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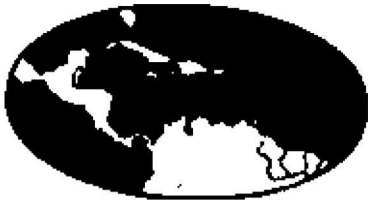

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PRELIMINARY RESULTS OF SUGAR CANE EXPERIMENTS ON THE SANDY LOAM SOILS OF THE "ZANDERIJ" FORMATION.

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SUMMARY

In three field experiments conducted at the experimental farm of Coebiti the effects of nitrogen, phosphorus, potassium and lime on the growth and quality of sugar cane were studied for the past two years.

Phosphate and potassium had significant positive effects on the leaf content, but not on the yield. Nitrogen did not influence both the leaf content and the yield. Liming raised the leaf content and the yield significantly, but reduced the sugar content, on the other hand. The effects of rock phosphate from Curaçao, which raised the soil pH, were similar to those of liming.

From the results of the first two years it was decided to lower the levels of the nitrogen, phosphorus and potassium dressings.

INTRODUCTION

Up till now sugar cane is planted in the young coastal plain on very heavy clay soils. Chemically these soils are good, but the physical conditions are very poor. Due to the low permeability and the flat topography the field drainage is unsatisfactory. That's why a cambered bed system is required. Because of this bed system, the high water holding capacity of these soils and the lack of a defined dry season, mechanization of harvest is not possible so far. For this reason, and within the scope of the soil productivity research on the so called "Zanderij" soils in the interior of Suriname, some sugar cane fertilizing trials were started in December 1975. Some analytical data of these soils are presented in table 1. More detailed information is given by Schroo (1976).

Table 1. Soil analytical data sandy loam Coebiti topsoil (0-25 cm)

Analysis	Value
pH – H_2O	5.0
pH – KCl	4.0
C (Walkley-Black) %	0.7
C.E.C. me %	3.0
Base saturation %	20
Exchangeable Al me %	0.7
Total N %	0.08
Total P205 ppm	55
Total K20 ppm	60
Available P205 ppm	6
Available K20 ppm	15
Available CaO ppm	100
Available MgO ppm	15
Available SO4 ppm	30
Available Moisture (per 50 cm topsoil) mm	60
% Sand (2000-53 mu)	81
% Silt (53-2 mu)	4
% Clay (less than 2 mu)	15

The experiments are carried out on a coarse sandy loam (with sandy clay loam in the subsoil). As can be seen from table 1 these soils are very poor. Field drainage is good, however, so mechanization is quite possible. Because of the low available moisture content the sugar cane might suffer from water shortage during long dry periods. Root studies showed, however, a root development to a depth of two meters, if the cane was planted in the wet season (Parsan, 1976).

Because of the low nutrient status of these soils three fertilizing trials were designed. The object of the first trial is finding the optimum levels for nitrogen, phosphate and potassium. In the second trial the effects of lime, magnesium and sulphate are studied, whereas in the third trial rock phosphate of Curaçao (Curaçao phosphate), which is relatively very cheap, is tested. This rock phosphate contains 16.7% P205 and reacts basic, so it can also be used as a liming material.

EXPERIMENTAL PROCEDURE

Experiment 1

This experiment was set up as a confounded (3x3x3)– factorial design with two replicates. Nitrogen was applied as Calcium Ammonium Nitrate (CAN); phosphate as Granulated Triple Super Phosphate (GTSP), and potassium as Muriate of potash (KCl). The nitrogen levels (N1, N2, N3) were 75, 125 and 175 kg N per ha, the phosphate levels (P1, P2, P3) 90, 135 and 180 kg P205 per ha, and the potassium levels (K1, K2, K3) 120, 150 and 180 kg K20 per ha. All plots were limed at a rate of 5 tons per ha. Dolocal (finely ground dolomitic limestone) was used as the liming material.

Phosphate was applied in the planting furrow just before planting and for the ratoon cane just after sprouting as a side-dressing. Nitrogen and potassium were given as side-dressings in three split doses at 1, 8 and 14 weeks after germination or sprouting. Liming took place before planting by broodcasting, followed by ploughing-in to a depth of 25 cm.

