

THE FOLLOWING ARE ABSTRACTS FROM REPORTS SUBMITTED BY VARIOUS FACTORIES ON THE SEASON'S WORK.

DARNALL SUGAR FACTORY.

Report by M. Viger.

Weather.—The rainfall was very poor from the month of January and has been unusually low throughout the season. Only 25.27 inches were recorded in 75 days.

Quality of Cane.—The season started with a fairly high sucrose of 12.70 per cent. for May and reached its peak unusually early on the week ending 26th September, when it was 14.99 per cent. After that the sucrose started to decline up to the end of the season. The average for the crop was 13.72 per cent., the highest obtained since 1933, when it was 14.03 per cent.

Purities of crusher and mixed juices were rather low (87.2 and 84.27) considering the high sucrose. The severe drought had a deleterious effect on juice purity. The average ash per cent. brix of the mixed juice, 3.59 per cent., is the highest figure on record. The juices were of a refractory nature, the non-sugars high, and the amount of final molasses produced excessive, 3.63 per cent. cane or 5.03 gallons per ton of cane (at 85 brix), is the highest on record.

The fibre was high, 15.78 per cent., considering 75.85 per cent non-Uba was crushed.

Hot Water Imbibition.—During the season hot water imbibition was tried out on the mills. The temperature of the water varied from 150°F. to 158°F. The condensate obtained from the second, third and fourth calandrias of the evaporator, which usually runs to waste, was used to this effect with a fair amount of success.

The advantages of using hot condensate for imbibition, in comparison to cold water, are as follows:—

1. The water is clean, and being practically distilled water it is free from salts.
2. The condensed water being hot is economical, as a certain amount of heat is transferred to the juice.
3. The intermediate carriers and milling plant are kept in a better hygienic condition, being more free from fermentation growth.
4. For Darnall it means a saving of 203,500 gallons of water from the river a day.
5. Extraction was increased from 0.35 to 0.40 per cent.
6. It was also observed that steam was better when using hot imbibition. This was probably due to the fact that hot bagasse loses its moisture more readily before reaching the furnaces.

When hot imbibition was used, no difficulty whatever was observed in the boiling house.

Clarification.—This department consists of three Bach continuous subsidiers, which have given entire satisfaction and saved both labour and steam. Towards the end of the season experiments were conducted with a view to reducing the amount of chemicals used. The results were fairly successful. The process consists in abstracting a portion of the settlings (about 40 to 50 per cent.) obtained from the subsidiers and returning the same to the preliming tanks, where it is thoroughly mixed with the incoming preheated raw juice (temperature 140°–150°F.) which has been previously conditioned to a certain pH (8.0 to 8.7) by the addition of a portion of the lime. The mixture is then further limed in another preliming tank, then pumped to a sulphitation tower, when the juice is sulphited and is allowed to flow out at a pH of 5.8 to 6.0 into the correcting tanks to be conditioned to the required pH with lime and phosphoric acid. The whole system is continuous. A certain portion of the settlings is being continuously introduced into the juice and the

remainder flows to the filters. The work of the filters is eased and their capacities increased.

The following savings were effected on 4,515 tons of sugar made:—

Lime, 53 tons	=	£151
Sulphur, 13.7 tons	=	159
Phosphoric acid, 6.5 tons	=	195
Total saving	=	£505

No ill-effects were observed in the factory through the reduction of the chemicals. The recovery was normal and the sugar of excellent quality, pol. 99.05 and filtration rate 114.

The study of two other processes of clarification (patented) has been started in the laboratory. So far the results observed have been very encouraging.

Filters (Oliver Campbell).—Darnall possesses a 2 (8 feet by 12 feet) Oliver Campbell filter, the total filtering area being 600 square feet for 105 tons of cane per hour. This gives a ratio of $\frac{\text{sq. ft. filter area of 5.7}}{\text{Tons cane per hour}}$

This is rather inadequate to deal with all the settlings, but a ratio of 8 will suit all conditions.

During the season twenty-one half-hourly tests were made. The items were as follows:—

	(A)	(B)	(C)	(D)
	Insoluble solids per cent. in feed before addition of bagacillo.	Bagacillo per cent. insoluble solids.	Bagacillo per cent. mud.	Mud retention per cent.
Average	6.8	31.5	23.4	70.5
Maximum	9.1	50.3	33.5	77.8
Minimum	4.6	11.7	10.7	55.7

The settlings are filtered at a temperature varying from 195° to 205°F. The temperature of the wash waters varied from 200° to 210°F.

The filtered liquor, which includes the muddy and semi-clear juices, had the following composition: brix 12.58, purity 82.1, and drop of purity from clarified juice 3.2. No extensive deterioration took place in the juices from the Oliver Campbell filters. The average reducing sugars in the clarified juice was 3.92 per cent. and in the Oliver Campbell juice 3.99 per cent. The pH of these juices was 7.4 and 7.3 respectively.

A number of screening tests made on the bagacillo added to the settlings show that on the average 83 per cent. passes through an 8-mesh screen.

The filters have been dismantled and thoroughly examined. There is evidence of slight corrosion on the rocker arms and trough, which seem to have been constructed from a very poor metal. The galvanised iron ducts, the fan casing and impeller were badly worn. The stainless steel filter screens were clogged with sand, which could not be removed in the ordinary way and the holes had to be cleaned by means of a small needle. This is tedious and will shorten the life of the screens.

pH Determinations.—It was found that considerable errors were made in colorimetric pH determinations. When a clarified juice is examined with bromo-thymol blue and the pH is found to be 7.3, then the reading of the glass electrode potentiometer will indicate 7.0. There is, of course, a considerable drop in pH from clear juice to massecuite and molasses, and the danger of sucrose inversion is always present, especially if the pH of the clear juice is on the low side. According to observations bromo-thymol blue reads +0.3 too high and phenol red +0.5 too high.

