What was known only anecdotally was that the negative effects of residue retention did not carry over to the plant-cane crop of subsequent cycles of production. This study consistently demonstrates yield recovery with the initiation of the plant-cane crop of each production cycle, and the plant-cane crop of cycle number five further confirmed that reality. While burning does not always produce superior yields, burning averages approximately 800 lb of sugar per acre more than the other two residue management treatments.



II. **Efficacy of Helena® Chemical Co. Products HM-0938-A (Utilize®) on Cultivar L01-299:**

Helena® Chemical Co. bio-nutritional product HM-0938-A is a foliar-applied experimental compound that is to be marketed with the brand name Utilize®. A field trial was conducted in 2014 on plant cane and 2015, 2016 and 2017 on stubble crops to evaluate the efficacy of HM-0938-A foliar applied at three rates (1.0, 1.5 and 2.0 pt/A) and two timings (May and June applications) . Each year cultivar L01-299 was fertilized with 120 lb N per acre (32% UAN) prior to the applications of the product. Plots were 3-rows wide and 50 ft in length and replicated four times in a randomized complete block design. The soil type was an Iberia silty clay. Data were recorded for biomass weight and juice quality, and leaf N percentage. As an average of four years, the only treatment superior to the check was the June application of 1.0 pint/A for pounds of sugar per acre. Nitrogen content of leaves was sampled in both May and June in 2017 and provided puzzling results. The highest yielding treatment, 1 pt applied in June, contained the lowest amount of leaf N at the June sampling but the highest leaf N at the May sampling.

Application rate pint/A of HM-0938A	Application timing	Sugar (lb/A) As average of all 4 years of trial	Leaf % N for 2017	
			May sampling	June sampling
0	0	9,033 b	2.03	1.62
1.0	May	8,911 b	2.02	1.54
1.5	May	9,419 ab	1.87	1.63
2.0	May	9,268 ab	2.11	1.75
1.0	June	9,858 a	2.03	1.45
1.5	June	9,045 b	1.98	1.65
2.0	June	8,733 b	1.95	1.76

Means in a column followed by a common letter are not significantly different at P = 0.05

Efficacy of Helena® Chemical Co. Products HM-9310 and HM-9827-A on Cultivar L01-299:

Helena® Chemical Co. bio-nutritional products HM-9310 and HM-9827-A are foliar-applied experimental compounds that are not commercially available for use in sugarcane. A field trial was conducted in 2017 on plant cane to evaluate the efficacy at the rate of 3 gal/A at two timings (May and June applications). Cultivar L01-299 was fertilized with 100 lb N per acre (32% UAN) prior to the applications of the product. Plots were 3-rows wide and 75 ft in length and replicated four times in a randomized complete block design. The soil type was an Iberia silty clay. Data were recorded for biomass weight and juice quality, and leaf N percentage. As is typical for plant cane nutritional studies, sugarcane did not differentially respond to the application of the products at either application timing. Just like for the application of HM-0938-A leaf N was higher when sampled in May as opposed to June.

Product	Application rate	Application timing	Sugar (lb/A)	Leaf % N	
				May sampling	June sampling
Check			10,763 a	2.08	1.62
HM-9310	3 gal/A	May	10,570 a	2.03	1.70
		June	10,692 a	1.98	1.87
HM-9827A	3 gal/A	May	9,935 a	2.03	1.80
		June	10,074 a	1.98	1.85

Means in a column followed by a common letter are not significantly different at P =0 .05

III. Response of L 01-299 to Different Sources and Rates of Sulphur Fertilizer:

A field trial on L 01-299 first stubble was initiated in 2016 and continued through second stubble in 2017 using two sources of sulphur, ammonium thiosulfate and elemental S, and three application rates, 25, 50 and 75 lb per acre, in addition to a control. The soil type was a Baldwin silty clay loam, soil that is typical of the “heavy” soil texture types used in the sugar growing region of Louisiana. For the second stubble test in 2017 both tonnage and TRS were not significant affected (P = 0.05) and there was a trend for increased yield of sugar per acre with S application except for the 25 lb S90 treatment.

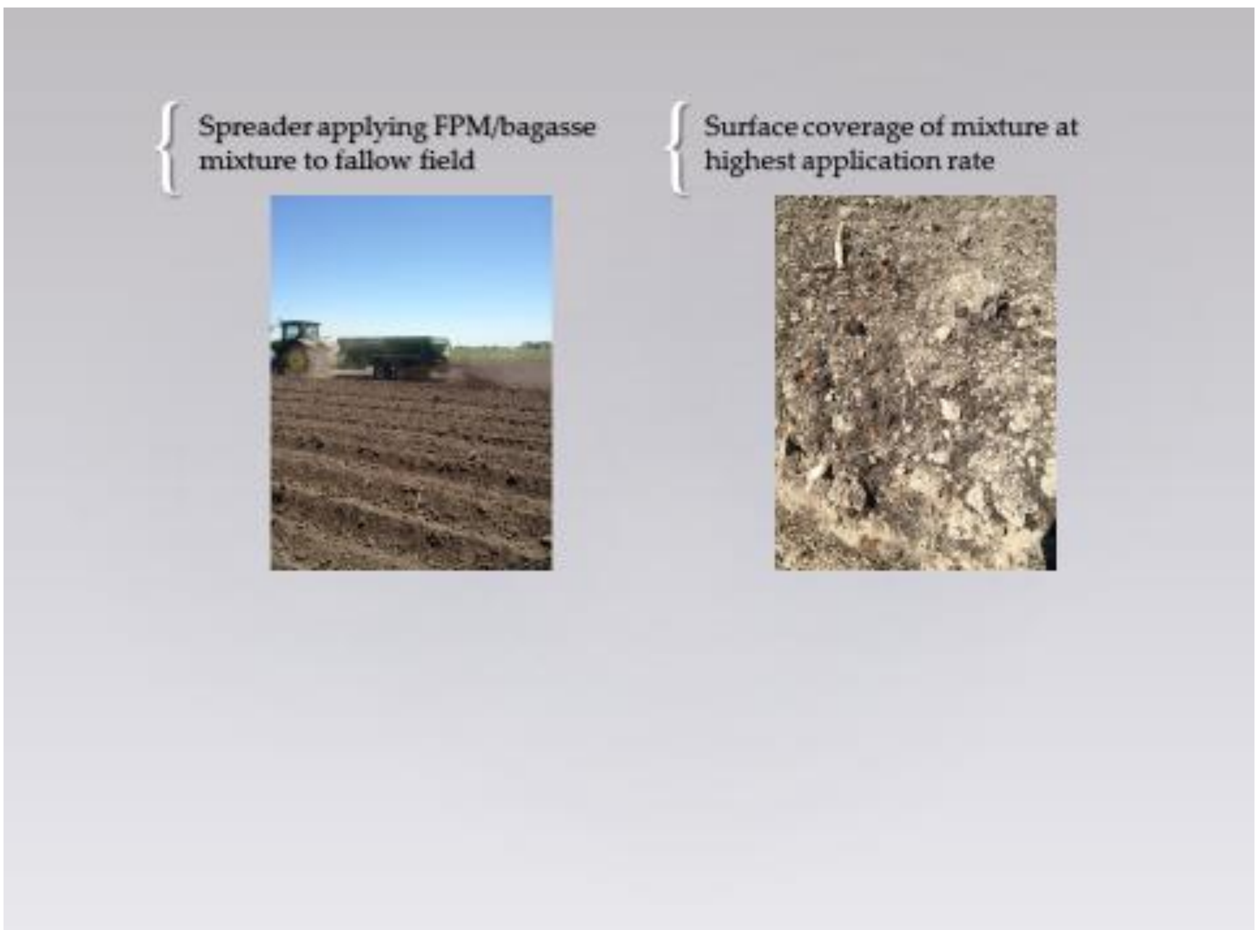
Sulfur Rate & Source (lb/A)	Tonnage (T/A)	TRS (lb/T)	Sugar (lb/A)
0	39.2 a	209 a	8180 ab
25 lb ATS	43.8 a	198 a	8590 ab
50 lb ATS	42.7 a	200 a	8370 ab
75 lb ATS	43.7 a	204 a	8840 a
25 lb S90	40.5 a	191 a	7715 b
50 lb S90	41.2 a	214 a	8790 a
75 lb S90	40.9 a	210 a	8580 ab