Each plot consists of 6 plant rows 6½ meters in length with an interrow spacing of 1½ meters. The cane variety used was D 141/46, obtained from Marienburg Estate. Selected cane tops were cut into three-eye pieces, about 25 cm long. Every 65 cm two pieces were placed in the planting furrow and covered with soil. Earthing up took place after the NK split-dressings. Weed control and crop protection were carried out, if necessary.

Experiment 2

This experiment was set up as a 5x5 — latin square design. The 5 treatments are:

A: Only N,P and K; no lime, no magnesium, no sulphate
B: A, plus lime
C: A, plus sulphate
D: A, plus lime and sulphate
E: A, plus lime, magnesium and sulphate.

Nitrogen was applied as Calcium Ammonium Nitrate (treatments A and B) and Sulphate of Ammonia (treatments C, D and E); phosphate as Granulated Triple Super Phosphate, and potassium as Muriate of potash.
Liming took place with aragonite (treatments B and D) and dolocal (treatment E).
Fertilizer levels were: 125 kg N, 135 kg P205 and 150 kg K20 per ha.
Lime amounts were: 7 tons aragonite and 5 tons dolocal per ha.

As for the rest the experimental procedure is equal to experiment 1.

Experiment 3

The design is the same as for experiment 2. The 5 treatments are:

F: no Curaçao phosphate
G: 500 kg Curaçao phosphate per ha
H: 750 kg Curaçao phosphate per ha
I : 1000 kg Curaçao phosphate per ha
K: 1250 kg Curaçao phosphate per ha

All plots received 125 kg N (as sulphate of ammonia), 150 kg K20 (as sulphate of potassium and magnesium) and 90 kg P205 (as granulated triple super phosphate) per ha. The latter gift can be considered a phosphate starter dose and was applied only before planting.

Curaçao phosphate was applied by broadcasting just before planting, followed by ploughing-in to depth of 25 cm.

As for the rest the experimental procedure is equal to experiment 1.

Measurements

Length measurements were made at 4, 6 and 8 months after planting or sprouting. Length of stem was measured between the seed piece and the top visible "dew-lap" (TVD), according

to Schroo (1954). All stems of six selected cane stools per plot were measured and the average was determined.

Leaf analysis

Leaf analysis was carried out at 4, 6 and 8 months after planting or sprouting, together with length measurements. Leaf sampling always took place in the early morning. Of each plot 12 cane stools along the diagonals were selected. Of each stool two leaves were taken from two well – developed stems. The uppermost leaf showing a "dew-lap" (TVD-leaf) was selected. The upper halves were cut off and discarded, the mid-ribs were stripped out and the remaining laminae, about 30 cm long, were oven-dried and powdered in a hammer mill (Schroo, 1954; Poidevin & Robinson, 1964). After wet digestion nitrogen, phosphate, potassium, calcium and magnesium were determined, according to Legger (1975).

Reaping and milling the cane

The stems were fully trashed and the stools cut off at seed piece level. The cane tops were also discarded (40 cm below TVD-leaf) and the remaining "net millable cane" was weighed. Of each plot 20 stems were selected and sent to the Marienburg Estate, where they were crushed in a laboratory mill and the weights of juice were noted. The juice samples were analysed for "degree Brix", "pol percent" and "purity". From these data the sugar content was calculated.

RESULTS AND DISCUSSION

The results of the leaf analyses are presented in tables 2-4. Leaf nitrogen content was not influenced by nitrogen, phoshorus and potamsium dressings at the chosen levels. Phosphate had a positive effect of leaf phosphate content (significant at the 5% level). Leaf potassium content was positively effected by potassium applications (significant at the 5% level). Negative effects of nitrogen and potassium have been found on leaf calcium content and leaf magnesium for plant cane (table 2).

