CLARIFICATION COMMITTEE'S PROGRESS REPORT FOR 1935-36

The investigations of the Clarification Committee have been devoted during the past year mainly to a study of the characteristics of the non-Uba canes.

With this end in view the Committee formulated a plan of co-operative work, covering those points likely to prove of value to the Industry in the coming years, when larger and larger quantities of specific varieties of cane are likely to be treated in our factories.

The report is divided into the following sections:—

(1) The apparent purity of mixed juice, reducing sugar ratio, and ash contents of the Co and P.O.J. canes compared with Uba.

(2) The comparative quantities of lime required to bring the juices to 8.4 pH.

(3) The comparative quantities of mud, and the clarity of the juices on treatment by Simple Defecation, and with Phosphoric Paste.

(4) The nature and quantity of cush-cush obtained.

(5) The comparative wax contents of the Filter Cake.

(6) Analysis of evaporator scale obtained from comparative runs at Chaka's Kraal.

(7) The comparative qualities of the sugar obtained from Uba and non-Uba canes.

(8) Effect of various methods of clarification on alcogel removal.

(9) Comparative clarification results using Dolomitic Lime.

THE COMPARATIVE PURITY, REDUCING SUGAR RATIO AND ASH CONTENTS OF THE Co. AND P.O.J. CANES COMPARED WITH UBA.

All tests were carried out on the mixed juice obtained from consignments of cane representative of a wide area, the principal centres being Darnall, Gledhow, Tongaat, Eshowe and Felixton.

The comparative Brix and Purity results were as follows:—

Variety.	No. of Tests	Age.	Average Brix.	Purity.		
				Average	Maximum	Minimum.
Co.290	20	Under 16 months	14.96	85.6	91.8	78.8
Co.290	23	Over 16 months	17.48	88.0	93.4	80.5
P.O.J.2725	10	Under 16 months	16.08	85.8	89.1	82.9
P.O.J.2725	13	Over 16 months .	17.37	88.4	94.2	83.3
P.O.J.2878	7	Over 16 months	15.40	88.7	94.1	85.7
Uba	12	Over 16 months	15.37	89.2	92.9	82.4

REDUCING SUGAR RATIO.

Variety.	No. of tests in average.	Age.	Average Reducing Sugar ratio.	Maximum.	Minimum.
Co.290	20	Under 16 months.. ..	1.78	4.66	0.06
Co.290	22	Over 16 months	2.52	5.86	0.45
P.O.J.2725	10	Under 16 months.. ..	2.72	4.26	1.22
P.O.J.2725	13	Over 16 months	1.77	3.75	0.39
P.O.J.2878	7	Over 16 months	1.72	3.07	0.72
Unclassified non-Uba canes ..	12	Over 16 months	1.24	2.83	0.55
Uba	23	Over 16 months	2.08	4.72	0.91

ASH PER CENT. BRIX.

Variety.	No. of tests in average.	Age.	Average Ash % Brix.	Maximum.	Minimum.
Co.290	20	Under 16 months.. ..	3.00	4.22	1.14
Co.290	11	Over 16 months	2.73	3.99	1.18
Average	31	.. ..	2.90	—	—
P.O.J.2725	9	Under 16 months.. ..	2.78	4.31	1.86
P.O.J.2725	8	Over 16 months	2.35	3.95	1.70
Average	17	.. ..	2.58	—	—
P.O.J.2878	5	Over 16 months	2.51	2.07	1.11
Unclassified non-Uba canes ..	12	Unknown	2.76	5.41	1.68
Uba	17	Over 16 months	2.80	4.25	1.28

The comparative ash contents at Chaka's Kraal were 3.55 gms. per litre for Uba, and 4.20 gms. per litre for non-Uba canes consisting chiefly of young Co.290.

During this test, composite samples of mixed juice and clarified juice were kept for ash analysis. The first two results are comparative, but the second and third series are short period clarification tests and are not comparative with the mixed juice.

COMPARATIVE WEEK'S RUN ON UBA AND NON-UBA CANES.