Numbers within a column that have the same letter are not significantly different (P = 0.05). All values are the means of six replications. Ammonium Thiosulfate and Tiger 90CR were used as sulfur sources.

IV. Fallow-land Application Trial with Filter Press Mud/Bagasse Mixture:

Louisiana sugar mills pile approximately 900,000 tons of bagasse and also discard about 350,000 tons of filter press mud (FPM) annually**.** Cost to transport and store these waste streams totals millions of dollars and requires significant land areas for deposition. A field trial to evaluate sugarcane response to an application of a FPM/bagasse mixture was initiated in the summer of 2017. A mixture of 2 parts FPM and one part bagasse by volume was applied on fallow land with a spreader at rates of 1.45, 2.91, 5.82 and 11.64 tons/A. Variety L01-299 was planted in the fall of 2017. Plant cane and sugar yields will be measured in the fall of 2018 and soil nutrient levels will be monitored for the duration of the trial. Soil nutrient levels determined in the spring of 2018 are shown in the table below. There exist a trend for P and K levels to increase with increasing application rates. Levels, however, for P and K for all treatments are considered low by soil test standards.

Application rate of FPM/bagasse, tons/A	Phosphorus, ppm	Potassium, ppm	Organic matter %
0	9.95	83.0	1.69
1.45	9.20	85.0	1.73
2.91	13.58	82.6	1.90
5.82	12.08	82.4	1.74
11.64	14.60	90.0	1.75



RESEARCH ON SOIL FERTILITY IN SUGARCANE PRODUCTION

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Summary

Field trials were conducted in 2017 to evaluate cane tonnage and sugar yield responses to potassium (K) and sulfur (S) fertilization. For the K rate and blend-K trial, treatments included muriate of potash (MOP) applied at 60, 120, 180, and 240 lbs K/ac, and 120 lbs K/ac application rate using Aspire®(compound fertilizer containing both K and B), 50%MOP+50%KMg (sulpomag; 0-0-22-22-11) and MOP+boron (B) blend as K sources. Response trials to S fertilization were conducted at four locations. In these trials, plots without S (control) and with S fertilizer (20 lbs S/ac) were compared based on cane tonnage, sugar yield, soil S and plant S status. All treatments for these studies were replicated four times and arranged in a randomized complete block design. Cane tonnage and sugar yield were maximized with 30 lbs K/ac application rate. At this rate, soil K level was increased by 10 mg/kg which translated to 5.8 ton/ac or 13.2% increase in cane tonnage and 865 lbs/ac or 7.95% increase in sugar yield (p<0.05). Additional increase in yield was observed from applying K at rate of 120 lbs/ac if MOP was mixed (or blend) with fertilizers containing other essential nutrients (Mg, S, and B). Sulfur fertilization at 20 lbs S/ac rate increased cane tonnage by an average of 4.8 ton/ac or 15.9% and sugar yield by 1229 lbs/ac or 15.4%. Corresponding increases in plant S uptake and stalk S removal rate were also observed in plots fertilized with S.

Objective

This research was designed to provide information on K and S fertilizer management to sugarcane to help growers maximize yields and profitability of sugarcane production. This annual progress report is presented to provide the latest available data on certain practices and not as final recommendation for growers to use all of these practices.

Results

Sugarcane Yield Response to Different Rate and Source of K Fertilizer

The effect of treatment was significant on cane tonnage and sugar yield (p<0.05; Table 1). On the other hand, none of the quality components responded to K rate and source effect. Based on the mean separation procedure, the optimal K application rate was 30 lbs/ac. With this application rate, cane tonnage was increased by 5.8 ton/ac or 13.2% whereas sugar yield was increased by 865 lbs/ac or 7.95% (p<0.05). At 120 lbs K/ac, cane supplied with MOP as K source had lower stalk and sugar yield than those which received Aspire and MOP blended with KMg or B. These three K sources on averaged had 8.1 tons/ac higher stalk yield (18.6%) and 1,532 lbs/ac higher sugar yield (14.1%) than the control (p<0.05). The outcomes of this study also demonstrated that additional benefit from applying higher K rate (than the optimal rate = 30 lbs/ac) was achieved if MOP was mixed (or blend) with fertilizers containing other essential nutrients (e.g., Mg, S, and B).

The soil K, S, Mg, and B levels tended to respond to K-blend fertilizer application but the differences observed among the treatments were not significant (Table 2). While soil pH was considered significantly different among the treatments at p<0.1, the differences did not exceed 0.8 unit. The leaf nutrient content was also evaluated with only K, S, and Mo content responded to the treatments (Table 3). Sugarcane which received 240 lbs K/ac obtained the highest leaf K content and canes which received MOP + KMg had the highest leaf S and lowest leaf Mo content. Similar response was observed for the stalk nutrient composition except that significant effect on P, Mg and B content was also observed (Table 4). It is observable that the cane applied with lower K rate (30 and 60 lbs K/ac including the control) attained higher stalk B content (almost similar to leaf B) than those which received higher K rate.

Sugarcane Response to Sulfur Fertilization

Figures 1 and 2 summarize the S response trials conducted at four locations in Louisiana. Sulfur application (20 lbs S/ac using ammonium sulfate as source) significantly increased cane tonnage in 3 out of four locations by an average of 4.8 ton/ac or 15.9% and sugar yield at two sites by an average of 1229 lbs/ac or 15.4% (p<0.1). At p-value = 0.16, S fertilization in 1st ratoon L01-299 on silt loam soil increased sugar yield by 1844 lbs/ac or 19.3% (Figure 2). The S content of both plant tissue and soil samples agreed with the yield response of cane to S fertilization. Table 5 provides information on S content of leaf and shredded stalk samples, stalk S removal rate, and soil S content at harvest. While some differences were not found significant (p<0.05), sugarcane that were fertilized with S consistently had higher midseason leaf S, stalk S, and stalk S removal rate than the sugarcane with no S application. Soil S was numerically higher in plots with S fertilizer than in the control (0 S) plots; however, the differences were not significant. The smaller differences in soil S values between S-fertilized and control plots maybe attributed to stalk removal rate and potential losses that had taken placed between fertilization and harvesting.

