SUGAR CROPS PRODUCTION MANAGEMENT RESEARCH AT THE IBERIA RESEARCH STATION

H.P. "Sonny" Viator[1], Richard Johnson[2], Brenda Tubana[3] and Paul White[2]

[1]Iberia Research Station – Jeanerette, LA
[2]USDA-ARS Sugarcane Research Unit – Houma, LA
[3]School of Plant, Environmental and Soil Science – LSU Baton Rouge, LA

SUMMARY:

Field trials consisted of **1)** N-rate application evaluations for the recently released cultivars, L01-299, L03-371 and HoCP04-838; **2)** continuing evaluation of the long-term effects of post-harvest residue management on sugarcane; **3)** assessing the efficacy of nutritional products (Agrotain®Plus and a Helena® Chemical foliar-applied product) on sugarcane; **4)** continuing the appraisal of sunn hemp and initiation of iron clay cow pea as fallow period cover crops; and **5)** determining sweet sorghum feedstock logistics for bio refinery sustainability. Unlike plant-cane the previous year, first stubble plots of L03-371 and HoCP04-838 responded positively to the application of 80 or more pounds of N per acre. Also, it required 120 pounds or N per acre to maximize yield of sugar in second stubble L 01-299. The long-term residue management study was in the first stubble phase of production cycle number four. This year there were no real differences between the residue management treatments (burn, retain or sweep residue), with first stubble yields differing by only a few hundred pounds of sugar per acre. The addition of Agrotain®Plus to recommended N fertilizer rates did not result in positive yield responses this growing season. The highest yielding treatment was the check plot receiving only fertilizer N. A foliar-applied bio nutritional product (experimental and proprietary) distributed by Helena® Chemical Company was evaluated on first stubble L 99-226 at three application times beginning in May and ending in July. All three treatment timings yielded over 9,000 pounds of sugar per acre, but the check plots used for comparison were compromised by the application of lower than scheduled rate of N fertilizer. Sweet sorghum hybrid yields were lower than the previous year, with total fermentation sugar yields of 2.40 vs. 1.86 tons per acre for 2012 and 2013, respectively. Highest fermentable sugar yields (3.7 tons per acre as an average of both years) were achieved by planting medium-maturity hybrids in May. In 2013 the late-maturity hybrids required considerably more days to reach flowering than in 2012.

I. NITROGEN RATE TESTS:

Newly released commercial varieties were evaluated for response to fertilizer N on heavy textured soil. For each trial a 0 lb N per acre check was compared to 40, 80,120, and 160 lb N per acre application rates. First stubble L03-371 and HoCP04-838 produced maximum sugar per acre yields at 80 lb of N per acre, as shown in figure 1. It required 120 lb N per acre to achieve the highest yield of second stubble L 01-299 (figure 2). The varied response to applied N fertilizer demonstrated by the commercial varieties evaluated in these tests indicates the difficulty in determining appropriate N rates and in predicting the response by sugarcane. Plant-cane response to N application is a coin toss at best, as over 50% of the plant-cane N rate studies evaluated the last decade showed no response to N.

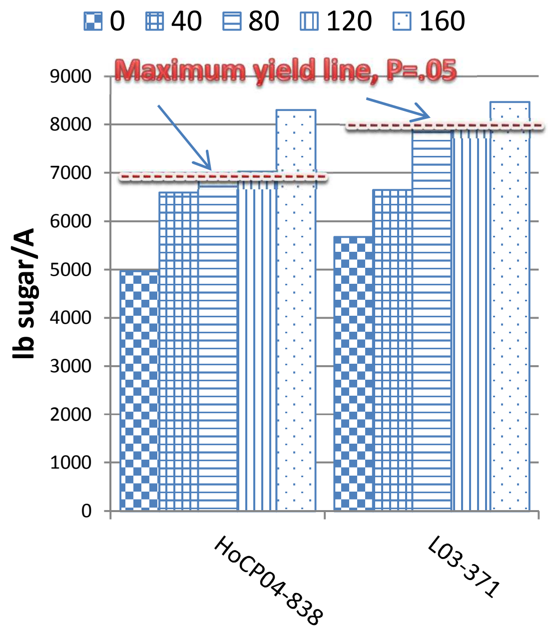


Fig. 1 – Response of 1st stubble to N rates

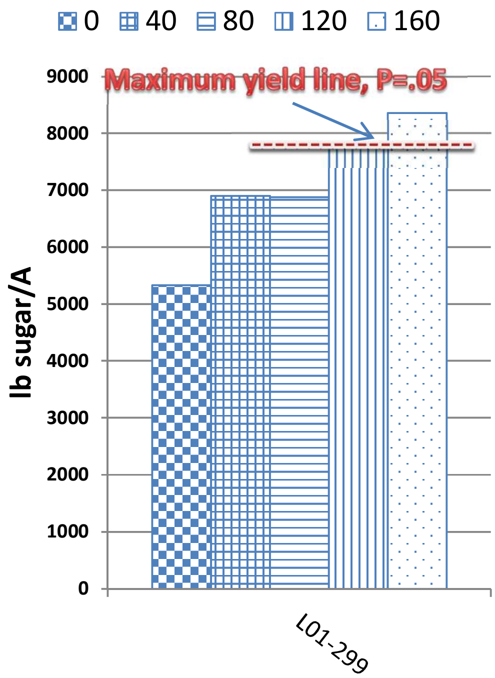


Fig. 2 - Response of L01-299 2nd stubble to N rates

II. 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 four. The study has clearly confirmed what other investigations have found, that 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, as shown by the spikes in plant cane sugar yield in figure 3. The first stubble crop in 2013 was somewhat unaffected by residue management, as the sugar yields for the burn, residue retained and residue swept treatments were 8,498, 8,607 and 8,842 lb of sugar per acre, respectively.

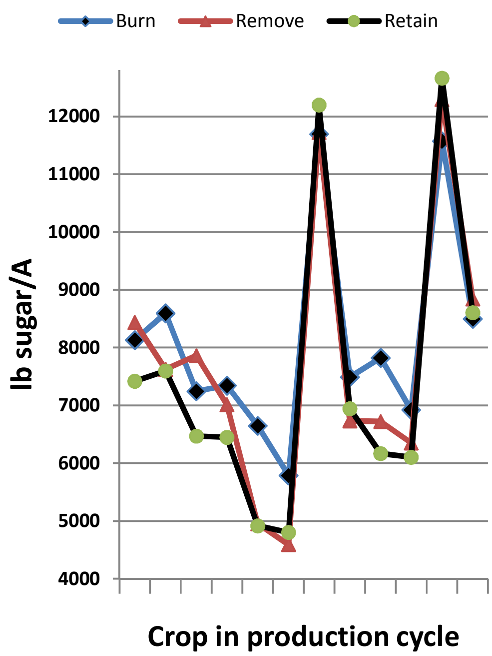


Fig. 3 - Long-term residue management study

III. EFFICACY OF AGROTAIN®PLUS ON STUBBLE SUGARCANE:

Sugarcane in south Louisiana is widely produced on heavy-textured soil in a high rainfall environment, a situation conducive to potential N losses after fertilizer is applied in the spring. A product, Agrotain® Plus, formulated as an additive for UAN solution to slow N losses by retarding nitrification and inhibiting ammonia volatilization was evaluated in 2013 on second stubble HoCP96-540. Because of the high nitrification potential of the soil Agrotain® Plus was evaluated at both the 1x rate (15 lb of Agrotain® Plus for each ton of UAN applied) and the 2x rate of Agrotain® Plus mixed with both 60 and a 120 lb N per acre application rates. The treatments were arranged in a RBD with four replications of plots that were 3 rows wide and 50 ft. in length. The soil type was typical of the sugarcane region, a Baldwin silty clay loam. The influence of Agrotain® Plus on sugar yield was somewhat nonsensical. The addition of the product to the 120 lb N per acre application rate reduced (*P=.09)* sugar per acre yield rather than increase it, 9,702 vs 8,824 lb sugar per acre (table1). None of the other three treatment comparisons involving Agrotain® Plus produced significantly superior yields.