Variety.	Grammes per litre and % Total ash.	Mixed Juice.	Clarified Juice.		
			Ordinary Routine method.	Lime and Sulphur only.	Lime only.
Uba	Total ash, gms. per litre	3.77	4.34	—	—
Non-Uba		4.36	4.86	5.78	4.18
Uba	Water soluble ash % total ash ..	66.08	69.06	—	—
Non-Uba		68.50	70.26	78.96	68.90
Uba	Silica % total ash	9.11	9.75	—	—
Non-Uba		6.67	7.47	8.38	3.35
Uba	Chlorine % total ash..	18.81	18.00	—	—
Non-Uba		18.72	18.99	18.44	17.85
Uba	Iron and alumina % total ash ..	11.47	3.46	—	—
Non-Uba		9.17	2.06	1.56	2.75
Uba	Lime % total ash	3.87	17.52	—	—
Non-Uba		3.14	12.14	9.52	12.44
Uba	Magnesia % total ash	10.28	5.67	—	—
Non-Uba		11.54	8.37	9.47	11.24
Uba	Sulphate % total ash	14.81	14.50	—	—
Non-Uba		14.13	13.64	15.24	14.69
Uba	Phosphoric oxide % total ash ..	1.96	0.32	—	—
Non-Uba		1.86	0.29	0.21	0.48
Uba	Potash % total ash	25.27	26.30	—	—
Non-Uba		33.56	32.24	34.13	31.27
Uba	Undetermined % total ash.. ..	4.47	4.48	—	—
Non-Uba		1.21	4.80	3.05	5.93

The non-Uba canes in this test gave a higher total ash in both mixed juice and in clarified juice.

The soluble ash, chiefly potash, was appreciably higher than in Uba. The chlorine and sulphate contents were the same, but the magnesia was also higher.

The usual comparatively high silica content of Uba juices was noticeable, and this persisted into the sugar. The Uba juices gave higher iron alumina and lime contents, while there was little difference in the phosphoric oxide contents.

Comparative tests on mixed juice from various centres were as follows:—

Variety. (Average of tests in each series.)	Age. (Over 16 months and under 16 months.)	District.	Total Ash. Gms. per litre.	Soluble Ash % Total Ash.	Silica % SiO_2	Iron and Alumina % Fe_2O_3 Al_2O_3	Chlorine % Cl	Lime % CaO	Magnesia % MgO	Sulphates % SO_3	Phosphoric oxide % P_2O_5	Potash % K_2O	P_2O_5—K_2O ratio	Undetermined %
Uba	Unknown	Gledhow ..	5.32	44.65	28.45	21.17	10.01	2.63	6.51	12.60	3.76	10.72	1 : 3	4.15
Uba	,,	Darnall ..	4.19	58.04	21.55	9.19	15.25	2.50	8.52	13.91	2.39	15.34	1 : 6	11.35
Uba	,,	Chakas Kraal	3.77	66.08	9.11	11.47	18.81	3.87	10.28	14.81	1.96	25.27	1 : 13	4.42
Co.290	Mostly under 16 months	Chakas Kraal	4.77	69.06	9.07	10.79	16.74	2.47	9.99	15.10	2.09	33.00	1 : 16	0.75
Co.290	Unknown	Gledhow ..	6.68	67.92	9.49	15.51	18.88	2.20	6.16	15.43	2.43	21.32	1 : 9	8.58
Co.290	Over	Darnall ..	4.58	66.11	9.93	7.77	19.38	5.59	11.77	16.20	2.73	15.04	1 : 5	11.59
Co.290	Under	Darnall ..	5.45	72.67	8.88	6.42	20.19	2.75	10.17	15.71	1.84	20.17	1 : 11	13.87
P.O.J.2725 ..	Unknown	Chakas Kraal	4.68	66.52	11.33	13.21	15.56	1.88	8.19	15.69	1.22	32.71	1 : 27	0.21
P.O.J.2725 ..	Over	Chakas Kraal	3.84	60.37	14.13	16.43	16.66	2.37	7.74	11.76	2.60	28.00	1 : 11	0.31
P.O.J.2725 ..	Under	Chakas Kraal	3.99	66.46	11.06	12.92	12.02	1.93	8.48	20.12	2.51	30.00	1 : 12	0.96
P.O.J.2725 ..	Unknown	Gledhow ..	5.90	72.05	12.91	12.91	14.93	1.72	2.09	15.49	1.92	28.53	1 : 15	9.50
P.O.J.2725 ..	Over	Darnall ..	4.55	59.32	18.22	11.39	12.38	1.30	9.80	17.30	2.58	26.38	1 : 10	0.65
P.O.J.2878 ..	Unknown	Chakas Kraal	3.89	65.29	13.27	13.76	12.79	1.62	8.59	19.27	2.60	28.00	1 : 11	0.10
P.O.J.2878 ..	Over	Darnall ..	3.82	44.47	29.71	9.52	12.66	1.49	9.89	11.51	2.64	19.36	1 : 7	3.22
Unclassified non Uba samples	Unknown	Darnall ..	5.53	63.88	13.89	9.58	17.98	1.90	9.22	7.07	2.41	30.98	1 : 13	6.97

AVERAGE RESULTS OF EACH VARIETY.