Acknowledgement
The authors wish to express appreciation for the financial support of Mosaic Co. and Sulvaris Inc.

Table 1. Cane tonnage, sugar yield and primary components of L01-299 cane variety (first ratoon) treated with different rate and sources of K, St. Gabriel, LA, 2017.

Source	Rate lbs/ac	Millable Stalk ton/ac	Sugar yield lbs/ac	BRIX %	TRS lbs/ton	Sucrose %	Polarity %	Purity %	Fiber %
Control	0	43.8 D	10878 C	19.68	250	17.34	74.8	86.61	12.94
MOP	30	49.6 ABC	11743 ABC	19.09	238	16.61	71.4	85.52	12.87
MOP	60	47.2 BCD	11035 BC	19.18	236	16.53	71.1	84.66	12.76
MOP	120	46.8 CD	11330 BC	19.54	244	17.02	73.3	85.60	12.78
MOP	180	47.5 BCD	11784 ABC	19.79	249	17.32	74.7	86.04	12.60
MOP	240	50.6 ABC	12569 A	19.40	250	17.24	74.2	87.32	12.36
Aspire	120	51.6 AB	12654 A	19.67	246	17.14	73.9	85.59	12.94
MOP + KMg	120	51.8 AB	12494 A	19.64	243	17.01	73.3	85.10	12.72
MOP + B Blend	120	52.4 AB	12082 AB	18.99	232	16.31	70.1	84.41	12.60
	***p*-value**	**0.035**	**0.034**	**0.1297**	**0.1422**	**0.1435**	**0.1442**	**0.110**	**0.713**
	SE	**2.204**	**501**	**0.224**	**5.14**	**0.298**	**1.359**	**0.696**	**0.236**

TRS – theoretical recoverable sugar

Table 2. Chemical properties of soil treated with different rates and sources of K, St. Gabriel, LA, 2017.

Source	Rate	pH	Mehlich-3 Procedure, mg/kg											
	lbs/ac		P	K	Ca	Mg	S	B	Cu	Fe	Mn	Mo	Ni	Zn
Control	0	7.76 abc	24.4	77	1180	293	12.5	0.759	2.18	170	122	0.009	3.04	1.64
MOP	30	7.37 de	27.8	88	1194	295	12.7	0.713	2.41	219	116	0.013	3.53	2.10
MOP	60	7.48 bcde	30.7	89	1167	314	11.1	0.660	2.27	236	119	0.008	3.08	2.05
MOP	120	7.90 a	33.8	117	1327	317	12.8	0.723	2.36	247	124	0.008	3.15	2.21
MOP	180	7.84 ab	33.0	99	1304	299	11.2	0.653	2.32	233	120	0.009	3.19	2.09
MOP	240	7.50 abcde	29.6	89	1217	287	11.9	0.643	2.20	243	112	0.012	3.09	2.03
Aspire®	120	7.41 cde	28.8	99	1304	315	11.8	0.890	2.48	265	134	0.014	3.84	2.33
MOP + KMg	120	7.61 abcd	33.4	95	1313	348	14.4	0.763	2.40	256	131	0.011	3.60	2.20
MOP + B Blend	120	7.19 e	27.1	84	1278	312	11.8	0.653	2.66	273	129	0.004	3.82	2.44
	***p*-value**	**0.082**	**0.8397**	**0.832**	**0.989**	**0.781**	**0.440**	**0.35**	**0.972**	**0.836**	**0.834**	**0.853**	**0.590**	**0.934**
	SE	**0.186**	**10.8**	**16.8**	**178**	**28**	**1.21**	**0.085**	**0.245**	**56**	**9.9**	**0.0046**	**0.371**	**0.50**

Aspire: compound fertilizer containing both K and B

Table 3. Leaf elemental composition of cane variety L01- 299 (1st ratoon) treated with different rates and sources of K, St. Gabriel, LA, 2017.

Source	**Rate** lbs/ac	**N**	**P**	**K**	**Ca**	**Mg**	**S**	**B**	**Cu**	**Fe**	**Mn**	**Mo**	**Ni**	**Zn**
		------------------------%------------------------						------------------------mg/kg----------------------------------						
Control	0	2.04	0.126	0.902	0.420	0.162	0.118	25.2	2.97	66.9	24.3	2.53	0.125	8.22
MOP	30	2.06	0.142	0.905	0.423	0.169	0.126	29.7	3.48	63.1	34.5	2.34	0.113	9.02
MOP	60	2.12	0.133	0.978	0.419	0.158	0.121	30.5	3.22	66.1	29.8	2.45	0.098	8.47
MOP	120	1.97	0.132	0.974	0.427	0.158	0.117	28.0	3.23	68.9	24.9	2.52	0.124	9.06
MOP	180	2.08	0.128	0.983	0.416	0.152	0.122	22.8	3.12	73.3	27.3	2.32	0.105	8.20
MOP	240	2.09	0.136	1.061	0.435	0.164	0.125	24.0	3.39	69.7	33.2	2.37	0.133	8.73
Aspire	120	2.05	0.138	0.945	0.387	0.148	0.122	20.8	3.12	67.8	31.0	2.28	0.156	8.36
MOP + KMg	120	2.13	0.125	0.929	0.400	0.157	0.192	13.8	3.21	72.4	26.2	1.25	0.162	8.30
MOP + B Blend	120	2.09	0.134	0.941	0.403	0.156	0.118	21.2	3.15	56.9	31.3	2.12	0.185	8.32
	***p*-value**	**0.575**	**0.139**	**0.061**	**0.94**	**0.516**	**<0.001**	**0.468**	**0.291**	**0.749**	**0.079**	**0.002**	**0.921**	**0.377**
	SE	**0.0534**	**0.005**	**0.040**	**0.0255**	**0.006**	**0.0048**	**6.98**	**0.167**	**7.05**	**2.75**	**0.217**	**0.047**	**0.382**

Table 4. Stalk elemental composition of cane varietyL01- 299 (1st ratoon) treated with different rates and sources of K, St. Gabriel, LA, 2017.