Table 1. Contrast analysis of sugarcane fertilized at two rates of N and two rates of Agrotain® Plus	
Treatment	Sugar Yield, lb/acre
Contrast Analysis	
60 lb N/acre	8510
60 lb N/acre + 1x rate	8763
P value	***0.61***
60 lb N/acre	8510
60 lb N/acre + 2x rate	8184
P value	***0.51***
120 lb N/acre	9702
120 lb N/acre + 1x rate	8824
P value	***0.09***
120 lb N/acre	9702
120 lb N/acre + 2x rate	9296
P value	***0.41***
CV%	7.7

IV. EFFICACY OF HELENA® CHEMICAL CO. PRODUCT HM-0938-A ON FIRST STUBBLE SUGARCANE:

Helena® Chemical Co. bio nutritional product HM-0938-A is a foliar-applied experimental compound that is not commercially available. A field trial was conducted in 2013 to evaluate the efficacy of HM-0938-A foliar applied at 1.5 pint per acre for three consecutive months beginning in May. Cultivar L99-226 in first stubble was fertilized with 120 lb N per acre (32% UAN) prior to the applications of the product. Plots were 3 rows wide and 40 ft in length and replicated four times in a randomized complete block design. The soil type was an Iberia silty clay. The experimental design did not include check plots, but a N-rate test within the same field had plots scheduled to receive 120 lb N per acre and was to serve as the control plots. Unfortunately, a mistake was made and the plots in the N-rate study scheduled to receive 120 lb N per acre actually received only 80 lb N per acre. There was, therefore, no valid control for comparison. There were no statistical differences between the three application timings for sugar content or biomass yield (table 2).

Table 2. Response of L99-226 second stubble to foliar application of Helena® Chemical Co. bio nutritional product			
Application timing	TRS	Cane yield tons/acre	Sugar yield lb/acre
May	219	42.3	9285
June	226	42.5	9592
July	227	42.0	9538
P =	*0.51*	*0.96*	*0.85*

V. EVAUATION OF SUNN HEMP AS A COVER CROP FOR SUGARCANE:

'Tropic Sun' sunn hemp (*Crotalaria juncea* L.) is a tropical legume capable of producing high amounts of biomass containing considerable N. A field trial was conducted in 2011-12 and again in 2012-13 to evaluate its suitability as a N-fixing cover crop for production during the fallow period prior to plant cane establishment. Sunn hemp seed was double drilled on sugarcane rows at the rate of 40 lb of seed per acre in April of each year. While the intent was to incorporate the biomass into the soil after 60 days of growth in 2011, emergence was initially suppressed by dry soil conditions and shredding was delayed by wet soil conditions resulting in an August shredding. In 2012 the biomass was shredded when it reached approximately six feet in height in June. For each test approximately two weeks were allowed for residue desiccation, then the residue was incorporated and sugarcane variety L99-226 was planted on September 9, 2011 and August 12, 2012. Sunn hemp sampling in 2011 revealed an average dry matter yield of 6 tons per acre, which contributed an average of 190 lb N per acre. Biomass accumulation was considerably less in 2012. Treatments compared were: 1) unfertilized plant-cane following a conventional fallow period; 2) plant-cane fertilized with 40 lb N per acre following fallow; 3) plant-cane fertilized with 80 lb N per acre following fallow; 4) unfertilized plant-cane following ploughed down sunn hemp; 5) plant-cane fertilized with 40 lb N per acre following sunn hemp; and 6) plant-cane fertilized with 80 lb N per acre following sunn hemp.

As shown in the table below, the only difference between the treatments at the $P=0.05$ level was superior tonnage for plant-cane following a conventional fallow period in 2013. Plant-cane after fallow averaged 48 tons of cane per acre compared to an average of 42 tons of cane per acre for the sunn hemp treatments. While disappointing, the occurrence of lower yields following a green manure crop is not surprising, as a similar disparity has occasionally been documented in Louisiana for green manure soybeans grown in rotation with sugarcane. Differences in yield in 2012 between the fallow and sunn hemp plots, however, were not significant, which may be most typical of the response to the occupation of fallow land with cover crops.

A generally accepted concept is that crops grown subsequent to green manure incorporation benefit from nitrogen contained in the leguminous biomass. This study was designed to measure indirectly whether a N fertilizer credit could be established for sunn hemp, i.e., can the N contained in the ploughed down sunn hemp substitute for spring applied N fertilizer on plant-cane. Unfortunately, as an average of both plant-cane crops the unfertilized plant-cane following the sunn hemp treatment yielded 1,100 pounds of sugar per acre less than the unfertilized plant cane grown after a conventional fallow period. Even the most N rich environment associated with the added fertilizer N supplied in the spring did not result in statistically higher yields than the unfertilized fallow check.

It is apparent that soil N was not a limiting factor for plant-cane growth and development. Failure of plant-cane to respond to applied N indicates the capability of the fallow period to make N readily available in quantities sufficient for plant-cane growth. This study will continue through the ratoon phase of the production cycle to determine full-cycle effects and soil NO_3^- and NH_4^+- N levels will be associated with yield measured after legume incorporation. This research is in cooperation with Drs. Paul White and Chuck Webber of the ARS-USDA Sugarcane Research Unit in Houma, LA.

Cover crop effects of sunn hemp on plant-cane L99-226							
Fallow period treatment	Plant cane N fertilizer lb/A	Cane yield[1] tons/acre		TRS[1] lb/ton		Sugar yield[1] lb/acre	
		2012	*2013*	*2012*	*2013*	*2012*	*2013*
Fallow	0	42a	48a	249a	211a	10469a	10090a
Fallow	40	39a	50a	245a	218a	9881a	11000a
Fallow	80	40a	47a	239a	212a	9745a	9858a
sunn hemp	0	37a	42 b	247a	220a	9166a	9193a
sunn hemp	40	45a	43 b	259a	232a	11661a	10783a
sunn hemp	80	43a	42 b	237a	219a	10203a	9767a
[1]Means in columns followed by different letters are significantly different **(***P*=.05)							

VI. A REGIONAL PROGRAM FOR PRODUCTION OF MULTIPLE AGRICULTURAL FEEDSTOCKS AND PROCESSING TO BIOFUELS AND BIOBASED CHEMICALS:

The LSUAgCenter received its largest grant ever, a $17.2 million award from the U.S. Department of Agriculture's National Institute of Food and Agriculture for a project to investigate energy cane and sweet sorghum for the production of biofuels and chemicals. The broad mission of the sweet sorghum research group is to "evaluate sweet sorghum hybrids for agronomic performance, inclusive of their ability to maintain juice quality into the fall season, produce commercial yields on marginal soil, respond to low-input sustainable production practices and deliver quantities of feedstock on a schedule that sustains the viability of the bio-refinery". While it is broad in scope and involves multiple disciplines and research stations, personnel at the Iberia Research Station are responsible for investigating and demonstrating the logistics of feedstock delivery. The test location was the Sugar Research Station because of its lab facilities and close proximity to the Audubon Sugar Institute, where plant samples were sent for fiber and sugar analyses. In both 2012 and 2013 hybrids of varying maturity were planted in early-April, mid-May and late May/early-June and harvesting with a John Deere combine was initiated when grain reached the hard-dough stage of development. The test was designed to provide a sustained feedstock supply from the initiation of harvest in July to late-October, which is typically the time for the occurrence of the first frost. Harvesting commenced with the early-maturity hybrids in late July and continued until the late May/June planting of the late-maturity hybrids were combine harvested in October of each year. Hybrid maturity was consistent across years for the early and mid-maturity hybrids, ranging from approximately 85 to 130 days from planting to maturity. The late-maturity hybrids, however, took much longer to mature in 2013 than in 2012, 169 vs. 129 days. The full-season hybrids grown in 2013 were fully photoperiod sensitive. Hybrid performance by planting date is shown in table 4. The ranking of fermentable sugar yields was consistent for each planting date, with the medium-maturity hybrids producing the most for each planting, except for the June 2013 planting date when the late-maturity hybrids out yielded the medium-maturity hybrids. Averaged over years and planting dates the early, medium and late maturing hybrids yielded 1.50, 2.77 and 2.13 tons per acre of fermentable sugar, respectively. The late-maturity hybrids underperformed in 2013 due to the delayed maturity. In

2012 the late-maturity hybrids produced 20% less sugar than the medium-maturity hybrids, but this same disparity was about 40% less in 2013 for the late-maturity hybrids planted in April and May.