Variety.	No. of Tests	Total Ash. Gms. per litre.	Soluble Ash % Total Ash.	Silica % SiO_2	Iron and Alumina % Fe_2O_3 Al_2O_3	Chlorine % Cl	Lime % CaO	Magnesia % MgO	Sulphates % So_3	Phosphoric oxide % P_2O_5	Potash % K_2O	P_2O_5—K_2O ratio	Undetermined %
Uba ..	16	4.43	56.26	19.70	13.94	14.69	3.00	8.47	13.77	2.70	17.11	1:7	6.62
Co.290 ..	30	5.37	68.94	9.34	10.12	18.80	3.25	9.52	15.61	2.27	22.38	1:10	8.71
P.O.J.2725	17	4.59	64.94	13.53	13.37	14.31	1.84	7.26	16.07	2.17	29.12	1:15	2.33
P.O.J.2878	6	3.86	54.88	21.49	11.64	12.72	1.55	9.24	15.39	2.62	23.68	1:9	1.67

These average results again show that non-Uba canes have an increase in soluble ash over Uba (except P.O.J.2878), consisting principally of potash salts, while the phosphoric oxide content is lower than with Uba.

THE COMPARATIVE QUANTITIES OF LIME REQUIRED TO BRING THE JUICES TO 8.4 pH.

The method used was the application of a standard solution of lime water using phenolphthalein paper as indicator. The results were as follows:—

Variety.	No. of tests in average.	Age.	Average lbs. of CaO required per 1,000 galls. Juice.	Maximum.	Minimum.
Co.290	20	Under 16 months.. ..	5.07	7.16	3.05
Co.290	23	Over 16 months	4.56	7.67	2.86
P.O.J.2725..	10	Under 16 months.. ..	5.09	6.90	3.35
P.O.J.2725..	13	Over 16 months	5.87	7.80	4.44
P.O.J.2878..	7	Over 16 months	4.98	7.54	3.74
Unclassified non-Uba canes..	12	Unknown	4.67	5.83	3.47
Uba	24	Over 16 months	5.47	7.96	4.00

The maximum figure obtained for Uba was actually 14.6 lbs. CaO per 1,000 gallons juice, but this appeared such an abnormal unchecked condition, that the next highest figure 7.96 has been taken.

A study of these figures indicate a possible maximum saving of about half a pound of lime per 1,000 gallons of juice, if the present standard practice of liming to 8.4 pH is continued in the future, but bearing in mind the small number of tests carried out and the great variations shown in the maximum and minimum figures this figure would appear of little, if any, economic importance.

THE COMPARATIVE QUANTITIES OF MUD, AND THE CLARITY OF THE JUICE ON TREATMENT BY SIMPLE DEFECATION AND WITH PHOSPHORIC PASTE.

The following methods of treatment were decided upon:—

(a) **Simple Defecation.**

Two litres of the juice sample were limed to 8.4 pH, heated to 100° C., and allowed to settle in glass cylinders for 2½ hours; after which the volume of mud was recorded, and the clarity of the supernatant liquid noted by the Kopke Turbidimeter, which proved very useful for such comparative work.

(b) **Phosphoric Treatment.**

A further sample treated in the same manner as under (a) was brought to 7.6 pH with phosphoric acid, heated and allowed to stand, as described under Simple Defecation.

The comparative results were very interesting, and are as follows:—

SIMPLE DEFECATION.

Variety and Age.	No. of Tests.	Per Cent. Mud.			Kopke Number.		
		Average.	Maximum.	Minimum.	Average.	Maximum	Minimum.
Uba, over 16 months	20	25.9	44.7	10.6	15	26	9
Co.290, under 16 months	20	23.5	47.8	10.4	27	48	13
Co.290, over 16 months	22	21.1	34.0	12.0	22	40	9
P.O.J.2725, under 16 months	11	21.1	43.0	8.1	19	35	9
P.O.J.2725, over 16 months	11	21.2	43.0	11.0	22	35	10
P.O.J.2878, unknown	7	26.1	61.7	13.0	27	36	15
Unclassified non-Uba canes	12	20.2	30.3	13.1	29	43	12

TREATMENT WITH PHOSPHORIC.

Variety and Age.	No. of Tests.	Per Cent. Mud.			Kopke Number.		
		Average.	Maximum.	Minimum.	Average.	Maximum	Minimum.
Uba, over 16 months	19	32.3	54.3	16.6	32	70	9
Co.290, under 16 months	20	29.4	58.0	14.9	60	85	35
Co.290, over 16 months	20	31.7	71.0	17.0	53	84	32
P.O.J.2725, under 16 months	11	24.0	79.0	12.5	41	80	12
P.O.J.2725, over 16 months	11	37.8	79.0	26.0	60	95	39
P.O.J.2878 unknown	7	20.3	48.0	12.3	58	81	36
Unclassified non-Uba canes	12	21.8	31.3	11.4	59	80	40

CLARITY OF JUICE.

Uba.

All tests gave results from very bad to fairly clear, with no correlation between quantity of muds and the clarity of the juice.

Co.290.