Source	**Rate** lbs/ac	**N**	**P**	**K**	**Ca**	**Mg**	**S**	**B**	**Cu**	**Fe**	**Mn**	**Mo**	**Ni**	**Zn**
		------------------------%------------------------						------------------------mg/kg----------------------------------						
Control	0	0.362	0.034	0.183	0.054	0.058	0.021	7.95	2.03	24.4	8.30	0.222	0.402	7.76
MOP	30	0.371	0.050	0.213	0062	0.061	0.024	7.78	2.09	28.3	8.97	0.245	0.642	9.01
MOP	60	0.369	0.045	0.249	0.056	0.057	0.022	8.90	2.23	25.8	8.13	0.226	0.296	8.06
MOP	120	0.376	0.039	0.263	0.053	0.056	0.024	5.86	1.93	29.5	8.11	0.270	0.544	7.78
MOP	180	0.366	0.043	0.294	0.050	0.050	0.024	6.67	1.94	25.1	7.54	0.172	0.565	6.92
MOP	240	0.411	0.041	0.358	0.054	0.054	0.023	5.61	2.01	26.6	9.06	0.162	0.832	7.77
Aspire	120	0.379	0.058	0.307	0.058	0.056	0.030	6.01	2.08	28.0	9.06	0.248	0.517	9.13
MOP + KMg	120	0.358	0.044	0.254	0.056	0.061	0.072	5.16	1.81	24.6	8.21	0.106	0.373	8.25
MOP + B Blend	120	0.391	0.052	0.310	0.059	0.058	0.025	6.74	2.07	24.0	8.24	0.212	0.536	8.58
	***p*-value**	**0.956**	**0.071**	**<0.001**	**0.472**	**0.035**	**<0.001**	**0.005**	**0.291**	**0.835**	**0.683**	**0.036**	**0.323**	**0.194**
	SE	**0.030**	**0.005**	**0.022**	**0.004**	**0.0018**	**0.003**	**1.205**	**0.109**	**2.79**	**0.706**	**0.0347**	**0.146**	**0.569**

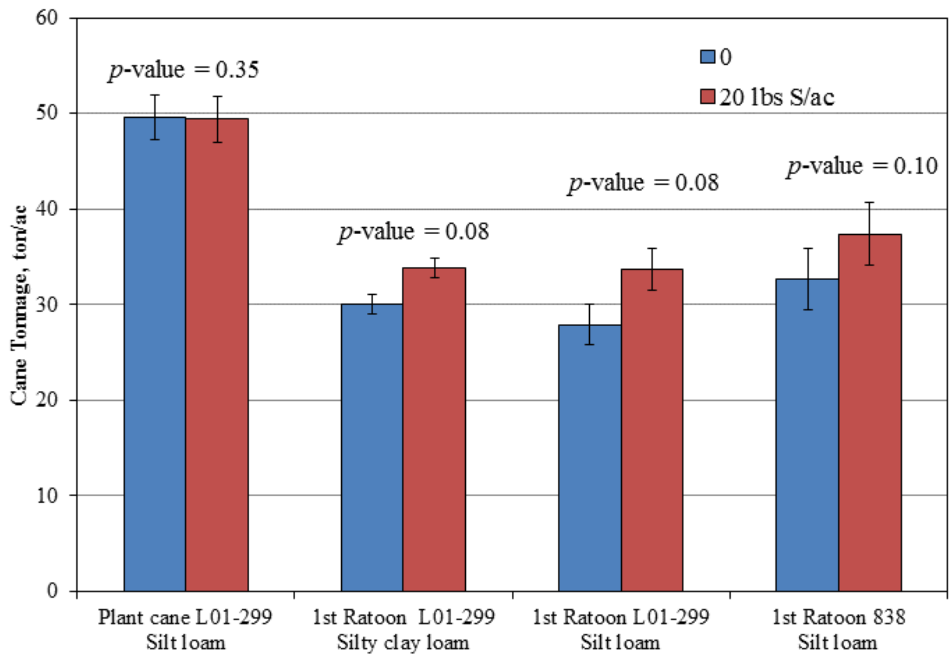

Figure 1. Effect of sulfur fertilization on cane tonnage at four locations in LA, 2017.

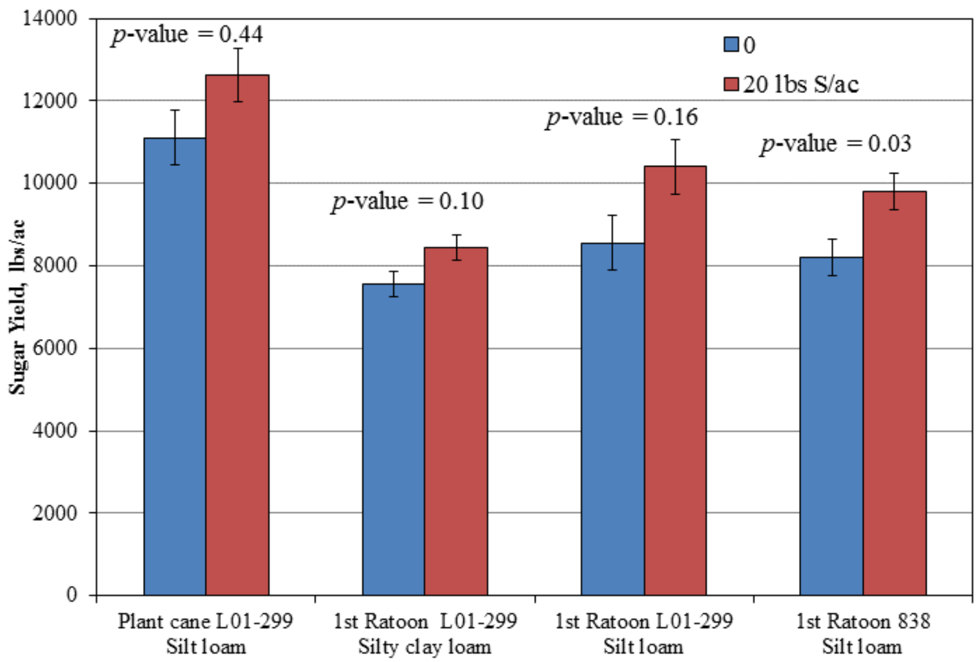

Figure 2. Effect of sulfur fertilization on sugar yield at four locations in LA, 2017.

Table 5. Plant S, soil S, and S stalk removal rate between control (0 S) and S-fertilized (20 lbs/ac) plots, Louisiana, 2017.