Planting date	Maturity group	Fermentable Sugar[1] tons/acre		Juice Yield[1] tons/acre	
		2012	2013	2012	2013
April	Early	1.57 c	1.16 c	10.6 c	9.9 b
	Medium	3.16 a	2.06 a	25.9 a	15.5 a
	Late	2.42 b	1.27 b	19.6 b	14.3 a
May	Early	1.56 c	1.49 c	15.0 c	13.2 c
	Medium	4.07 a	3.32 a	33.9 a	24.9 a
	Late	3.26 b	1.88 b	29.8 b	22.1 b
Late May/June	Early	1.62 b	1.62 c	15.6 c	12.3 c
	Medium	2.17 a	1.82 b	26.1 a	16.9 b
	Late	1.79 b	2.13 a	23.2 b	22.8 a

[1]Means in columns within planting date followed by different letters are significantly different **(***P=.05)*

RESEARCH ON SOIL FERTILITY AND CULTURAL MANAGEMENT PRACTICES IN SUGARCANE PRODUCTION

Brenda S. Tubaña[1], Payton Dupree[1], Marilyn Dalen[1], Brandon White[1], Murilo Martin[1], and Jeff Hoy[2]

[1]School of Plant, Environmental, and Soil Sciences
[2]Department of Plant Pathology and Crop Physiology

In Cooperation with
Sugar Research Station

Summary

Multiple field trials were conducted in 2013 to evaluate cane tonnage and sugar yield responses to different rates and sources of phosphorus and potassium fertilizer, and silicon fertilization rate and timing. Yield and quality parameters of different cane varieties planted using whole stalks and billets were also evaluated. Increasing rate of P fertilizer applied as triple superphosphate had no clear effect on sugar yield of cane variety L01-299. Among the sources, the application of phosphorus as monoammonium phosphate showed positive effect on sugar yield. Sugar yield of cane variety L01-299 did not respond to potassium rate and source even in there were observed changes on the amount of extractable potassium in soil. While there were differences on soil pH and extractable Si in soil in response to rate and time of application of CaSiO3 slag, the sugar yield of cane variety L01-299 was not affected. The planting method, i.e. whole stalks and billets, had no effect on yield and quality parameters of different cane varieties (113, 114, 9001, 9002, 299, and 371). However there were varietal differences detected on all measured variables ($P<0.05$).

Objective

This research was designed to provide information on phosphorus, potassium, and silicon fertilizer management to sugarcane to help growers maximize both economic yields and profitability of sugarcane production. In addition, the performance of different cane varieties in response to planting method (whole stalk vs. billets) was also documented. 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 P Fertilizer

Cane variety L01-299 was planted on September 10, 2012 using billets as planting material. Each plot consisted of three 40-ft long, 6ft-wide rows. A total of 11 treatments with four replications were laid-out on a randomized complete block design; treatments included a check, different rates (10, 20, 45, and 65 lbs/acre) of phosphorus applied as triple super phosphate (TSP) and two rates of phosphorus (45 and 65 lbs/acre) applied as monoammonium phosphate (MAP), MES, and MESZ. Nitrogen and potassium fertilizer were applied at 100 and

60 lbs/acre using urea-ammonium nitrate (UAN, 32% N) and muriate of potash, respectively, in mid-March 2013 while application of phosphorus treatments was accomplished in March.

Treatment effect on theoretical recoverable sugar (TRS), sucrose content and sugar yield was significant (*P*<0.10; Table 1). However the effect of increasing phosphorus rate had no clear effect on these parameters. When compared to the check plot, the application of MAP at 45 and 65 lbs/acre significantly raised sugar yield. This can be attributed to a combination of both higher cane tonnage and TRS. At 45 lb P_2O_5/ac rate, both MAP- and TSP-treated plots had higher cane tonnage and sugar yield than MESZ-treated and check plots; MES, MESZ and check had similar cane tonnage and sugar yield (Figures 1A and 1B). In general, similar effect was observed when these sources were applied at 65 lbs P_2O_5/ac rate (Figures 2A and 2B). The application of phosphorus fertilizer regardless of source has raised the soil test phosphorus level at least by 3 ppm; the highest (15 ppm) was with 65 lbs P_2O_5/acre application rate using TSP as source (Table 2). In terms of significant effect on soil extractable nutrients and soil pH, no notable differences were observed.

Sugarcane Yield Response to Different Rate and Source of K Fertilizer

Cane variety L01-299 variety was used for this study. The treatments consisted of two checks, five rates (30, 60, 120, 180, and 240 lbs/acre) of potassium as muriate of potash and 120 lbs K_2O/acre applied as EM1, EM2, EM4, and MOP+KMag. Treatments were replicated four times and arranged in a randomized complete block design. Both nitrogen and phosphorus fertilizer were applied in mid-March at rates of 100 and 60 lbs P_2O_5/acre as UAN and triple superphosphate, respectively, while potassium treatments were applied in March.

The treatment effect on quality parameters and sugar yield was found to be not significant (Table 3). However, mean cane tonnage among treatments was found to be significantly different (*P*<0.10). The highest cane tonnage was obtained with the application of 120 lbs K_2O/acre as EM4. This same treatment tended to obtain the highest sugar yield. Based on the standard error values among the sources MOP, EM1, EM2, EM4 and MOP+KMag at 120 lbs K_2O/acre rate, both cane tonnage and sugar yield of EM4-applied plots were significantly higher than the check and MOP-treated plots (Figures 3A and 3B).

The test revealed that the treatment had affected the amount of Mehlich-3 extractable potassium and zinc in soil sampled at harvest (Table 4). The highest increased was observed with EM4-treated plots with at least increasing the extractable potassium and zinc value by 21 and 0.6 ppm, respectively. The enhanced level of potassium and zinc in soil perhaps can explain the cane tonnage and sugar yield response of cane treated with EM4 (Figures 3A and 3B) especially that the initial potassium and zinc levels of this soil were interpreted as not sufficient or below the critical level.

Effect of Silicon Rate and Time of Application on Sugarcane Yield

This sugarcane study was established on a Commernce silt loam soil consisting of different rates and time of application of $CaSiO_3$ (Plant Tuff) as treatments. The cane variety was L01-299. Among the treatments, cane with 0.5 ton $CaSiO_3$/acre at preplant and an addition of 0.25 ton $CaSiO_3$/acre in spring tended to obtain the highest amount of millable stalks (Figure 4).