With Simple Defecation when the percentage of mud was lower than 30, the clarity of the juice was very poor, at higher percentages of mud up to 42 the juice was good.

This general observation was common to all Co.290 tests.

With the phosphoric series juices under 16 months showed a progressive increase in clarity from very cloudy to brilliant and this was associated with the progressive rise in the volume of mud.

With juices over 16 months all juices ranged from clear to brilliant.

P.O.J.2725 and 2878.

With simple defecation juices under 16 months old were either bad or very bad, while those over 16 months ranged from cloudy to very cloudy.

After treatment with phosphoric the juices from young cane varied from poor to good, while the juices from canes over 16 months were superior ranging from fairly clear to brilliant.

These observations apply also to the few tests conducted on P.O.J.2878.

General Observations.

In general Uba gave higher volumes of mud, the average percentages being only exceeded by P.O.J. 2878 in simple defecation and by old P.O.J.2725 on treatment with phosphoric.

From these results reductions in the volume of muds are unlikely to be more than from 5 to 10%.

The maximum and minimum results again show extremely wide fluctuations, the most noticeable being in the P.O.J. series on treatment with phosphoric, where the maximum percentages of mud are between 70 and 80%.

The possibility of bad spells of juice from these canes is most marked, and has already been noted in one factory.

On the other hand the clarity of the juices from non-Uba canes is generally superior to Uba, this condition being most marked in the phosphoric treatment series.

In the light of these laboratory tests and information from practical factory operations this past season, the Committee is not justified in assuming that a departure from present technique is warranted, and further it is not a certain prospect that the treatment of non-Uba juices will require appreciably less chemicals.

THE NATURE AND QUALITY OF THE CUSH-CUSH OBTAINED.

A series of tests were conducted at Maidstone using the ordinary mill sieve, and strainers of 30, 60, and 90-mesh respectively, with the following results.—

CUSH-CUSH GRAMS PER GALLON.

Variety of Cane.	No. of tests.	Mill Sieve.			30-Mesh.			60-Mesh.			90-Mesh.		
		Avge.	Max.	Min.	Avge.	Max.	Min.	Avge.	Max.	Min.	Avge.	Max.	Min.
Co.290	12	426	680	275	62.7	98.2	40.5	32.0	44.9	22.0	11.0	15.2	7.5
P.O.J.2725	6	403	505	325	72.9	127.0	45.2	28.5	38.1	12.0	9.9	13.8	7.0
Uba	6	385	520	275	58.1	82.7	43.4	32.8	49.7	23.7	12.7	21.0	4.7

THE COMPARATIVE WAX CONTENTS OF THE FILTER CAKE.

	Wax % Dry cake.
Average Uba (one week)	9.66
Average non-Uba (one week)	6.93
Non-Uba without sulphur	17.11
Non-Uba without phosphoric	6.36

From these results the per cent. of wax in Press Cake from non-Uba canes is likely to show an appreciable reduction. With simple defecation, however, the percentage is considerably increased due to the decreased quantity of precipitate.

ANALYSIS OF EVAPORATOR SCALE.

Comparative scales from Uba and non-Uba canes.

	Uba.	Non-Uba.
Loss on ignition	38.45	25.50
Insoluble residue	29.74	47.73
HCl soluble silica, SiO_2	1.14	0.15
Iron and alumina Fe_2O_3, Al_2O_3	1.40	1.33
Lime, CaO	22.70	14.42
Magnesia, MgO	Trace	Trace
Phosphoric oxide, P_2O_5	0.48	0.20
Potash, K_2O	Nil	Nil
Sulphates, SO_3	3.43	5.77
Sulphites, SO_2	0.48	2.96
Undetermined	2.18	1.94

The scale from the Uba was comparatively voluminous and soft, as indicated by the analysis, there being 12.95% more organic matter, and 17.99% less insoluble residue. As usual Uba showed higher soluble silica, with more lime and less sulphates and sulphites.

The non-Uba scale was comparatively white and scanty, a sample being obtained by suspending a plate in the evaporator.

THE COMPARATIVE QUALITIES OF THE SUGAR OBTAINED FROM UBA AND NON-UBA CANES.

Analysis of the Sugars.

Composite samples of sugars from the two weekly runs at Chakas Kraal were collected, with the following interesting results:—

	Week Uba.	Week Non-Uba
Moisture	0.28	0.56
Polarisation	98.20	97.65
SO_2, parts per million	90.00	95.00
Safety factor	0.15	0.24
pH	6.90	6.70
Reducing sugars %	0.24	0.33
Starch	distinct blue with iodine	comp. little
Ash	0.29	0.37
Gums	0.38	0.33
Filterability	42.80	78.80

Ash analysis—

	Uba.	Non-Uba.
Silica % ash, SiO_2	8.05	5.80
Iron and alumina, Fe_2O_3, Al_2O_3	3.02	1.64
Lime, CaO	25.16	22.59
Magnesia, MgO	6.64	7.42
Sulphate, SO_3	19.53	16.67
Undetermined	37.60	45.88

Outstanding Points.