Table 2. Results of leaf analysis experiment 1 for plant cane (upper half) and first ratoon (lower half)

	% N			% P			% K			% Ca			% Mg		
	a*	b*	c*	a	b	c	a	b	c	a	b	c	a	b	c
N1	2.37	2.04	1.70	0.22	0.21	0.17	0.77	1.12	0.99	0.64	0.43	0.31	0.27	0.20	0.16
N2	2.34	2.07	1.73	0.22	0.21	0.17	0.82	1.08	1.03	0.57	0.42	0.31	0.25	0.20	0.16
N3	2.36	2.05	1.74	0.22	0.21	0.17	0.80	1.13	1.02	0.57	0.43	0.31	0.24	0.19	0.15
P1	2.32	2.04	1.70	0.21	0.21	0.16	0.79	1.12	1.00	0.58	0.42	0.30	0.25	0.20	0.16
P2	2.35	2.06	1.70	0.22	0.21	0.17	0.82	1.15	1.03	0.59	0.42	0.30	0.26	0.20	0.16
P3	2.40	2.06	1.77	0.23	0.21	0.18	0.78	1.07	1.00	0.61	0.43	0.32	0.26	0.20	0.16
K1	2.38	2.09	1.74	0.22	0.21	0.17	0.71	1.04	1.01	0.63	0.43	0.32	0.27	0.21	0.16
K2	2.35	2.05	1.74	0.22	0.21	0.17	0.82	1.16	0.98	0.56	0.42	0.30	0.25	0.20	0.16
K3	2.33	2.02	1.70	0.22	0.21	0.17	0.86	1.14	1.05	0.59	0.42	0.30	0.25	0.19	0.16
mean	2.36	2.06	1.72	0.22	0.21	0.17	0.80	1.11	1.01	0.59	0.42	0.31	0.26	0.20	0.16
N1	2.22	2.06	1.63	0.23	0.22	0.20	1.11	1.29	1.15	0.40	0.36	0.36	0.18	0.19	0.19
N2	2.22	2.00	1.64	0.23	0.22	0.20	1.14	1.25	1.14	0.38	0.35	0.36	0.17	0.20	0.18
N3	2.25	2.04	1.66	0.23	0.22	0.20	1.15	1.31	1.13	0.38	0.37	0.37	0.17	0.19	0.19
P1	2.22	2.04	1.65	0.21	0.22	0.20	1.12	1.28	1.18	0.37	0.37	0.37	0.17	0.19	0.19
P2	2.23	2.03	1.66	0.23	0.23	0.20	1.12	1.29	1.12	0.39	0.36	0.37	0.18	0.19	0.19
P3	2.24	2.02	1.63	0.24	0.22	0.20	1.16	1.30	1.11	0.39	0.35	0.35	0.18	0.19	0.19
K1	2.24	1.99	1.66	0.23	0.22	0.20	1.09	1.24	1.08	0.39	0.36	0.37	0.18	0.19	0.19
K2	2.22	2.04	1.62	0.23	0.22	0.20	1.15	1.31	1.15	0.38	0.36	0.36	0.18	0.19	0.19
K3	2.23	2.06	1.65	0.23	0.23	0.20	1.16	1.31	1.18	0.38	0.36	0.36	0.18	0.20	0.18
mean	2.23	2.03	1.64	0.23	0.22	0.20	1.14	1.29	1.14	0.38	0.36	0.36	0.18	0.19	0.19

* a = 4 months after germination or sprouting
b = 6 months after germination or sprouting
c = 8 months after germination or sprouting.

The results from table 3 clearly show the very positive effects (significant at the 1% level) of liming with aragonite on leaf calcium content. Liming with dolocal also positively influenced leaf calcium content, but to a lesser extent. The effect of dolocal on leaf magnesium content was very positive.

Table 3. Results of leaf analysis experiment 2 for plant cane (upper half) and first ratoon (lower half)