The largest increase in pH was achieved with 2 ton $CaSiO_3$/acre at preplant. This could be due to a longer reaction time allowed to take place for preplant applied $CaSiO_3$ slag than spring applied $CaSiO_3$. On the other hand, higher increased in the amount of extractable silicon was attained in spring application even at minimal rates of $CaSiO_3$ slag (0.5 to 1 ton/acre). In Louisiana sugarcane production system, granular fertilizer is commonly applied in spring which is a few weeks before the on-set of cane active growth stage. The application of a more manageable rate of $CaSiO_3$ containing material and concurrent with other granular fertilizer commonly applied to sugarcane are economically attractive to producers. The outcomes of this study have shown indications that changes in both soil pH and extractable soil silicon are dependent on the time and rate of $CaSiO_3$ application. Perhaps, the lack of evident response of cane this year can be attributed to crop age being the first year crop. The responsiveness to any fertilizer treatment is dependent on the age of cane crop such that lower response (sometime no response at all) is commonly observed in plant cane (1^{st} year crop).

Yield and Quality Parameters of Different Varieties of Cane Planted as Whole Stalks and Billets

This study consisted of two planting methods (whole stalk vs. billets) and six different cane varieties (113, 114, 9001, 9002, 299, and 371) factorial treatment structure arranged in split-plot in a randomized complete block design with four replications. Planting method was assigned as the main plot and the variety as the sub-plot. Based on the analysis of variance, planting method had no effect whereas variety showed significant influence on all measured variables (Table 5). Among varieties, both 299 and 371 obtained the highest sugar yield, sucrose, and TRS (P<0.05). Varieties 113, 114, 9001, and 9002 had higher fiber (19.5-23.9%) than 299 (11.9%) and 371 (9.7%).

Acknowledgement
The authors wish to express appreciation for the financial support of American Sugar Cane League, Mosaic Co., and Edward Levy Co.

Table 1. Quality parameters, cane tonnage and sugar yield of variety L01-299 (plant cane – 1st harvest) at different rates and sources of phosphorus, 2013, St. Gabriel, LA.

Source	Rate lbs/ac	Population 1000/ac	Brix %	TRS lbs/ton	Sucrose %	Cane Tonnage ton/ac	Sugar Yield lbs/ac
Check	0	162.9	17.77	220	15.4	46.7	10349
TSP	10	144.0	18.33	235	16.2	48.7	11423
	20	150.6	17.53	215	15.1	47.4	10175
	45	173.9	17.64	218	15.2	53.4	11534
	65	181.4	17.48	214	15.0	49.5	10578
MAP	45	177.0	18.84	236	16.5	53.0	12518
	65	178.5	18.31	229	16.0	53.5	11974
MES	45	171.6	17.02	207	14.6	49.8	10292
	65	150.7	17.82	218	15.3	48.6	10594
MESZ	45	153.0	17.86	220	15.4	47.3	10354
	65	139.8	17.76	224	15.6	46.0	10260
Treatment effect (P-value)		0.7295	0.1337	0.0826	0.0930	0.5614	0.0858
Standard Error		18.3	0.3895	6.76	0.424	2.8	600

Table 2. Soil pH and Mehlich-3 extractable nutrients of soil samples at harvest.

Source	Rate lbs/ac	pH	Mehlich-3 Extractable Nutrients, mg/kg						
			P	K	Ca	Mg	S	Zn	Cu
Check	0	5.9	19.1	80.0	1527	338	6.15	1.384	2.08
TSP	10	6.0	21.9	89.3	1620	370	6.38	1.538	2.18
	20	5.9	24.5	94.5	1565	355	6.10	1.612	2.12
	45	5.7	26.5	94.2	1653	371	7.31	1.506	2.39
	65	5.7	34.2	118.2	1811	410	7.25	1.661	2.61
MAP	45	6.0	27.9	91.6	1642	367	6.40	1.535	2.36
	65	5.9	28.3	95.6	1846	424	7.73	1.568	2.63
MES	45	5.5	31.9	100.0	1659	362	10.48	1.517	2.30
	65	5.6	28.0	101.0	1595	363	8.64	1.408	2.22
MESZ	45	5.9	24.2	87.1	1553	341	7.93	1.618	2.24
	65	5.7	25.1	81.2	1484	315	6.57	1.708	2.12
Treatment effect (P-value)		0.9599	0.5511	0.7617	0.6652	0.6744	0.1020	0.578	0.5578
Standard Error		0.33	5.0	13.1	139	38.5	1.02	0.138	0.242

Table 3. Quality parameters, cane tonnage and sugar yield of variety L01-299 (plant cane – 1st harvest) at different rates and sources of potassium, 2013, St. Gabriel, LA.

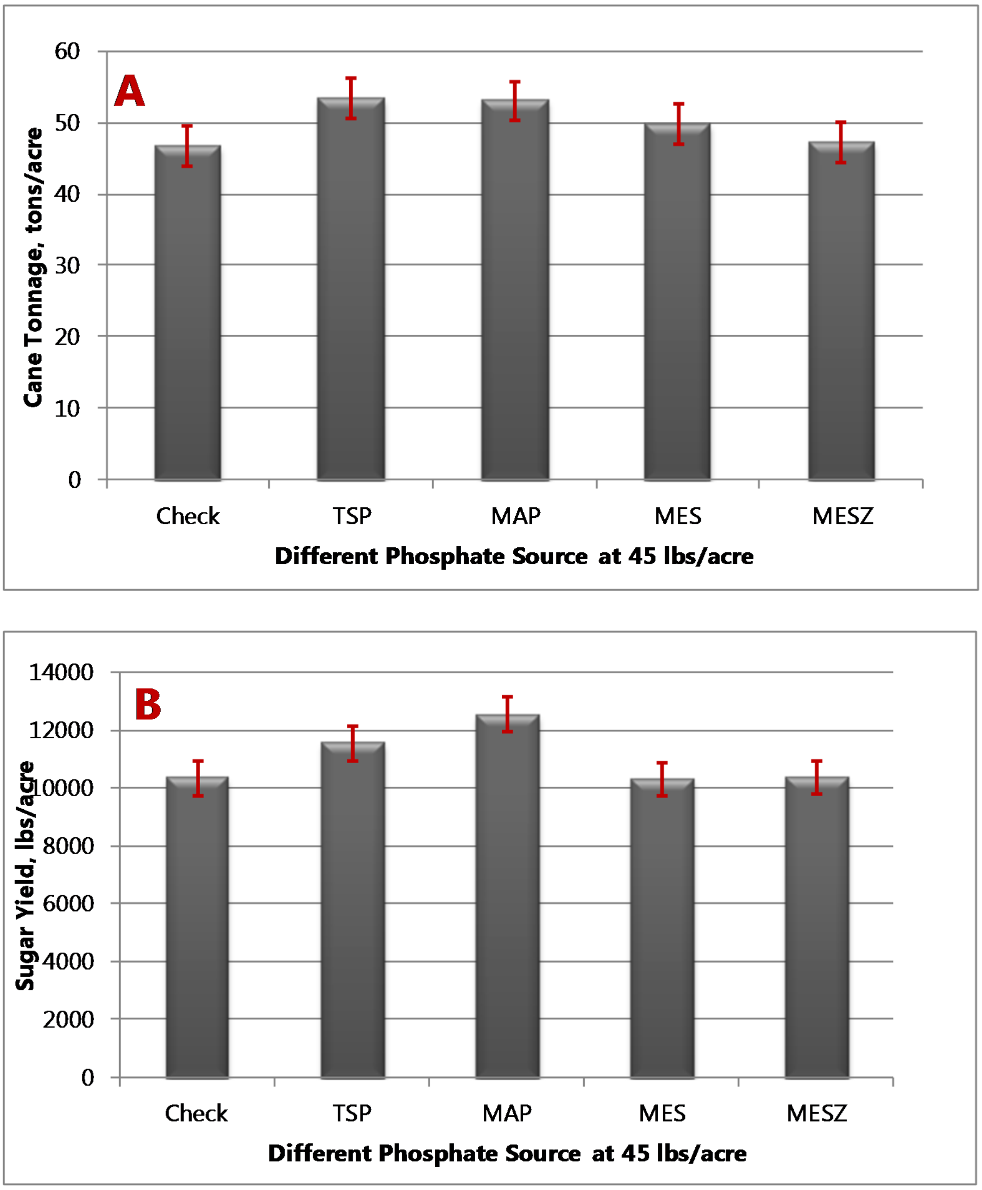
Source	Rate lbs/ac	Population 1000/ac	Brix %	TRS lbs/ton	Sucrose %	Cane Tonnage ton/ac	Sugar Yield lbs/ac
Check	0	157.2	16.69	207	14.5	48.1	9799
MOP	30	152.5	17.53	222	15.4	49.1	10830
	60	162.1	16.79	208	14.5	46.2	9612
	120	154.6	17.14	213	14.9	46.1	9814
	180	173.6	16.94	210	14.7	48.2	10118
	240	182.0	16.79	206	14.5	52.7	10865
EM1	120	168.7	16.83	208	14.6	49.3	10284
EM2	120	160.0	17.10	211	14.8	52.3	11068
EM4	120	181.7	16.97	211	14.7	54.7	11575
MOP+KMg	120	180.6	16.99	211	14.8	53.3	11237
Treatment effect (P-value)		0.5964	0.7678	0.8324	0.8098	0.0938	0.2943
Standard Error		18.5	0.358	6.72	0.411	2.745	676