Source	Leaf S (Mid)	Leaf S (Har)	Stalk S	S Stalk Removal	Soil S
	%	%	%	lbs/acre	mg/kg
Plant Cane, L01-299, Silt Loam					
Control (No S)	0.135	0.102	0.042	12.82	6.71
20 lbs/ac	0.185	0.102	0.050	14.93	7.23
***p*-value**	**0.031**	**0.849**	**0.134**	**0.016**	**0.295**
SE	**0.0097**	**0.007**	**0.004**	**1.359**	**0.662**
1st Ratoon, L01-299, Silty Clay Loam					
Control (No S)	0.098	0.080	0.030	5.38	8.48
20 lbs/ac	0.014	0.075	0.042	8.72	8.81
***p*-value**	**0.001**	**0.826**	**0.001**	**0.001**	**0.507**
SE	**0.004**	**0.008**	**0.003**	**0.518**	**0.832**
1st Ratoon, L01-299, Silt Loam					
Control (No S)	0.150	0.073	0.037	7.63	8.88
20 lbs/ac	0.170	0.077	0.047	10.88	9.26
***p*-value**	**0.013**	**0.002**	**0.001**	**0.001**	**0.549**
SE	**0.006**	**0.004**	**0.004**	**1.036**	**9.070**
1st Ratoon, HoCP 04-838, Silt Loam					
Control (No S)	0.090	0.060	0.010	2.47	4.20
20 lbs/ac	0.205	0.108	0.038	8.20	7.48
***p*-value**	**0.001**	**0.173**	**0.081**	**0.031**	**0.531**
SE	**0.012**	**0.009**	**0.004**	**0.978**	**0.945**

NITROGEN MANAGEMENT RESEARCH IN LOUISIANA SUGARCANE PRODUCTION SYSTEMS

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Sugar Research Station

Summary

Field trials were established with treatments consisting of application time (March vs. April), N source (urea ammonium nitrate solution - UAN vs. controlled-release N), and rate (40, 80 and 120 lbs N/ac); a control plot was also included. Another trial was conducted to evaluate if N form (nitrate vs. ammonium) has an impact on sugarcane productivity. All treatments were replicated four times and arranged either in randomized complete block design or complete randomized design. Cane tonnage, quality components, and sugar yield were determined at harvest. A drone equipped with digital camera was flown in early June to collect images of sugarcane plots treated with different N rate and source. The estimated cane tonnage based on normalized difference vegetation index (NDVI) was correlated with the measured cane tonnage at harvest. The benefit of using the right source and time of application was dependent on soil type. Generally, application timing and N source made a positive impact on yield of cane planted on soil with clayey texture. Sugarcane planted on clay soil had higher response to N fertilization than cane planted on silt loam soil. On average across application time and source, N fertilization increased cane tonnage by 5 tons/ac (22%) and 15 tons/ac (49%) and sugar yield by 1290 lbs/ac (27%) and 4000 lbs/ac (61%) of cane planted on clayey and silt loam soils, respectively. There were indications that controlled-release N fertilizer and ammonium-N based fertilizer performed better in soils with clayey texture than on silt loam soils. Only 32% variability in measured cane tonnage could be explained by predicted cane tonnage. The linear relationship between the predicted cane tonnage (based aerial image derived NDVI) and measured cane tonnage was relatively weak with a correlation coefficient (*r*) value of 56%.

Objectives

This project intends to evaluate the effect of N source, rate, and application time on sugarcane productivity. In addition, this project also aims to calibrate NDVI readings derived from aerial images.

<u>Effect of Nitrogen Source, Rate and Application Time on Sugarcane Yield</u>

A linear-plateau analysis was conducted to determine the N rate that maximized cane tonnage at two application times i.e., March vs. April (Table 1). The optimal N rates for March and April application on Commerce silt loam soil were very similar (100 vs. 90 lbs N/ac) attaining similar cane tonnage levels of 44 and 46 tons/ac, respectively. A rate higher than 120 lbs N/ac was required on Sharkey clay soil regardless of application time to attain maximum cane tonnage of 31 ton/ac, a yield level substantially lower than what was obtained on the Commerce silt loam soil. This result implies that soil type seemed to have higher influence on optimal N rate requirement and maximum yield of sugarcane than the application time and that the effect of application time is dependent on the soil type. This is partly due to the different loss potential of applied N between silt loam and clay soil. Greater amount of applied N is lost in poorly drained clay soil through denitrification process than well-aerated silt loam soils.

The required amount of N to maximize cane tonnage and sugar yield was influenced by N source and soil type (Figures 1 and 2). For Commerce silt loam soil, lower amount of N was required to attain maximum cane tonnage (46 tons/ac) and sugar yield (10,397 lbs/ac) using UAN as N source compared to Agrocote®. The optimal N rate was 90 and 70 lbs N/ac when UAN was used compared to 100 and 125 lbs N/ac when Agrocote was used for maximum cane tonnage and sugar yield production, respectively. On the other hand, N rate requirement was reduced by more than 50% on Sharkey clay when Agrocote was used compared to UAN. However, maximum cane tonnage and sugar yield were comparable between two N sources. Sharkey clay would yield same cane tonnage level with 67 lbs N/ac application rate using Agrocote compared to 138 lbs N/ac using UAN as source. Using sugar yield as response variable, 30 lbs N/ac was optimal to attain >6300 lbs/ac yield using Agrocote compared to 80 lbs N/ac for >5800 lbs/ac yield using UAN as source. The benefit of controlled-release technology is influenced by soil type. In this case, soil with high loss N potential such as the Sharkey clay benefitted from a using controlled-release N fertilizer as opposed to a highly soluble N source such as UAN.

Figures 3 and 4 show the impact of using different forms (sources) of N on cane tonnage and sugar yield of L01-299 planted on silt loam and silty clay soil. Cane on silty clay loam had higher response to N fertilization than cane on silt loam soil. On average, the application of N at 80 lbs/ac rate increased cane tonnage by 11 ton/ac (33%) and 14 ton/ac (48%) on silt loam and silty clay soil, respectively; whereas sugar yield was increased by 2,567 lbs /ac (30%) and 3,420 lbs/ac (48%). A notable effect of N source was observed on silty clay soil with ammonium sulfate performing the best among the sources. Plots that were knife-in with UAN at the rate of 60 lbs N/ac combined with foliar application of dissolved ammonium sulfate (at 20 lbs N/ac) had the lowest cane tonnage and sugar yield. For silt loam soil, differences were only observed on cane tonnage and only when ammonium sulfate was compared with calcium nitrate. It was noted in previous studies that ammonium-N is a preferred form of N that is taken up by sugarcane. This may be attributed to a better uptake root system of cane for ammonium-N than nitrate-N and less investment in energy of sugarcane during the assimilation of ammonium-N to amino acids (and proteins, enzymes etc.) than nitrate-N.

Calibration of Aerial-NDVI: Correlation between Predicted and Measured Cane Tonnage

Yield is one of bases to determine sugarcane N requirement. The model that is currently used to predict cane tonnage uses NDVI taken by a ground-based sensor (GreenSeeker®) as predictor. Deriving NDVI from aerial images taken by unmanned aircraft system equipped with a digital camera presents an opportunity to use remote sensing technology in a more efficient way, covering larger production area than ground-based sensor. Images from four N response trials in St. Gabriel were taken and then converted to NDVI (Figure 5). The predicted cane tonnage based on these NDVI readings were correlated with measured cane tonnage (Figure 6). Only 32% variability in measured cane tonnage could be explained by predicted cane tonnage. The linear relationship between these two variables was relatively weak with a correlation coefficient value of 56%.

Acknowledgements

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Table 1. Optimal N rate and maximum cane tonnage of L01-299 grown on Commerce silt loam and Sharkey clay soil at two different application time.