	% N			% P			% K			% Ca			% Mg		
	a*	b*	c*	a	b	c	a	b	c	a	b	c	a	b	c
A	2.23	2.05	1.63	0.17	0.19	0.14	0.82	1.03	1.03	0.36	0.32	0.24	0.15	0.13	0.11
B	2.23	2.11	1.67	0.19	0.19	0.14	0.85	0.96	1.05	0.60	0.50	0.41	0.18	0.14	0.12
C	2.19	2.00	1.63	0.16	0.17	0.13	0.86	1.09	1.05	0.34	0.26	0.20	0.16	0.13	0.12
D	2.24	2.05	1.67	0.18	0.19	0.14	0.73	0.99	1.01	0.66	0.53	0.39	0.18	0.13	0.11
E	2.26	2.09	1.70	0.19	0.20	0.15	0.76	0.94	1.00	0.46	0.40	0.31	0.27	0.20	0.20
mean	2.23	2.06	1.66	0.18	0.19	0.14	0.80	1.00	1.03	0.48	0.40	0.31	0.19	0.14	0.13
A	2.14	2.01	1.46	0.21	0.20	0.18	1.12	1.12	1.15	0.29	0.25	0.24	0.11	0.13	0.12
B	2.18	2.05	1.54	0.21	0.21	0.18	1.11	1.10	1.04	0.45	0.49	0.43	0.13	0.15	0.14
C	2.13	2.01	1.45	0.20	0.20	0.17	1.08	1.12	1.09	0.22	0.22	0.23	0.11	0.13	0.13
D	2.21	2.12	1.46	0.21	0.20	0.18	1.11	1.04	1.04	0.45	0.50	0.41	0.11	0.13	0.12
E	2.17	2.06	1.50	0.21	0.21	0.18	0.97	1.02	0.95	0.32	0.37	0.31	0.20	0.24	0.21
mean	2.17	2.05	1.48	0.21	0.20	0.18	1.08	1.08	1.05	0.35	0.37	0.33	0.13	0.16	0.14

* a = 4 months after germination or sprouting
b = 6 months after germination or sprouting
c = 8 months after germination or sprouting.

Table 4. Results of leaf analysis experiment 3 for plant cane (upper half) and first ratoon (lower half)

	% N			% P			% K			% Ca			% Mg		
	a*	b*	c*	a	b	c	a	b	c	a	b	c	a	b	c
F	2.18	1.95	1.54	0.17	0.18	0.14	1.01	1.25	1.17	0.29	0.24	0.20	0.19	0.14	0.12
G	2.19	2.01	1.61	0.20	0.20	0.14	1.00	1.20	1.12	0.31	0.24	0.22	0.18	0.15	0.14
H	2.20	2.02	1.68	0.20	0.21	0.15	1.07	1.26	1.17	0.31	0.24	0.25	0.18	0.15	0.14
I	2.26	2.11	1.69	0.22	0.22	0.16	1.04	1.29	1.17	0.33	0.28	0.22	0.18	0.17	0.15
K	2.30	2.08	1.62	0.23	0.23	0.16	1.02	1.32	1.16	0.34	0.29	0.23	0.20	0.17	0.14
mean	2.23	2.04	1.63	0.20	0.21	0.15	1.03	1.26	1.16	0.31	0.26	0.22	0.19	0.15	0.14
F	1.99	1.89	1.25	0.14	0.14	0.13	1.23	1.25	1.20	0.23	0.26	0.21	0.13	0.16	0.12
G	2.08	1.87	1.22	0.15	0.15	0.13	1.25	1.20	1.11	0.25	0.24	0.20	0.12	0.16	0.10
H	2.13	1.96	1.42	0.17	0.17	0.15	1.32	1.25	1.21	0.28	0.29	0.26	0.13	0.16	0.14
I	2.20	1.93	1.43	0.17	0.17	0.15	1.26	1.20	1.12	0.28	0.30	0.28	0.14	0.18	0.15
K	2.10	2.03	1.39	0.18	0.19	0.16	1.32	1.21	1.28	0.27	0.32	0.27	0.15	0.16	0.14
mean	2.10	1.94	1.34	0.16	0.16	0.14	1.28	1.22	1.18	0.26	0.28	0.25	0.13	0.16	0.13

* a = 4 months after germination or sprouting
b = 6 months after germination or sprouting
c = 8 months after germination or sprouting.

From table 4 it can be concluded that Curaçao phosphate had positive effects on both leaf phosphate and leaf calcium content. Comparing the results for plant cane and for ratoon cane, we can see that leaf nitrogen content is slightly higher in plant cane, whereas leaf potassium content is slightly lower. There is also a decrease in leaf nitrogen content when the plant matures, both for plant cane and for ratoon cane. Especially after 6 months nitrogen content dropped considerably. This relation also was found by Evans (1961).

The results of the length measurements, yield determinations and juice analysis are given in table 5 and 6. Unfortunately it was not possible to determine yield and to make juice analysis of the first ratoon, because of heavy lodging of the cane, causing much damage. This lodging was caused by very strong winds, together with heavy showers, which occurred in July 1977.