Table 4. Soil pH and Mehlich-3 extractable nutrients of soil samples at harvest.

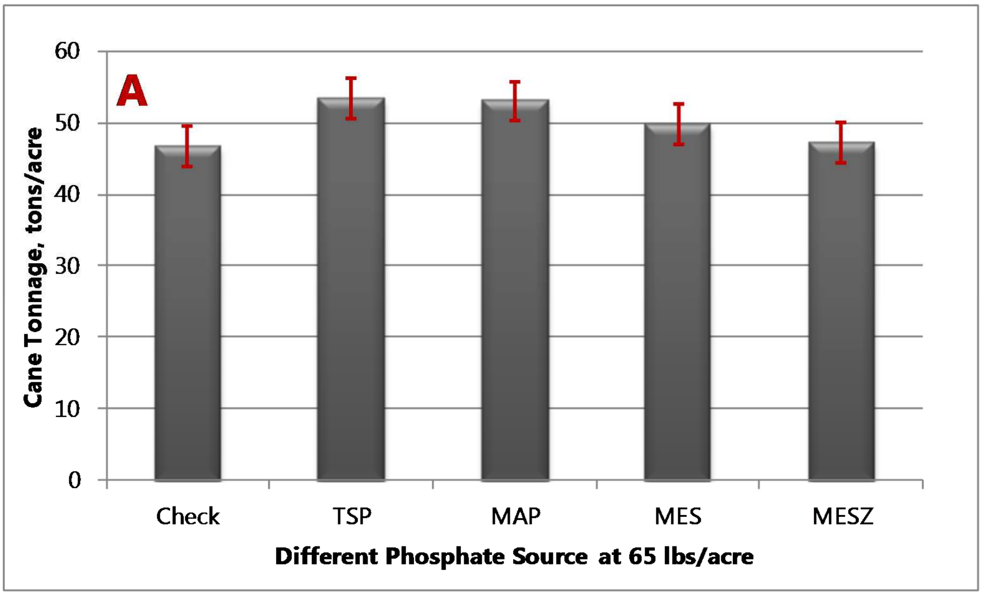
Source	Rate lbs/ac	pH	Mehlich-3 Extractable Nutrients, mg/kg						
			P	K	Ca	Mg	S	Zn	Cu
Check	0	6.5	18.8	75	1478	321	5.78	1.553	2.23
MOP	30	5.8	18.5	80	1566	328	6.19	1.371	2.07
	60	7.1	16.9	85	1720	387	4.89	1.684	2.33
	120	6.4	17.1	78	1573	344	5.81	1.502	2.23
	180	6.9	14.7	87	1636	395	5.87	1.528	2.18
	240	6.3	22.8	87	1595	331	6.79	1.598	2.23
EM1	120	6.1	22.9	92	1631	343	8.17	1.709	2.31
EM2	120	6.3	16.9	81	1536	344	5.93	2.033	2.22
EM4	120	5.8	23.0	106	1756	385	7.12	2.186	2.54
MOP+KMg	120	6.3	17.5	81	1507	339	12.27	1.499	2.03
Treatment effect (P-value)		0.4274	0.2085	0.0855	0.4737	0.3238	0.7518	0.0785	0.5993
Standard Error		0.40	2.43	6.7	93	27	2.66	0.192	0.155

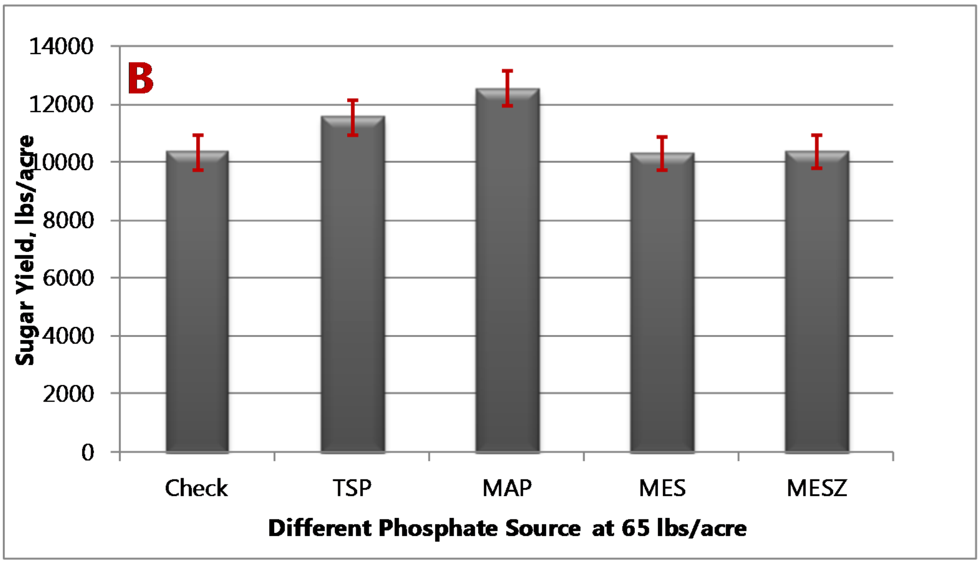
Table 5. Yield and quality parameters of different cane varieties planted using whole stalks and billets, 2013, St. Gabriel, LA.

Treatments	TRS lbs/ton	Fiber %	Sucrose %	Cane ton/acre	Sugar lbs/acre
Planting					
Whole stalk	170a	18.08a	12.75a	24.6a	4492a
Billets	157a	18.02a	12.09a	24.6a	4165a
Variety					
113	138b	19.49a	11.13b	30.1b	4112b
114	127b	19.71a	10.06b	22.7c	2903c
9001	130b	23.90a	10.64b	13.3d	1714d
9002	118b	23.61a	10.05b	14.6d	1708d
299	223a	11.87b	15.62a	38.5a	8558a
371	245a	9.72b	17.01a	28.5bc	6976a