Soil	Application Time	Optimal N Rate lbs/ac	Maximum Cane Tonnage ton/ac
Commerce silt loam	March	100	44
	April	90	46
Sharkey clay	March	>120	31
	April	>120	31

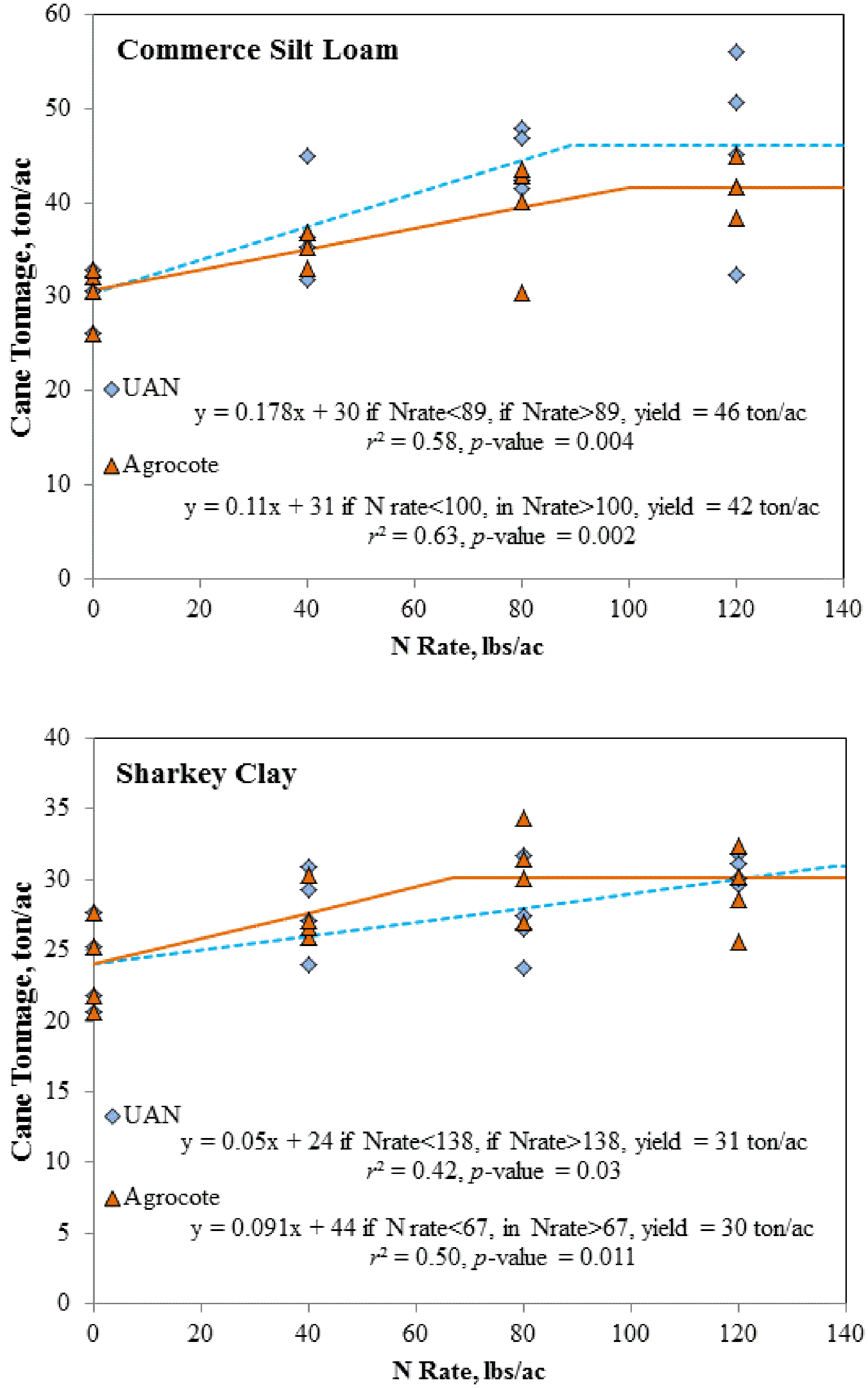
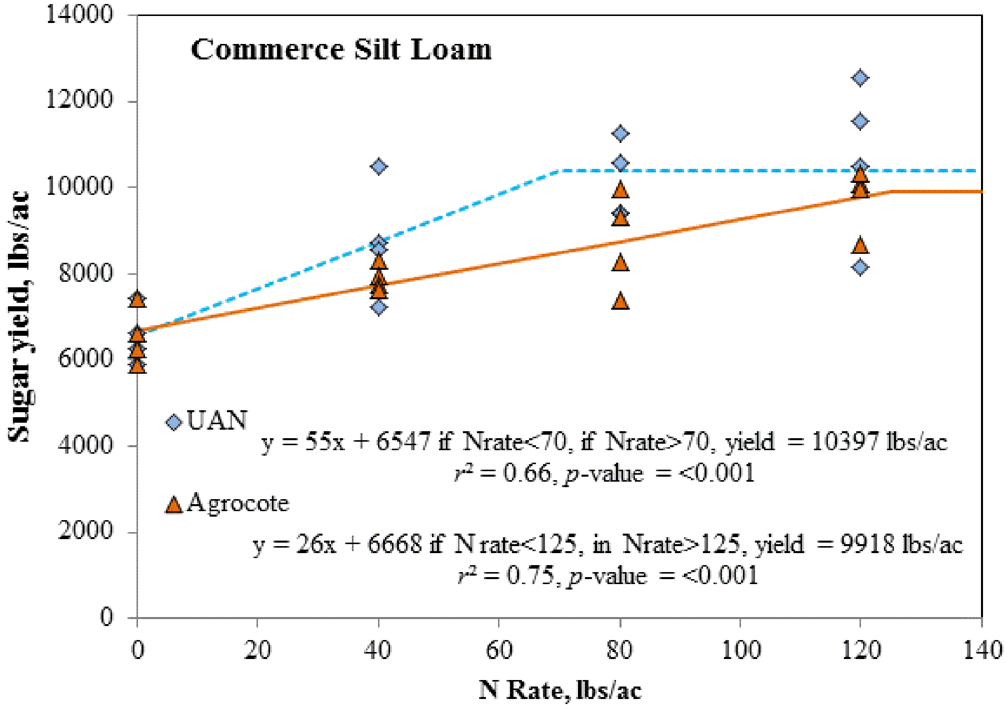


Figure 1. Optimal N application rate for cane tonnage of L01-299 cane variety grown on Commerce silt loam and Sharkey clay soils using UAN and Agrocote as N source, 2017, St. Gabriel, LA.



