SOIL FERTILITY RESEARCH IN SUGARCANE

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In Cooperation with
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Summary

Several fertility trials were conducted in 2009 to evaluate the performance of recent cane varieties as affected by nitrogen (N), fertilizer adjuvants, and different sources and rates of potassium (K). Nitrogen applied at a rate of 80 lbs N ac^{-1} significantly increased cane and sugar yield of 2^{nd} stubble cane varieties HoCP96-540, L99-226 and LCP85-384. Compared with the check plot (0 K_2O plot), there were only slight increases in both cane and sugar yield when K was supplied at rates of 120 lbs ac^{-1} as sulfate of potash (SOP) and 60 lbs ac^{-1} as muriate of potash (MOP). Our results showed that while one-time application of fertilizer adjuvant at planting in combination with spring application of adjuvant + PGR had numerically higher cane and sugar yields compared with the control, these differences were not significant. Application of adjuvants on top of regular fertilization did not improve sugarcane yield. A contrast analysis confirmed that differences in sugarcane yield were attributed to N application.

Objectives

This research was designed to provide information on soil fertility management in an effort to help growers produce maximum economic yields and increase profitability in 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. Recommendations are based on several years of research data.

Results

Effect of Nitrogen on Sugarcane Yield

An experiment was conducted to determine the effect of spring-applied N fertilizer on the yield and yield components of 2^{nd} stubble-cane of three cane varieties planted on a Commerce silt loam (Table 1). The responses of varieties LCP85-384, HoCP96-540 and L99-226 with different N rates (0, 40, 80, and 120 lbs N ac^{-1}) were evaluated. Sugarcane variety HoCP96-540 obtained the highest cane (35 tons ac^{-1}) and sugar (7196 lbs ac^{-1}) yield among the varieties tested. Across all varieties, N significantly increases both cane and sugar yield. Nitrogen applied at the rate of 80 lbs ac^{-1} maximized both cane and sugar yield. No further increases in cane and sugar yield were observed at application rate of 120 lbs N ac^{-1}.

Response of Sugarcane to Different Sources and Rates of Potassium

This study was established on a silty clay soil that was tested low to medium for K and high for sulfur (S). Sugarcane variety HoCP96-540 was planted in September 2008. Results of the first year trial (plantcane) are summarized in Table 2. There were only slight increases (not significant, $P<0.05$) in both cane and sugar yield when K was supplied at rates of 120 lbs ac^{-1} as SOP and 60 lbs ac^{-1} as MOP. Application rate at 240 lbs K_2O ac^{-1} tended to decrease both cane and sugar yield. Supplying K_2O as MOP tended to increase sugar yield by about 500 lbs ac^{-1} when compared with SOP as K_2O source. On the other hand, cane yields of both MOP and SOP treated plots were very similar (39 vs. 41 ton ac^{-1}). There is an increasing trend of Mehlich-3 extractable K with increasing rates of K_2O as SOP however this was not observed in MOP.

Fertilizer Adjuvant Effects on Sugarcane Yield

Two trials were conducted in 2009 to investigate the effect of AminoGrow products as fertilizer adjuvants on sugarcane yield. The effect of N and Trimat (Table 3) on sugarcane yield and yield components was consistent across varieties. There were significant differences when evaluating the overall effect of the treatments for cane and sugar yields. However, a contrast analysis confirmed that these differences were attributed to N application. At 80 lbs N ac^{-1}, with and without Trimat application, cane and sugar yields were the same across varieties. The benefit of Trimat and PGR+ application to sugarcane was also tested (Table 4). There was no interaction between variety and treatment indicating that both varieties had consistent response to application of Trimat and PGR+. Our results showed that while the one-time application of Trimat at planting in combination with spring application of Trimat and PGR+ had numerically higher cane and sugar yields compared with the control, these differences were not significant. This could be attributed to large variation that existed among replications within each of the treatments. The one-time, fall application of Trimat at planting but without spring amendments of these adjuvants obtained similar yields to plots that received Trimat and PGR+ in spring.

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Table 1. Effect of nitrogen on the second stubble yield of three cane varieties planted on a Commerce silt loam at the Sugar Research Station, St. Gabriel, LA, 2009.