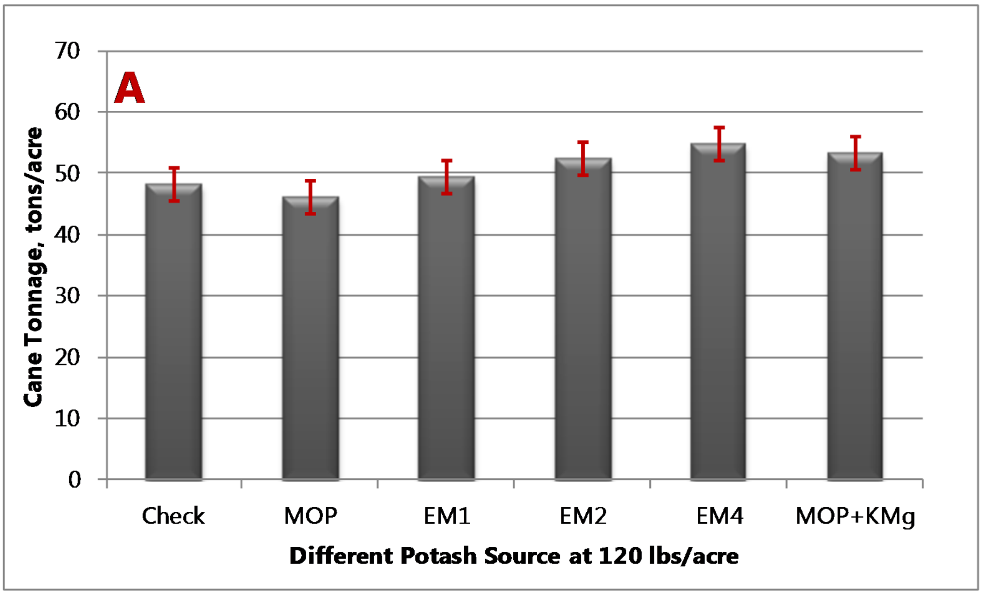


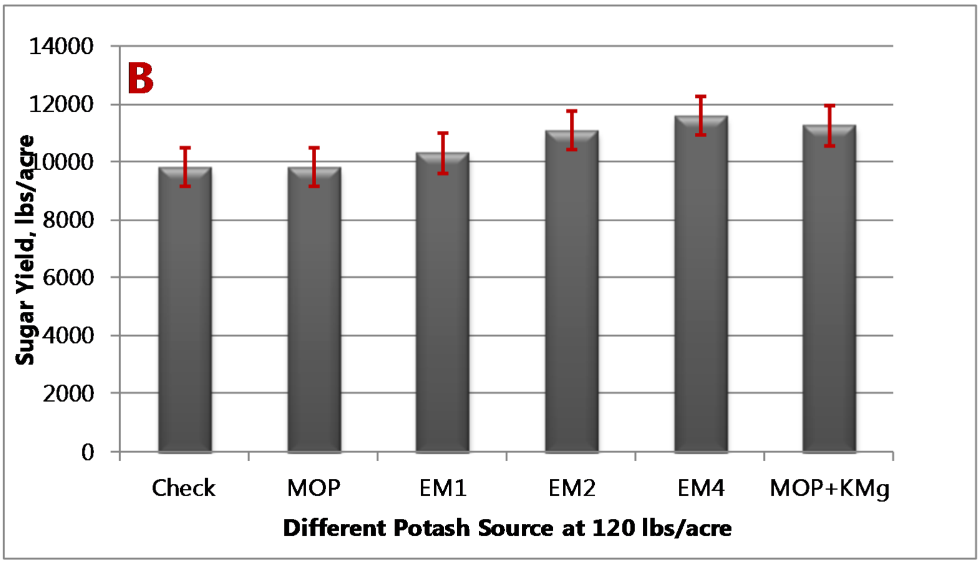
Figures 1A and 1B. Tonnage (1A) and sugar yield (1B) of cane variety L01-299 applied with 45 P_2O_5 lbs/acre as triple superphosphate, MAP, MES and MESZ.





Figures 2A and 2B. Tonnage (1A) and sugar yield (1B) of cane variety L01-299 applied with 65 lbs P_2O_5/acre as triple superphosphate, MAP, MES and MESZ.





Figures 3A and 3B. Tonnage (1A) and sugar yield (1B) of cane variety L01-299 applied with 120 K_2O lbs/acre as muriate of potash, EM1, EM2, EM4, and MOP+KMag.

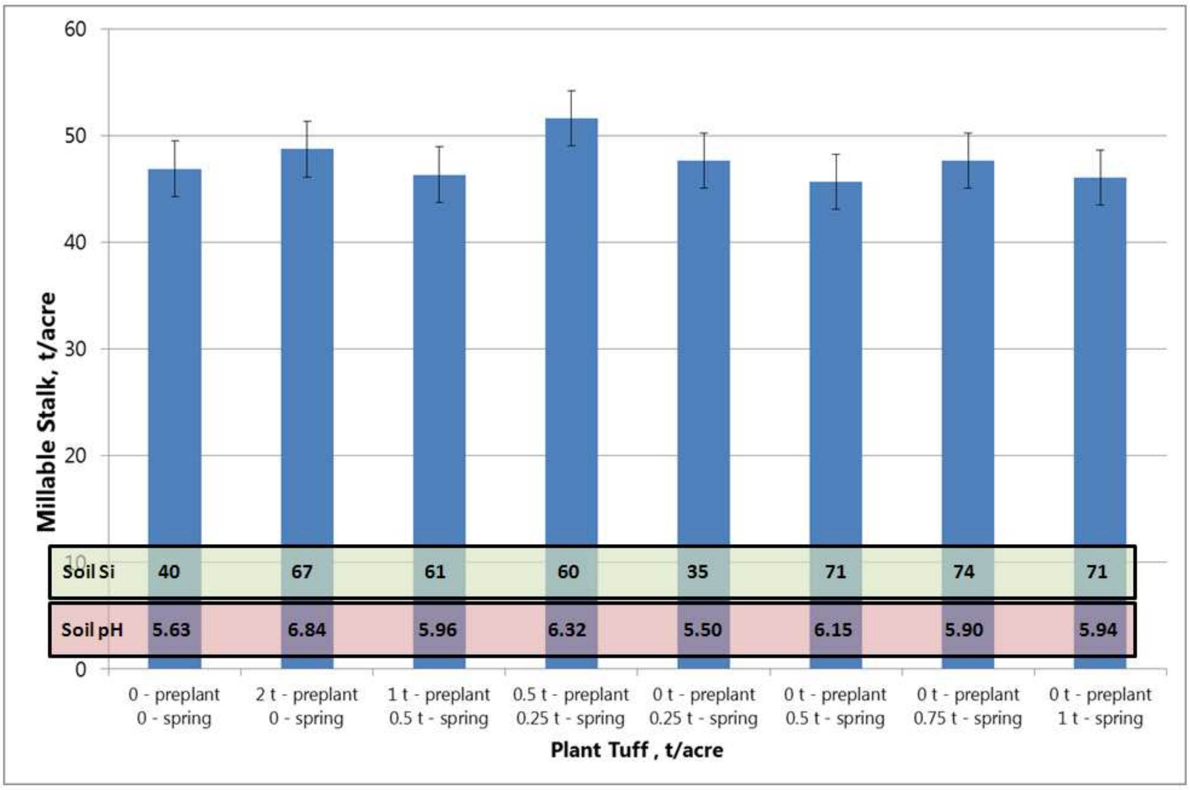


Figure 4. Effect of rate and time of $CaSiO_3$ application on the amount of millable stalks of cane variety L01-299, soil pH, and acetic acid extractable silicon, 2013, St. Gabriel, LA.

EVALUATION OF DECISION TOOLS FOR DETERMINATION OF SUGARCANE NITROGEN REQUIREMENT

Brenda S. Tubaña[1], Payton Dupree[1], Brandon White[1], Allen Arceneaux[1], Madgi Selim[1], Sonny Viator[2], and Rich Johnson[3]

[1]School of Plant, Environmental, and Soil Sciences
[2]New Iberia Research Station
[3]USDA-ARS, Houma, LA

In Cooperation with
Sugar Research Station

Summary

Three large field trials were established in 2013 in St. Gabriel and Donaldsonville, LA to test the performance of three nitrogen (N) decision tools for sugarcane production: 1) current LSU AgCenter N recommendation/farmer's standard practice, 2) N recommendation based on cane N stalk removal rate and soil nitrate level, and 3) optical sensor-based N recommendation. Across sites, optical sensor-based N recommendation consistently obtained higher net return than current/farmer's standard practice. On average, net return was raised by $59/acre due to increased income from higher sugar yield in combination with savings acquired due to lower amount of N fertilizer applied. The N recommendation based on stalk N removal rate and soil nitrate resulted in inconsistent benefit with respect to net return; one site lost $23/ac while one obtained as high as $223/acre higher net return than the current/farmer's standard practice.