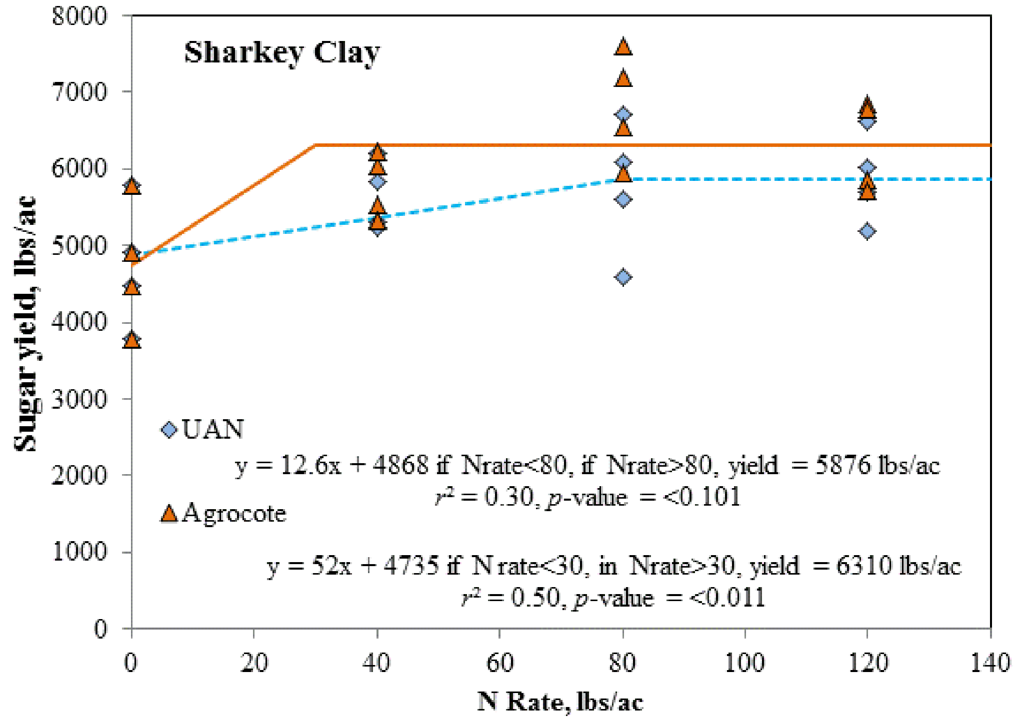


Figure 2. Optimal N application rate for sugar yield of L01-299 cane variety grown on Commerce silt loam and Sharkey clay soils using UAN and Agrocote as N source, 2017, St. Gabriel, LA.

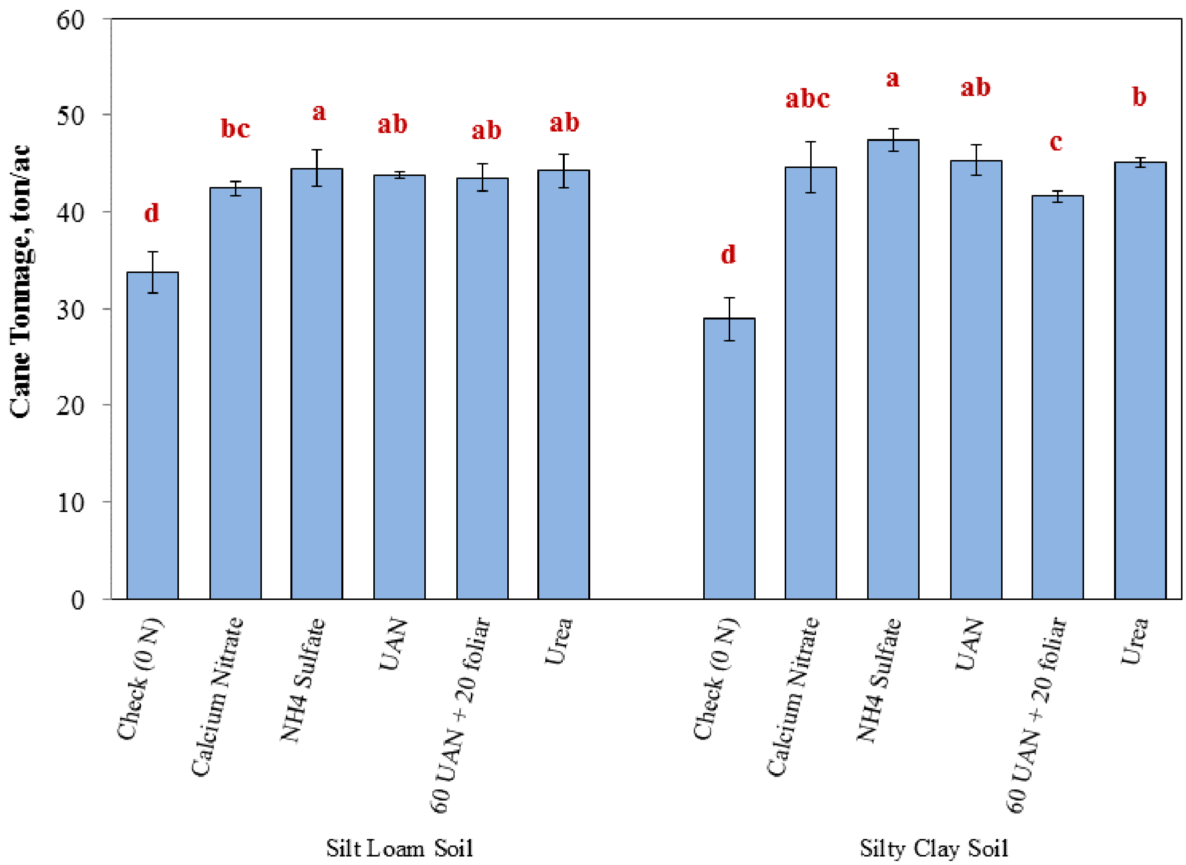


Figure 3. Effect of different N sources on cane tonnage of L01-299 cane variety grown on a silt loam and silty clay soils, 2017, St. Gabriel, LA. Note: Except with the check, N rate used was 80 lbs N/ac.