Treatment		Population 1000 ac^{-1}	TRS Lbs ton^{-1}	Purity %	Cane Yield ton ac^{-1}	Sugar Yield lb ac^{-1}
Variety						
	L99-226	26.0	207	80.7	28.4	5865
	LCP85-384	34.3	193	80.8	29.0	5562
	HoCP96-540	34.0	205	81.9	35.0	7196
	Pr>F	***0.0001***	***0.0012***	***0.537***	***<0.0001***	***<0.0001***
Nitrogen Rate, lb/ac						
	0	27.1	199	81.0	23.7	4722
	40	31.0	208	81.9	31.2	6454
	80	33.0	201	80.8	33.8	6817
	120	34.6	198	80.1	34.4	6837
	Pr>F	***0.0147***	***0.1617***	***0.0385***	***<0.0001***	***<0.0001***

Table 2. Yield and yield components of sugarcane as affected by source and rate of potassium. Mehlich-3 Extractable potassium of soil samples collected after harvest is also reported.

Source	Potash Rate lbs K_2O ac^{-1}	Soil K	Population 1000 ac^{-1}	TRS lbs ton^{-1}	Purity %	Cane Yield ton ac^{-1}	Sugar Yield lb ac^{-1}
-	0 (Check 1)	225	27.6	201	83	39	7755
-	0 (Check 2†)	223	32.1	194	82	39	7542
SOP	60	225	30.6	199	83	38	7638
SOP	120	236	34.5	192	81	40	7807
SOP	240	248	33.0	195	82	37	7243
MOP	60	228	30.0	301	82	42	8414
MOP	120	232	30.8	203	83	38	7701
MOP	240	218	33.4	195	82	41	7977
MOP†	60	247	34.4	195	81	41	8093
MOP†	120	227	32.8	194	80	40	7844
MOP†	240	236	35.5	188	81	42	7822
	Pr>F	***ns***	***ns***	***ns***	***ns***	***ns***	***ns***

† applied with 20 lbs S ac^{-1}
SOP: Sulfate of Potash, 0-0-50
MOP: Muriate of Potash , 0-0-60
ns – not significant

Table 3. Effect of fertilizer adjuvant and nitrogen on the second stubble yield of three cane varieties on a Commerce silt loam, Sugar Research Station, St. Gabriel, LA, 2009.

Treatment		Population 1000 ac^{-1}	TRS lbs ton^{-1}	Purity %	Cane Yield ton ac^{-1}	Sugar Yield lb ac^{-1}
Variety						
	L99-226	2486	208	81	25.0 b	5179
	L99-233	2837	213	82	24.1 b	5146
	HoCP96-540	2867	202	81	27.4 a	5500
	Pr>F	***ns***	***ns***	***ns***	*	***ns***
Trt No.						
1	0 lb N/ac	2256 d	210	81.8	20.2 c	4236 c
2	80 lbs N/ac	2977 ab	200	80.1	31.3 a	6295 a
3	0 lb N/ac + Trimat	2620 bc	210	81.6	19.8 c	4136 c
4	40 lbs N/ac + Trimat	2679 b	210	81.6	25.9 b	5392 b
5	80 lbs N/ac + Trimat	3119 a	207	81.0	30.3 a	6306 a
	Pr>F	*	***ns***	***ns***	***	***

ns – not significant, * and ***, significant at 95% and 99.9% level of confidence

Table 4. Effect of fertilizer adjuvant on the first stubble yield of two cane varieties on a Cancienne silty clay loam, Sugar Research Station, St. Gabriel, LA, 2009.

Treatment		Population 1000 ac^{-1}	TRS lbs ton^{-1}	Purity %	Cane Yield ton ac^{-1}	Sugar Yield lb ac^{-1}
Variety						
	L99-226	2769 b	208	81.7	32.0 b	6717
	HoCP96-540	3430 a	202	81.5	37.8 a	7656
	Pr>F	***	***ns***	***ns***	**	***ns***
Trt No.	Fall TRT – Spring TRT					
1	Control – Control	3178	199	81.6	32.4	6466
2	T & PGR – T, PGR & F	2898	208	81.5	35.0	7308
3	T – T, PGR & F	3162	204	81.5	36.0	7383
4	T – Control	3161	208	81.7	36.2	7588
	Pr>F	***ns***	***ns***	***ns***	***ns***	***ns***

ns – not significant, ** and ***, significant at 99% and 99.9% level of confidence

T – Trimat

PGR – Growth Regulator

F – Foliar NPK

EFFICACY OF NUTRI-PHITE™ AS A PHOTOSYNTHESIS REGULATOR IN SUGARCANE

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Summary:

Nutri-Phite™, a photosynthesis regulator, was foliar applied at both a half gallon/acre rate and at a full gallon/acre rate (split applied a month apart). Sugar and cane yield responses were not significant. While higher N use efficiency has been measured in other crops, it was not evident in this plantcane study.