Tabel 5. Results of length measurements, yield determinations and juice analysis for plant cane and of length measurements for the first ratoon (last columns): Experiment 1

	Stem	Length (cm)	M.C**	Rend.	Sugar	Purity	Pol %	Brix	Stem	Length (cm)	
	b*	c*	kg	%	kg	%		o	a*	b*	c*
N1	203	264	696	7.34	51.2	86.7	15.47	17.85	146	212	235
N2	204	262	684	7.34	50.2	87.8	15.63	17.80	145	212	240
N3	203	261	715	7.35	52.6	86.6	15.41	17.79	146	210	240
P1	202	262	701	7.34	51.5	87.6	15.65	17.86	145	212	239
P2	202	262	706	7.35	52.0	86.9	15.50	17.84	146	212	241
P3	206	264	688	7.34	50.6	86.6	15.37	17.73	146	210	238
K1	203	262	672	7.40	49.8	87.0	15.61	17.94	147	211	243
K2	203	262	715	7.42	53.1	87.5	15.57	17.79	145	211	241
K3	204	263	708	7.21	51.3	86.5	15.32	17.71	145	213	234
mean	203	262	698	7.34	51.4	87.0	15.50	17.81	146	211	239

* a = 4 months after sprouting
b = 6 months after germination or sprouting
c = 8 months after germination or sprouting

** M.C. = net millable cane.

The results from table 5 show that there were no effects at all of nitrogen, phosphate and potassium at the chosen levels. On the contrary, there were very positive effects of liming on stem length during growth and on yield. This is also true for application of Curaçao phosphate. These positive effects, however, were leveled by negative effects on juice quality (purity, pol %, brix). For this reason sugar yield (rendement x cane yield) was not influenced by liming and application of Curaçao phosphate (table 6).

Table 6. Results of length measurements, yield determinations and juice analysis for plant cane and of length measurements for the first ratoon (last columns): Experiment 2 and Experiment 3.

	Stem	Length (cm)	M.C**	Rend.	Sugar	Purity	Pol %	Brix	Stem	Length (cm)	
	b*	c*	kg	%	kg	%		o	a*	b*	c*
A	177	229	680	8.29	56.4	89.9	17.31	19.26	141	199	254
B	195	249	730	7.88	57.8	89.0	16.10	18.11	152	219	269
C	172	222	646	8.77	56.4	91.6	17.73	19.53	140	204	256
D	197	250	699	7.88	55.2	88.7	16.35	18.42	147	214	261
E	205	268	734	7.16	52.7	87.5	15.53	17.74	154	226	259
mean	189	244	698	8.00	55.7	89.3	16.60	18.61	147	212	260
F	185	244	729	8.40	61.3	90.5	17.03	19.02	112	164	221
G	194	254	798	8.01	63.9	88.5	16.73	18.88	123	175	227
H	199	260	840	7.72	65.0	87.8	16.53	18.81	132	197	245
I	202	266	883	7.25	64.0	86.5	15.64	18.06	139	203	255
K	211	274	855	6.84	58.5	85.9	15.15	17.64	143	213	251
mean	198	260	821	7.64	62.5	87.9	16.22	18.48	130	190	240

* a = 4 months after sprouting
b = 6 months after germination or sprouting
c = 8 months after germination or sprouting

** M.C. = net millable cane.

Summarizing the following can be concluded from these experiments:

1. The chosen levels of nitrogen, phosphate and potassium fertilizers were too high and for this reason the levels will be lowered for the second ratoon.
2. Liming did not influence sugar yield in plant cane, but this has to be studied also for ratoon cane.
3. Curaçao phosphate had similar effects as liming. Moreover, this fertilizer makes it also possible to grow at least one ratoon crop without applying water soluble phosphate.

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Preliminary results of sugar cane experiments on the sandy loam soils of the "Zanderij" formation.
(I.E. Soe Agnie)

Question by: J.H. van Eyck
Country: Suriname

QUESTION: It is not clearly stated in the paper (see table 6) at what age of the cane the juice analysis were performed.

ANSWER: The age of the cane was about 12 months.