The sugars from the non-Uba canes showed a considerable increase in filterability.

The Uba sugar had an appreciable starch content, there being practically none in the non-Uba sugar.

The ash components of the mixed juice and clarified, more especially silica, persist throughout the manufacture into the sugar.

A series of tests conducted at the Refinery show conclusively that no relationship exists between the total silica content and filterability. In respect to the soluble silica content the results are inconclusive, and it would appear that the cause or causes of poor filterability are most likely associated with a number of factors in which silica is of minor importance.

EFFECT OF VARIOUS METHODS OF CLARIFICATION ON ALCOGEL REMOVAL BY M. VIGER.

The following methods of clarification were used:—

(1) Cold sulphitation.
(2) Cold liming followed by sulphitation.
(3) Sulphitation followed by liming.
(4) Harloff's process modified.
(5) Harloff's process with addition of phosphoric paste.
(6) Simple defecation, no phosphoric.
(7) Simple defecation with phosphoric.
(8) Superheating.

Each experiment was repeated five times, but only averages are recorded.

(1) Cold Sulphitation.

The juice was sulphited to 2.2 gms. SO_2 per litre, limed to neutrality, and 1 gram of P_2O_5 added per litre, heated to 210° F. and settled.

	Brix.	Purity.	pH.	Total Gums % Brix.
Juice before treatment	16.8	84.9	—	2.90
Juice after treatment	17.5	86.3	6.7	1.20

Alcogel removal 58.6 %.

(2) Cold Liming followed by Sulphitation.

The juice was limed and sulphited to 2.4 gms. SO_2 per litre, corrected with lime to neutrality, and heated.

	Brix.	Purity.	pH.	Total Gums % Brix.
Juice before treatment	16.8	84.9	—	2.90
Juice after treatment	17.4	86.8	6.8	1.38

Alcogel removal 52.3 %.

(3) **Sulphitation followed by Liming, no P_2O_5.**

The juice was sulphited to 2.2 gms. SO_2 per litre, limed to neutrality, and heated to 210° F.

	Brix.	Purity.	pH.	Total Gums % Brix.
Juice before treatment	16.8	84.9	—	2.90
Juice after treatment	17.3	86.1	6.7	1.50

Alcogel removal 48.2 %.

(4) **Harloff's Process Modified.**

The juice was heated to 60° C. then limed (90%), and sulphited to 2.1 gms. SO_2 per litre, corrected to neutrality, and reheated to 210° F.

	Brix.	Purity.	pH.	Total Gums % Brix.
Juice before treatment	16.8	84.9	—	2.90
Juice after treatment	17.3	87.0	6.8	1.15

Alcogel removal 60.3 %.

(5) **Harloff's Process with addition of Phosphoric Paste.**

The juice was treated as described under (4), but after final correction with lime above neutrality 1 gram of P_2O_5 was added.

	Brix.	Purity.	pH.	Total Gums % Brix.
Juice before treatment	16.8	84.9	—	2.90
Juice after treatment	17.2	87.0	6.8	0.99

Alcogel removal 65.8 %.

This process is our standard practice to-day, and in practice shows the lowest incrustation of evaporators, etc.

(6) **Simple Defecation, no Phosphoric.**

The juice was limed and heated.

	Brix.	Purity.	pH.	Total Gums % Brix.
Juice before treatment	16.8	84.9	—	2.90
Juice after treatment	17.5	85.8	7.1	1.85

Alcogel removal 36.1 %.

(7) **Simple Defecation with the use of Phosphoric.**

Factory samples gave an average Alcogel removal of 42.3%.

(8) **Superheating.**

Superheating the mixed juice (Muller's Process) was tried for two weeks in the factory, but figures did not show any improvement over the Harloff's process.

SUMMARY OF RESULTS BASED ON ALCOGEL REMOVAL.

(1) Phosphoric oxide increases the percentage of alcogel removal.

(2) The action of lime prior to sulphitation assists in alcogel removal.

(3) Initial heating of the raw juice to 60° C., followed by liming and sulphitation, gives the greatest alcogel removal, and least incrustation of the heaters and evaporators.

(4) Simple defecation gave the worst results, which were only slightly improved by using phosphoric.

In factory practice the output was diminished through increased viscosity, while the recovery was lower by 2.5% to 3%.

COMPARATIVE CLARIFICATION RESULTS USING DOLOMITIC LIME.