Objectives and Methods:

Research with other crops has demonstrated higher N use efficiency with application of Nutri-Phite™. Its mode of action is to function as a photosynthesis enhancer. Nutri-Phite™ was applied to sugarcane cultivar “L01-283” in 50 ft plots at two rates, a half gallon/acre and a gallon/acre split applied a week apart, with the initial application accomplished when the sugarcane was approximately three feet tall. Applications were made on June 2 and June 10 with a pressurized backpack sprayer at 30 gallons of water per acre. A recommended rate of N fertilizer was blanket applied to the entire experimental area prior to application of the product. Data were recorded for stalk population and cane and sugar yield.

Results:

Sugarcane appeared indifferent to the application of Nutri-Phite™. No significant response in cane or sugar yield was recorded, as shown in the table below. Failure to elicit a response may have been because application was not made at an appropriate growth stage for sugarcane. Perhaps the product did promote higher N use efficiency, but it was not detectable because sugarcane often does not respond to a N-enriched environment in the plantcane phase of the production cycle. Additional evaluation is warranted to determine optimal application timing, especially in the stubble phase of the production cycle where a positive response may be more possible.

Application rate of formulated material	Pounds sugar/acre	Tons cane/acre	TRS lb/ton	Stalks/acre
Check	7,354	32.4	227	29,185
Half gallon/acre	6,776	31.9	213	28,459
Gallon/acre, split applied 8 days apart	7,091	32.6	219	31,654
LSD = .05	NS	NS	NS	NS

THE RESPONSE OF SWEET SORGHUM TO NITROGEN FERTILIZER RATES

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Summary:

Two sweet sorghum varieties, M-81E and Topper 76-6, were evaluated for their response to varying nitrogen fertilizer rates (40, 60, 80 and 100 pounds per acre) on a Baldwin silty clay loam in 2008 and 2009. The variety by nitrogen application rate interaction was not significant for all production traits. Only Brix was affected by N rate.

Performance of sweet sorghum varieties at varying fertilizer N rates at Jeanerette, LA in 2008-09

N rate (lb/a)	Brix	Tons of millable stalks/a	Stalk population/a	Tons of fermentable sugar/a
40	17.0 a[1]	21.9	32,235	3.34
60	16.4 bc	23.1	32,020	3.41
80	16.5 ab	26.1	33,414	3.90
100	16.0 c	25.4	32,121	3.64
P =	0.002	NS	NS	NS

[1]Nitrogen rate means, averaged over the two varieties, in columns followed by a common letter are not significantly different at P=0.05. The variety x N rate interaction for all variables was not significant.

Evaluation of sweet sorghum varieties at varying fertilizer N rates at Jeanerette, LA in 2008-09

Variety	N rate (lb/a)	BRIX	Tons of millable stalks/a	Population/a	Tons of fermentable sugar/a
M81E	40	16.9	21.4	31133	3.23
	60	16.3	22.7	33372	3.32
	80	16.1	26.4	34818	3.84
	100	15.6	25.7	33892	3.61
	Variety mean	*16.2 b[1]*	*24.1*	*33304*	*3.50*
Topper 76-6	40	17.0	22.5	33336	3.45
	60	16.5	23.4	30667	3.50
	80	17.0	26.0	32011	3.95
	100	16.3	25.0	30311	3.66
	Variety mean	*16.7 a*	*24.2*	*31581*	*3.64*
P =		0.007	NS	NS	NS

[1]Varietal means, averaged over N rates, in columns followed by a common letter are not significantly different at the P=0.05. The variety x N rate interaction for all variables was not significant.

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MONITORING OF SOIL SALINITY AFTER HURRICANE STORM SURGES

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Summary:

Monitoring of soil salinity subsequent to the storm surges of Hurricanes Katrina, Rita, Gustav and Ike was accomplished to assess the association between salinity level and sugarcane yield. While many sites possessed salinity levels well above the damage threshold (estimated to be approximately 1,000 ppm in the root zone) shortly after the waters receded, salinity at most of these sites was significantly lowered by the high rainfall amounts typically recorded in south Louisiana. Also, sugar yields were mostly acceptable when the sites were harvested a year after the storms. Recalcitrant salinity, believed to be caused by movement of salty water and high water tables, was detected at a few locations where sugarcane fields are in close proximity to tidal waters. The level and distribution of soil salinity associated with the storm surge and the extent of leaching of the salinity by rainfall were similar for all the Hurricanes.