Objective

This project intends to evaluate the performance of different decision tools for determining sugarcane N requirement using yield and net return to N fertilizer as metrics.

Results

This study was established in 2013 at the Sugar Research Station in St. Gabriel (plot size: 9000 ft^2) and two locations in Donaldsonville, LA (plot size of site 1: 12,000 ft^2 and plot size of site 2: 33,000 ft^2) using cane variety L01-299. The treatments included the current LSU AgCenter N recommendation/farmer's standard practice, N recommendation based on stalk N removal rate and soil test nitrate, and optical sensor-based N recommendations. All treatments were replicated three times at each site.

Across the three sites, both cane tonnage and sugar yield were comparable among the N decision tools tested in these demonstration trials (Figures 1 and 2). On average by site, the highest cane tonnage was obtained at the Sugar Research Station (52 tons/ac) followed by Donaldsonville 1 (44 tons/ac) then Donaldsonville 2 (39 tons/ac). Similar trend in sugar yield was obtained when sites were compared such that the highest average sugar yield was obtained at the Sugar Research Station with 9680 lbs/acre; Donaldsonville 1 had 8800 lbs/ac while

Donaldsonville 2 had 7900lbs/ac. The mean Brix percentage, theoretical recoverable sugar, and sucrose content among treatments were not significantly different (*P*<0.01; data not shown).

The average rate of fertilizer applied, sugar yield, economic variables (income and saving), and net return to N for the different N decision tools for the three sites are reported in Table 1. The current/farmer's standard practice served as reference for evaluating net return to N fertilizer. Nitrogen decision tool which uses stalk N removal rate and soil test nitrate consistently recommended lower N application rates than the current/farmer's standard practice; 70, 90, and 80 lbs N/ac for Donaldsonville 1, Donaldsonville 2, Sugar Research Station sites, respectively. On the other hand, optical sensor-based N recommendation was higher by 10 lbs/ac in Donaldsonville 1 and lower by 20 and 30 lbs/ac in Donaldsonville 2 and Sugar Research Station sites, respectively than the current/farmer's stand practice's N application rate. Plots under the optical sensor-based N recommendation consistently obtained higher yield than the current/farmer's standard practice. The results from these trials are encouraging especially with the use of optical sensor-based N recommendation. Across sites, optical sensor-based N treated plots consistently obtained higher net return than current/farmer's standard practice. Net return was raised by $60, $66, and $50 per acre at Donaldsonville 1, Donaldsonville 2, and Sugar Research Station sites, respectively. The N recommendation from soil test nitrate earned higher net return in Donaldsonville 1 ($223/ac) and Sugar Research Station ($8/ac) than current/farmer's standard practice but lost $23/ac at Donaldsonville 2.

Acknowledgement

The authors wish to express appreciation for the financial support of NRCS through the Conservation Innovation Grant and American Sugar Cane League.

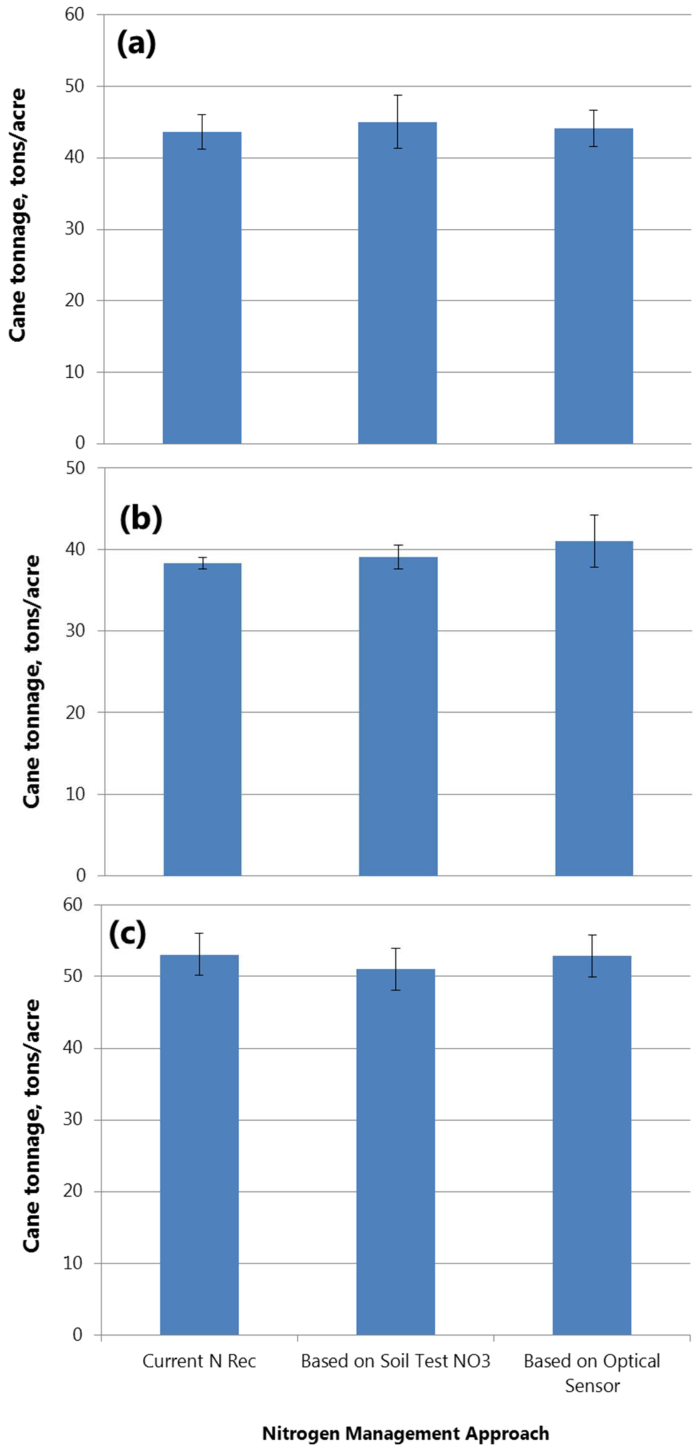


Figure 1. Cane tonnage yield of sugarcane applied with N rate based on different N decision tools in (a) Donaldsonville 1, (b) Donaldsonville 2, and (c) Sugar Research Station in St. Gabriel, 2013.