Three samples of lime were used in the following tests, the analyses being as follows:—

	Carbon dioxide.	Silica % SiO_2	Iron & Alumina % Fe_2O_3 Al_2O_3	Lime % CaO	Free Lime % CaO	Magnesia % MgO	Moisture & undetermined
No. 1—Powdered Dolomitic slaked lime ..	2.05	3.41	0.40	55.00	48.5	20.28	18.46
No. 2—Dolomitic quicklime in lumps ..	0.31	5.86	0.40	66.00	56.9	27.08	0.35
No. 3—Ordinary lime	0.26	0.86	0.30	92.00	83.8	0.72	5.86

These three limes were made into milk of lime and used in the tests as follows:—

A 400 lb. representative sample of cane was obtained (off crop) having the following analysis:—

Brix	18.50
Purity	89.60
Sucrose % cane	12.42
Fibre % cane	18.35

The juice was divided into three lots, and treated according to usual factory practice, using, however, the three types of lime.

ANALYSIS OF THE JUICE ASH.

			Total Ash.	Insoluble Ash.	Soluble Ash.	Chlorine, Cl	Silica, SiO_2	Iron and Alumina, Fe_2O_3 Al_2O_3	Lime, CaO.	Magnesia, MgO.	Sulphates, SO_3	Phosphates, P_2O_5	Potash, K_2O.	Undetermined.
Ordinary Lime.	Crusher juice	Per cent. ..	100.00	34.28	65.72	16.38	9.95	7.95	2.56	15.92	17.28	1.69	27.43	0.84
		Grms. per litre	3.90	1.34	2.56	0.64	0.39	0.31	0.10	0.62	0.67	0.07	1.07	0.03
	Clarified juice	Per cent. ..	100.00	35.75	64.24	10.93	1.39	1.29	2.88	30.24	16.44	0.28	21.28	15.27
		Grms. per litre	5.03	1.80	3.23	0.55	0.07	0.06	0.14	1.52	0.83	0.01	1.07	0.78
Dolomite Lime.	Clarified juice	Per cent. ..	100.00	32.90	67.10	12.77	1.59	1.31	3.05	28.82	17.06	0.39	25.71	9.30
		Grms. per litre	4.59	1.51	3.08	0.59	0.07	0.06	0.14	1.32	0.78	0.02	1.18	0.43
	Clarified juice	Per cent. ..	100.00	26.32	73.68	16.85	4.02	1.63	8.27	14.59	19.08	0.41	29.58	5.57
		Grms. per litre	3.69	0.97	2.72	0.62	0.15	0.06	0.30	0.54	0.70	0.02	1.09	0.20

Analysis of the clarified juice obtained was as follows:—

	No. 1 Lime.	No. 2 Lime.	No. 3 Lime.
Brix	19.4	19.3	18.8
Purity	88.2	87.9	90.1
Parts SO_2 per million brix in clear juice	6,434	5,011	952
Drop in purity	−1.4	−1.7	+0.5
pH	8.0	7.7	7.6

No. 1.—It was difficult to obtain a final point on tempering, as some of the lime particles were continuously dissolving. Such lime would give trouble in factory practice.

The juice settled slowly, was of a dark colour and contained a fair amount of suspended matter.

No. 2.—The final tempering was easier in this case, but the juice was dark, and contained a good deal of suspended matter.

No. 3.—The final tempering was easy. The juice settled quickly with a light colour, and was practically free from suspended matter.

USE OF DOLOMITIC LIME.

The juices treated with Dolomitic lime had a bad appearance, settled slowly, contained fair amounts of suspended matter, and had an exceedingly high SO_2 content, which would be reflected in the sugar produced from such juices.

The juices also showed a drop in purity after clarification, with a heavy increase in total ash, and magnesia per cent. ash.

In view of these experiments and previous factory experience Dolomitic lime containing such high percentages of magnesia is quite unsuitable for ordinary sulphitation practice in Natal.

Clarification Committee.

B. E. BEATER.
L. BLACKLOCK.
G. BOOTH.
W. H. FOSTER.
F. W. HAYES.
J. RAULT.
M. VIGER.
G. C. WILSON.
G. C. DYMOND (Convener).

ACKNOWLEDGEMENTS.

Especial thanks are due to W. T. Latham, B. Balcomb, the staff of Chaka's Kraal and others who assisted with contributory data.

Mr. CHRISTIANSON: We have here a report which should be very useful to us in future, and the Committee are to be congratulated upon it. I refer in particular to some work done by Mr. Viger, and also to the work on dolomitic lime. The work done by Mr. Viger is very valuable, and I think I am correct in saying was instrumental in improving our factory work tremendously. It is very gratifying to see that this work is now put down permanently on record.