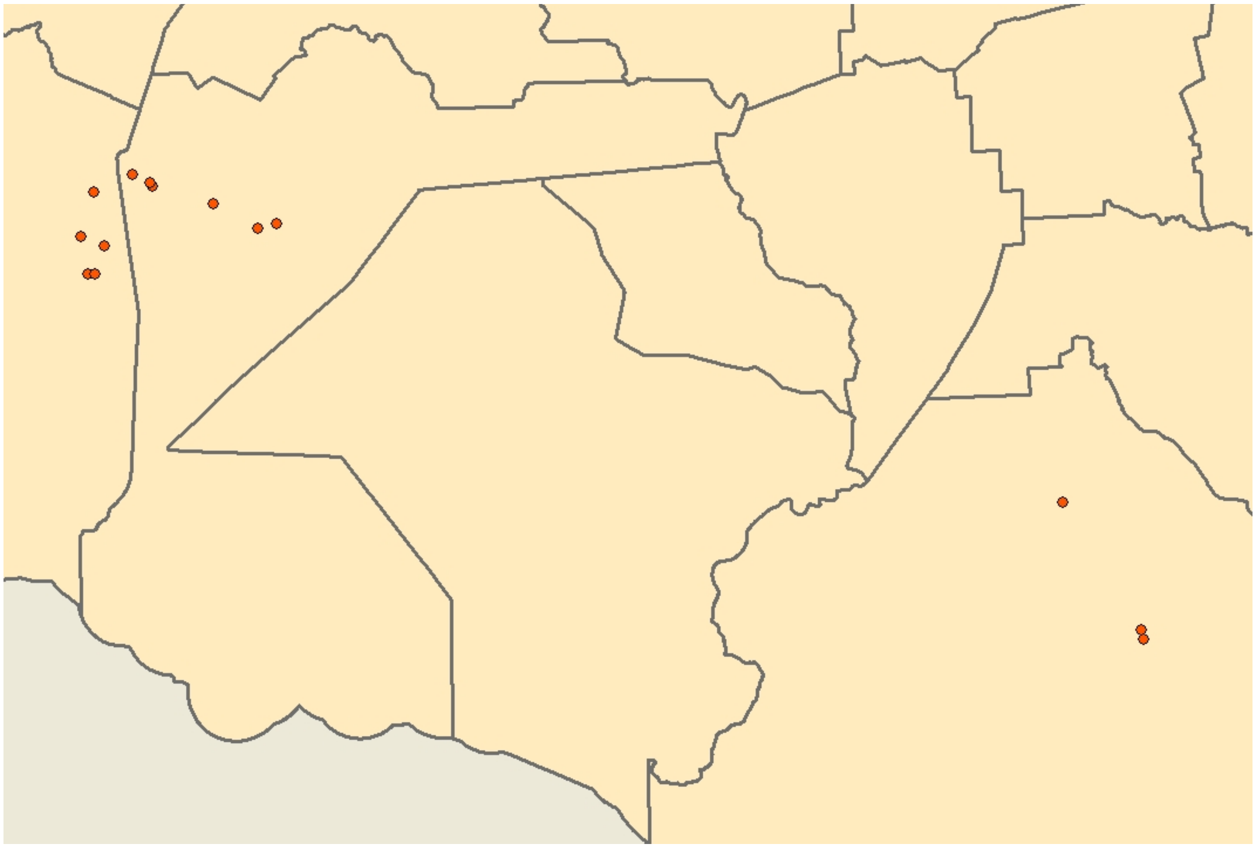
Methods:

Sites sampled for soil salinity after the tidal surges of Hurricanes Gustav and Ike were re-sampled for salt content at harvest this fall. Sample depth was 0 to 6 in. and 6 to 12 in. in the rooting zone. Sugar per acre yield estimates were also measured for sugarcane immediately adjacent to the geo-referenced sites sampled for soil salinity, using 25 ft. long plots for hand harvesting of samples for lab analysis.

Results:

Soil salinity level ranged from 112 to 4,774 ppm immediately after the storm surge and from 91 to 1,869 ppm at sugarcane harvest a year later. Of the 14 sites sampled after Hurricanes Gustav and Ike, only one still possessed salinity above 1,000 ppm. Sugar yield ranged from 2,388 to 9,717 lb of sugar per acre, with the lowest yielding site possessing the highest level of salinity. It appears that soil salinity generally disappears within a year in our high-rainfall environment. Some areas, however, remain salty because of their proximity to salty water subject to tidal movements or a high water table.

Research partially supported by a grant from the American Sugar Cane League.



Sites samples for soil salinity and sugarcane yield after the storm surges of Hurricanes Gustav and Ike. Salinity ranged up to 4,774 ppm shortly after the storm.