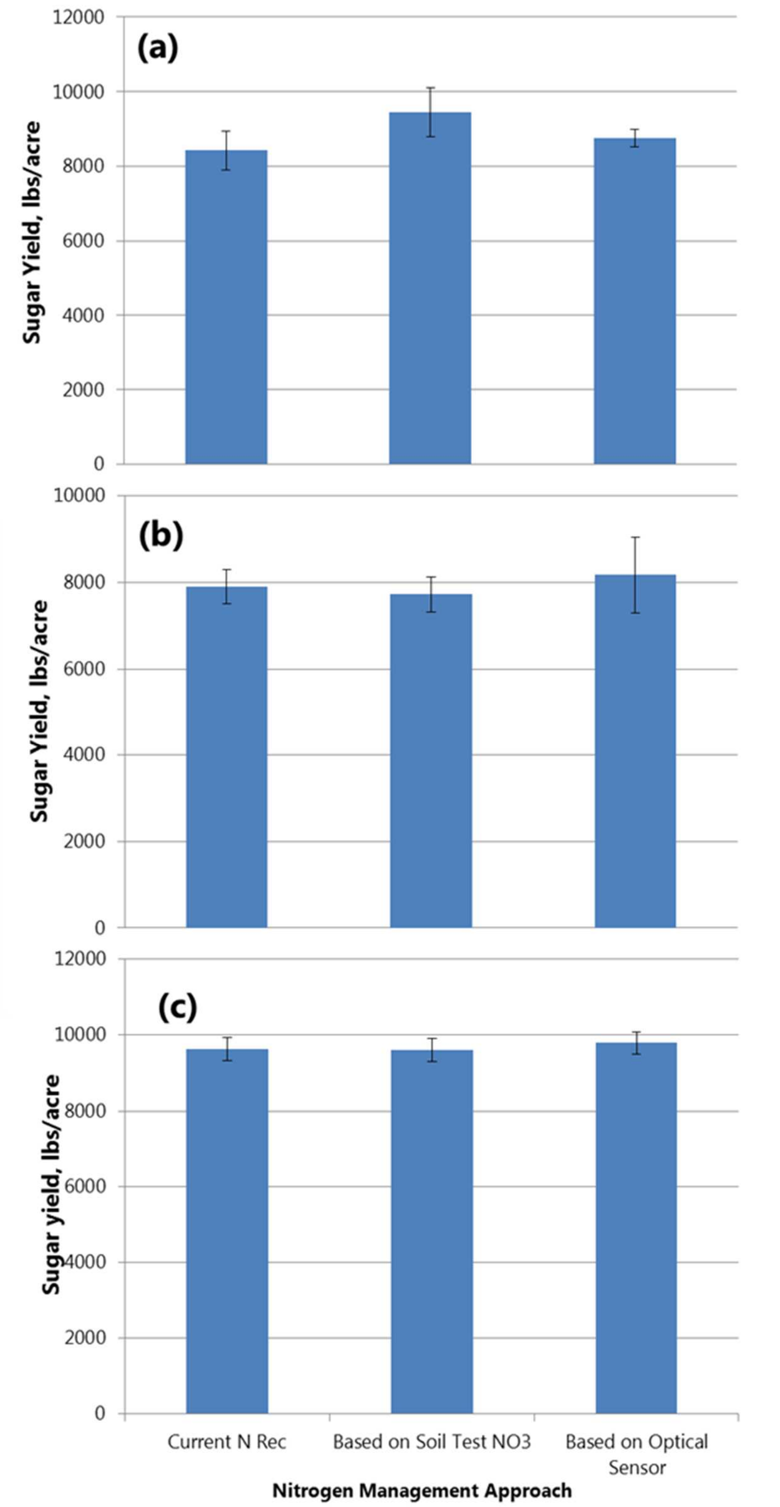


Figure 2. Sugar yield of cane applied with N rate based on different N decision tools in (a) Donaldsonville 1, (b) Donaldsonville 2, and (c) Sugar Research Station in St. Gabriel, 2013.

Table 1. Nitrogen rate, sugar yield, and net return of sugarcane under different N recommendation approach.

Site	N Decision Tool	N Applied	Sugar Yield	Income: Sugar yield		Saving: N fertilizer		Net
		lbs/ac	lbs/ac	lbs/ac	$/ac	lbs/ac	$/ac	$/ac
Donaldsonville 1	Current/Farmer's Std Practice	100	8420					
	Stalk N removal + Soil nitrate	70	9447	1027	205	-30	18	223
	Optical Sensor-Based	110	8749	329	66	10	-6	60
Donaldsonville 2	Current/Farmer's Std Practice	110	7899					
	Stalk N removal + Soil nitrate	90	7721	-177	-35	-20	12	-23
	Optical Sensor-Based	90	8170	272	54	-20	12	66
SRS	Current/Farmer's Std Practice	100	9632					
	Stalk N removal + Soil nitrate	80	9614	-18	-4	-20	12	8
	Optical Sensor-Based	70	9793	161	32	-30	18	50

SRS – LSU AgCenter Sugar Research Station
Soil test NO3 –
Raw sugar price - $0.20/lb
Price of N fertilizer - $0.60/lb
Current/Farmer's Standard Practice – reference to compute for economic return

EVALUATION OF BIOWASH ON SUGARCANE VARIETY L 01-299

Kenneth Gravois
LSU AgCenter, Sugar Research Station

In 2013, the LSU AgCenter was approached to test the effect of BioWash™ on sugarcane growth and development. A yield trial was conducted during 2013 at the Sugar Research Station in St. Gabriel, Louisiana. A first stubble field of L 01-299 was used as the test site. The experimental design was a randomized complete block (four replications). Treatments included nitrogen (N) rates of 30, 60, 90, and 120 lbs N/acre with two foliar applications of BioWash at a rate and timing indicated by the company. The nitrogen and first BioWash application was done on May 9, 2013; the second application of BioWash was done on May 28, 2013; the third application of BioWash was done on June 17, 2013. Another treatment of 120 lbs. N/acre with BioWash applied to the soil (applied at same dates as foliar applications) was also included. A treatment of 120 lbs. N/acre with no application of BioWash served as a control to evaluate all other treatments.

Standard cultural practices were followed during the 2013 growing season. Several traits important to sugarcane yield were measured: plant height (inches, July 2nd), plant height (inches, August 2nd, plant height (inches, September 10th), and stalk population (#/acre, recorded August 13th). The trial was harvested on November 21, 2013 under dry conditions. Plots were harvested with a mechanical sugarcane combine, and the cane was weighed in a wagon fitted with three load cells to record plot weight. Prior to harvest, eight-stalk samples were cut from each plot and taken to the sucrose laboratory to assess sucrose content (lbs. sugar/ton of cane). Stalk weight (lbs.) was also estimated by weighing the eight-stalk bundles. From the plot weights, tons of cane/acre was estimated. Sugar per acre was estimated as the product of sucrose content and tons of cane/acre.

Data were analyzed with SAS (v9.3) software. Replication was considered a random effect; treatments were considered a fixed effect. Least square means were estimated and tested for statistical significance (P=0.05) with the PDIFF option of PROC MIXED.

Table 1. Summary of a field trial conducted at the Sugar Research Station in St. Gabriel, LA in 2013 testing the product BioWash on sugar yield and yield components. The sugarcane variety was L 01-299 in a first stubble crop.

Nitrogen Rate (lbs. N/acre)	**Biowash Application**	**Foliar or Soil**	**July Height**		**August Height**		**September Height**		**Stalk Population**	
			in.		**in.**		**in.**		**No./acre**	
120	NO	NO	35.2	B	67.1	A	96.7	A	25,628	A
120	YES	FOLIAR	35.8	AB	67.1	A	97.8	A	25,882	A
120	YES	SOIL	35.8	AB	68.4	A	97.3	A	28,060	A
90	YES	SOIL	38.5	A	68.4	A	98.8	A	26,354	A
60	YES	SOIL	36.2	AB	67.1	A	97.3	A	28,096	A
30	YES	SOIL	36.6	AB	67.6	A	98.5	A	27,770	A

Nitrogen Rate (lbs. N/acre)	**Biowash Application**	**Foliar or Soil**	**Sugar Yield**		**Cane Yield**		**Sucrose Content**		**Stalk Weight**	
			lbs/acre		**tons/acre**		**lbs/ton**		**lbs**	
120	NO	NO	9281	A	41.1	A	225	A	2.15	A
120	YES	FOLIAR	9598	A	42.2	A	227	A	2.31	A
120	YES	SOIL	8823	A	39.4	A	224	AB	2.40	A
90	YES	SOIL	9618	A	44.2	A	218	AB	2.06	A
60	YES	SOIL	8781	A	40.0	A	220	AB	2.29	A
30	YES	SOIL	9317	A	43.6	A	214	B	2.31	A