Mr. MOBERLY: Mr. Chairman, it is impossible in the time available—I have not read this paper before—to pick out very much, but there are a couple of points which I do notice. Particularly in the results of tests on the comparative qualities of cane and the clarity of juice. I think the general experience of the treatment of these juices from new varieties is that almost invariably they have given less mud and clearer juice. I am not discussing the value of that difference ,and whether the more clear juice has given better recovery, but I don't see that this condition would necessarily arise with the additional use of sulphur I should say it is certainly arising with the use of no more sulphur than is in use to-day.

Mr. DUCHENNE: Our experience at Umfolozi is that the reducing sugar ratios of non-Uba canes are consistently lower than Uba.

Mr. RAULT: Usually the reducing sugar is more or less in inverse ratio to the purity. So when you say that the non-Uba canes give us a lower or higher reducing sugar ratio, you should also mention the purity.

I might say also that although normally with non-Uba canes there is a higher purity, this year it has not been marked. In many cases the non-Uba canes have had lower purities than Uba.

Mr. BECHARD: In regard to the first query by Mr. Moberly. I am a bit chary of offering any explanation of this, because I have nothing to do with the Committee. I read in the light of the experiments made that by treatment with phosphoric acid certain results were obtained. These results would probably have been intensified if in factory practice sulphur had been added.

Mr. RAULT: As a contribution to clarification by various limes, I may tell you what happened to us at Natal Estates, when we were trying our juices lately on a factory scale, and not in the lab., with lime that contained a fair amount of magnesia. You know that in all text-books we have a definite figure for magnesia in lime over which we should not go. But in this case of actual tests, these statements from text-books may not seem to be justifiable. If you have more than a certain amount of magnesia you get a cloudy juice. At Natal Estates with carbonation the limit for magnesia didn't seem to be so low. For three days we worked lime with a content of about 10% of magnesia, but we kept the factory going. We didn't have difficulties that would stop us from making sugar or keeping things going. We no doubt found that we required more lime to get the same results. The other figures for clarification were quite good, and filtration, ash content, etc., were satisfactory, but we had to use more lime. A few years ago we used lime which contained 30% of magnesia. At that time we were not so strict in our control. As far as I remember we did work our factory for a few hours with such lime. The explanation of our comparative ease of working may be due to the fact that in carbonation our reactions are much more alkaline. We filter at a p.H. of about 10.6 to 10.4, whilst usually you use 7.2 with sulphitation. Possibly magnesium or magnesia at a p.H. of 10.6 is more easily eliminated.

Mr. VIGER: In the case of carbonation an explanation has been offered by Mr. Rault. In carbonation a lime with 30% of magnesia has given an even clearer juice than lime with a low content of magnesia, and the quantities and qualities of juice have been better. But in sulphitation the magnesia permissible is 5 or 6 per cent. Some years ago we tried lime having a lot of magnesia. We obtained a passable juice. The juice remained cloudy and was more alkaline than usual. The juice was not as clear as with lime containing 2% of magnesia, but 5 or 6 is permissible.

Mr. RAULT: In following up the mention of magnesia limestone, we all know that Natal limestone is very hard. Were it not for the amount of magnesia, and the effect on certain juices, you could use much cheaper lime in the clarification, obtaining it from Natal.

Mr. COIGNET: With regard to the composition of the juice and to what extent it is affected by the composition of the soil, I should like to point out that in nature there is no hard-and-fast rule. It is

the case with most living bodies, plants, or animals to have a more or less constant composition. Wouldn't it be the case also with cane? The soil would affect the growth more than the composition of the plant itself, its derivative products, such as sugar? It is a well-known fact in dairy farming that if the supply of food is cut down to a certain extent, the composition of the milk will not change accordingly. The supply would rather then be drawn from the bone reserve to make up for the deficiency, and afterwards it will be the quantity of the product that will be affected.

Mr. BOOTH: In reply to Mr. Moberly's question on clarification comparisons between Uba and new variety juices, I think the whole thing should be read in the light of an experiment—a purely laboratory experiment—and not an application to strict factory practice. Mr. Dymond merely tells you the results of experiments done in various factory laboratories, the results of which he tabulated under the heading of Clarity of Juice. I think he is perfectly logical if you admit the subjunctive mood. He is merely giving a lead at the present time from the experiments made. He is justified in suggesting a "ca canny" policy. That was entirely the feeling of the meeting when these experiments were discussed. I did not realise at first Mr. Dymond was referring only to the results of laboratory tests, or that laboratory tests were merely taken on their face value. I do understand now the real meaning of the conclusions—working from these laboratory tests it is a fair assumption that if you change over to factory conditions with sulphur results will be obtained in an even more marked degree. At first I thought there was a tendency to discount the actual factory experience obtained this year, because I am quite certain that the factory results point in every case to clearer juice and less mud.