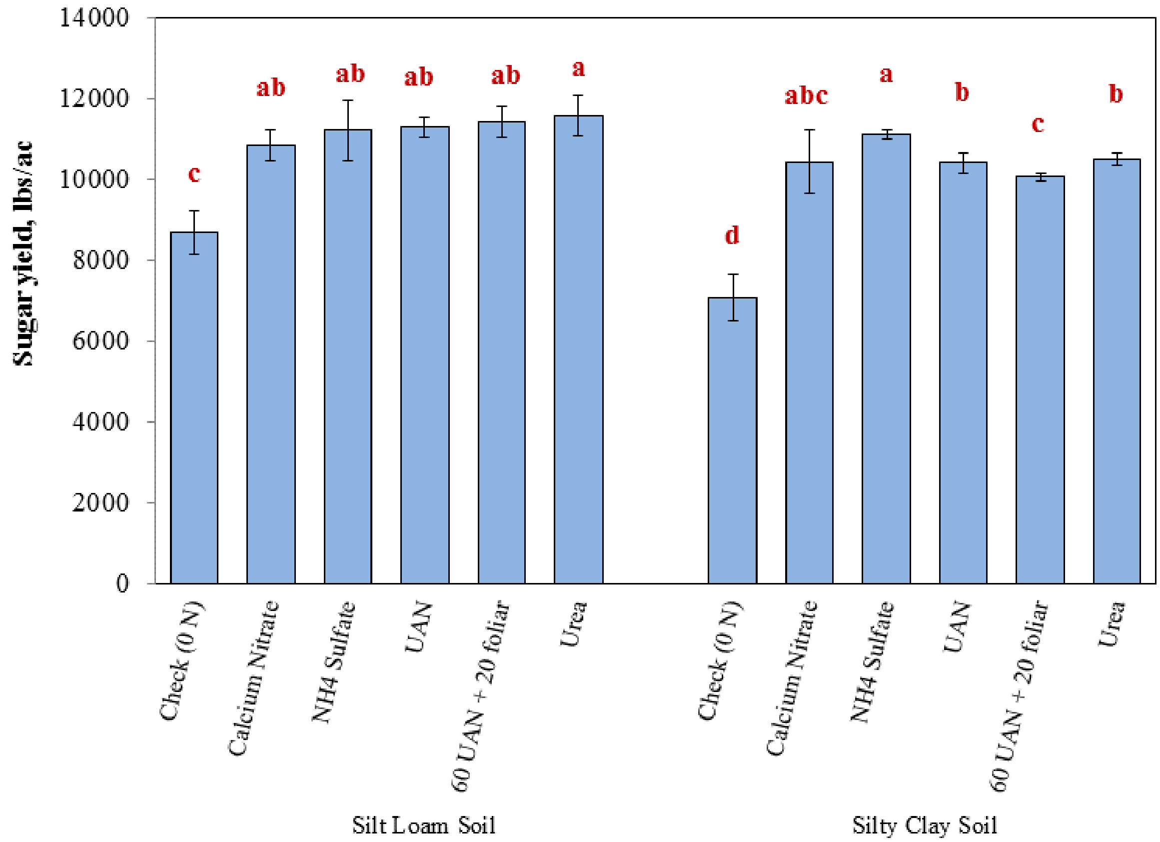


Figure 4. Effect of different N sources on sugar yield of L01-299 cane variety grown on a silt loam and silty clay soils, 2017, St. Gabriel, LA. Note: Except with the check, N rate used was 80 lbs N/ac.

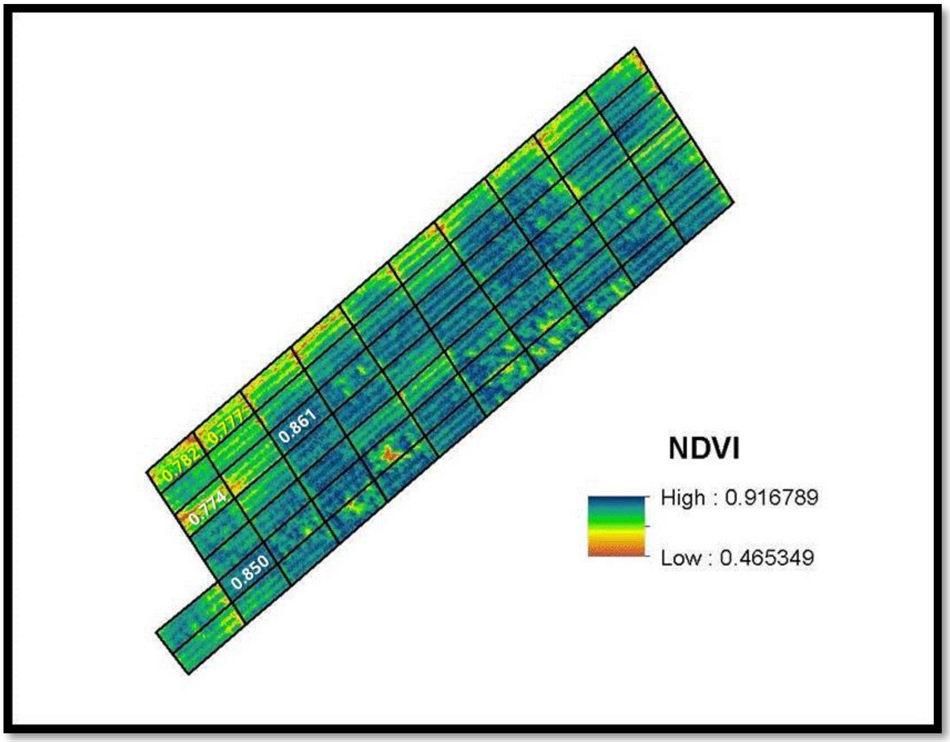


Figure 5. NDVI map converted from the aerial image of N response trial in St. Gabriel, LA, 2017. Each polygon represents a plot and each plot yields one NDVI reading (observation).

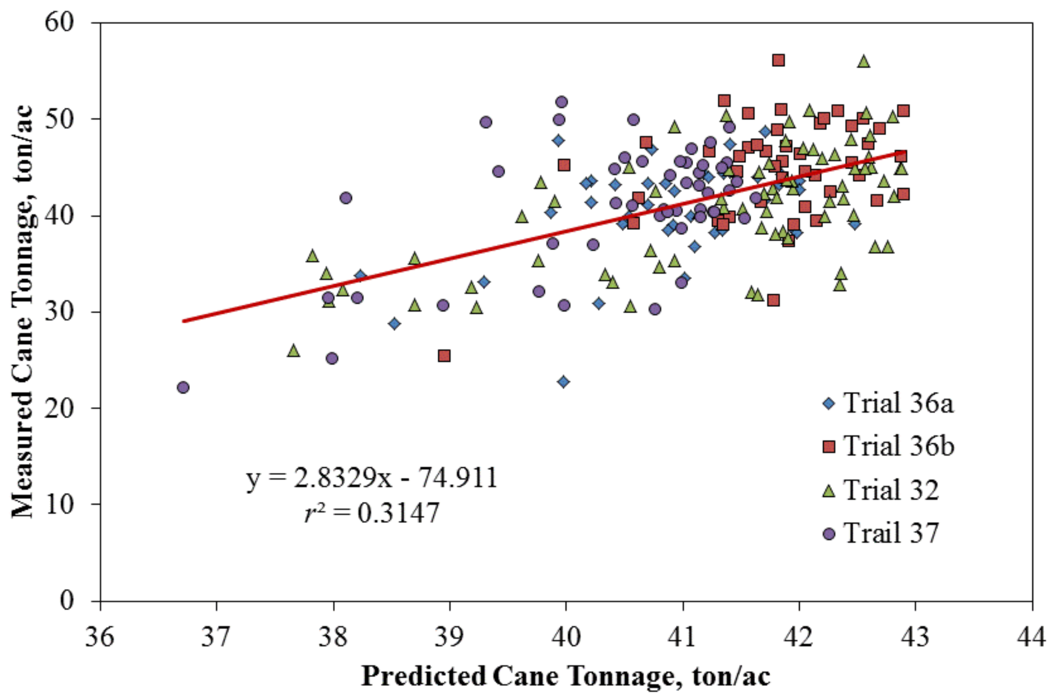


Figure 6. Correlation between predicted cane tonnage based on aerial-NDVI readings and measured cane tonnage from four N response trials conducted in 2017, St. Gabriel, LA. Number of observations = 208.