Mr. HAYES: I have here some figures on the ash analysis of samples of Raw Sugars collected at the Refinery during the 1935 season. In the committee report compiled by Mr. Dymond mention is made of these tests which were, unfortunately, completed too late to be included. The analyses were carried out during last season at the request of the Clarification Committee, as Mr. Dymond in previous work had found a certain relationship between the silica content of the ash and the filtrability of the sugar, and it was desired to see if these results would be verified by more widely representative samples.

It would seem that if silica is to have any influence on filtrability the figure for "soluble silica" should be the one on which conclusions are based, as the amount of "Total silica" must necessarily be affected largely by purely adventitious matter. Consequently silica results are shown as HCl soluble and insoluble.

However, no correlation was found between silica, or any other single constituent of the ash, and filtrability. It would seem that we must definitely look elsewhere for the causes of good or bad filtration in sugars. The difficulty in basing conclusions on the composition of the ash lies in the fact that the ashing process itself. no matter how carefully temperature is controlled, must affect considerably the form in which the constituents are found; many of these, no doubt, being in a colloidal form in a solution of the original sugar.

W. E. Smith, in a report to the Hawaiian Sugar Planters' Association in 1923, concluded that the inorganic salts were present in too small a proportion to seriously affect filtration, and he attributed filtration difficulties almost entirely to quantities of cane wax in suspension. He developed a method for determining wax by filtering the sugar solution through kieselguhr, and extracting the resulting cake with ether. However, this procedure has been given extensive trials in the Refinery laboratory, and we are of the opinion that all the wax is not retained by the kieselguhr. A straight wax extraction on the sugar itself. with either benzene, ether, or acetone, presents crtain analytical difficulties which we are now attempting to overcome.

ANALYSIS OF RAW SUGAR ASH.

Samples taken from deliveries during 1st week of

1935 season. Results % on Ash.

Mill Number.	Filt. Rate of Sugar.	HCl. Insoluble.	Soluble Silica.	Fe_2O_3 and Al_2O_3.	CaO.	MgO.	SO_3.	P_2O_5.
9	41	9.45	2.99	1.08	23.92	5.46	26.50	1.73
10	42	10.32	2.16	2.11	28.70	5.11	28.37	3.05
15	40	11.24	2.32	6.18	28.40	4.63	28.67	2.62
5	49	9.04	1.94	0.36	28.48	3.62	29.02	5.94
12	54	3.10	3.02	1.58	23.46	4.90	18.62	2.90
11	59	9.56	2.82	0.79	29.81	4.09	34.78	1.31
4	59	5.17	4.63	1.09	21.99	4.23	20.79	1.09
8	75	6.74	2.18	3.53	23.77	5.97	28.26	2.41
2	86	6.63	2.20	5.29	23.82	3.51	27.10	0.44

From average analysis of Monthly Samples.

Mill Number.	Filt. Rate of Sugar.	HCl. Insol.	Soluble Silica.	Fe_2O_3 and Al_2O_3.	CaO.	MgO.
12	51	7.90	1.88	3.80	31.42	3.74
8	51	9.32	2.24	2.83	35.28	5.98
10	52	11.98	3.78	3.36	27.54	4.17
5	56	9.01	1.52	5.39	22.35	4.83
9	63	13.20	3.23	1.36	19.29	6.37
11	70	7.58	3.63	2.35	21.23	4.12
15	75	12.62	3.08	2.93	16.80	4.51

Mr. DUCHENNE: There is one very interesting point in connection with the analysis of the ash. On page 85 you will see Co. 290 is higher in chlorides than any other variety. A few years ago, whilst doing work for the Umfolozi Sub-station, Co. 290 was shown to contain more sodium chloride than any other cane. We have a suspicion at the back of our mind that this was the reason why this cane resisted drought to such an extent, and better preserved its quality, if I may say, than most of the other canes. Dr. Haldane in India has also found that 290 canes preserve their quality after cutting to a greater extent than any other cane. I wonder whether the Experiment Station might conduct some experiments and find out whether that is the case.

Mr. DODDS: I am afraid we have no information to offer at present on the point that Mr. Duchenne has raised concerning the keeping qualities of the new varieties and how far they may be associated with any special features of their composition. It is, of course. a very important matter. I realise the importance, but we have no information to offer yet. It is well known in other countries that Co. 281 is better able to grow in soils which have a high saline content than other canes. That was the case in Puerto Rico. How far this may be associated with the chloride content of the cane remains to be seen.

Mr. CHRISTIANSON: There is one point I wanted to make, and that is that I think the work of this Committee is so tremendously valuable to the Industry, and such a lot of work has been done by the various members, that it should all be put on record. This has been done in the case of Mr. Viger's work at Tinley Manor; and further records of this description should be kept.

The PRESIDENT: I am sure that it is desirable to get chemists to come forward with all the information that they may have and put it on record in the way we have done this year. I think it would be a very good thing for getting the data which we require on these new canes. We will close the session with a hearty vote of thanks to this Committee for this Report.