DOORKOP SUGAR ESTATES.

Report by G. Booth.

Clarification.—The past season presented no particular difficulties in juice clarification, despite the fact that the throughput was the speediest yet accomplished. One particular fact associated with certain fields again manifested itself, viz., the juice from cane cut from these fields could not be clarified. In how far this peculiarity can be associated with the uptake of certain plant-foods or lack of other elements is not known. It is suggested that a possible connection between availability of the sucrose in the cane and the type and treatment of the soil from whence the cane was obtained is well worthy of study.

Massecurites and Molasses.—The outstanding problem last year was the behaviour of low products. The third massecurites could not be concentrated to the usual density. Molasses production increased, and from August onwards the purity of exhaust molasses rose considerably for no apparent reason. Unfortunately, due to staff shortage, observations on the glucose/ash ratio could not be undertaken.

Rapid methods of analysis to assist in factory control are required, so that information as above indicated may be made available in as short a time as possible. In this connection the salometer, for example, is described by some as a useful adjunct to the laboratory. Some technologists do not agree. As the factory chemist is not always in a position to test out the usefulness of an instrument, a definite opinion on local observations would be welcomed. Similarly, the saturascope seems to have good possibilities now that the reheating of massecurites is common practice. As each massecurite has its own characteristics as revealed by cuitometer control, a line of study on this instrument is indicated.

NEW GUELDERLAND SUGAR FACTORY.

Report by C. Jelly.

Observations on the Use of the Saturascope.—This instrument which was in use at the factory the whole of the 1941-42 season, was used in conjunction with the Stevens heat-treatment plant, which we have installed in the mixer of our foreworking centrifugals.

The saturation temperature, or the temperature to which a massecurite may be heated without dissolving sugar, is a very important control item whenever reheating of the massecurite, either in crystallizers or in centrifugals, is practised.

It is not necessary to describe the saturascope, as this is done in detail in the I.S.J. 1936, page 189, but we have found by experience that the equipment as described must be modified if the saturation temperatures of all "B" and "C" massecurites are to be determined as a part of regular laboratory routine work.

Since a single determination will usually take about fifteen minutes, it becomes evident that the microscope used should be a good one, as continued use of an inferior instrument may result in permanent injury to the eyes of the operator. The instrument we have in use at the factory is a Leitz Inclined Binocular. The light is supplied by a microscope lamp using special filament six-volt globes. The source of supply of current is 220 volts A.C. and a small transformer with tapings at 4, 6 and 8 volts is interposed. A new heating element of German silver wire was inserted in the saturascope. The gauge of the wire being such that the saturascope was heated from room-temperature to 140 degrees F. in a period of five minutes. The 4-volt tapping on the transformer was invariably used, and no red filter on the microscope lamp is necessary. In respect of the optical equipment to be used on the microscope we must condemn the suggestion in the I.S.J. that a 30x eye-piece and a 10x objective should be used. Theoretically the idea is very sound, since the greater the magnification of the objective the less depth of focus is obtainable, and by using an objective as suggested the depth of focus is comparatively great. The use of a 30x eye-piece, however, imposes very severe eye-strain on the operator, and we have found that results can be equally well observed when using a 12x eye-piece, thus giving a total magnification of 120.

The operation of the saturascope is otherwise substantially as described in the article in the I.S.J., except that the rheostat can be dispensed with and a switch installed before the satura-

scope heating element. In practice, as the temperature increases, the current is switched off so as to hold any particular temperature for a period of about two minutes while the effect can be observed. The temperature is advanced 1 degree F. at a time. We have found on repeated tests that a variation of two to three degrees F. in the saturation point is quite common on different samples of the same massecurite. This, however, is of no serious consequence, since in factory practice the temperature of the circulating water used for heating should be adjusted to 5 degrees F. below the apparent saturation temperature.

In all systems where reheating of the massecurite is practised, it is important that no further dilution of the massecurite should be used after the saturation temperature has been determined and the temperature of the circulating water set, otherwise serious remelting of sugar will occur. Should it become necessary for any reason whatsoever to dilute the massecurite, either with water or molasses, then a new saturation point should be determined.

The determination of the saturation point is in our opinion an absolutely necessary control figure. We have found that two massecurites of the same purity and of the same density at the time of striking can have saturation temperatures differing by 12 to 15 degrees F. This apparently is caused by the amount of injection water used in steaming out the pan and also by the amount of dilution used on the massecurite after striking.

While realising that it has nothing whatever to do with the saturascope, we feel that whether reheating of the massecurite is practised or not, the saturascope has shown that the habit of steaming out pans after striking is one that cannot be too strongly condemned. The remelting of sugar which occurs when boiling hot injection water is added is very great, and it does not appear to show that it ever crystallizes to the same extent.

ESPERANZA SUGAR FACTORY.

Report by W. G. Galbraith.

Weather Conditions and Cane Quality.—The season has been one of the driest on record. During the whole crushing season only 7.87 inches of rain fell, as against 19.94 last year. Fortunately the cane was not affected to any great extent as far as its milling and factory qualities were concerned. The sucrose was exceptionally good, being 15.17 per cent., the highest in the industry and also a record for the factory. The purity of the juice was very good, and the fibre only slightly higher than last year. Towards the end of the season, however, the condition of the cane fell off somewhat, due to young cane, trash and green tops.

Factory Performance.—The overall recovery was a record for the factory—extraction being 0.74 per cent. better than last year and boiling house recovery showing an improvement of 0.24 per cent. This record was attained notwithstanding the fact that a high percentage of white sugars (43.0 per cent.) and a high percentage of Government grade sugar (25.2 per cent.) were made and a high rate of output was maintained.

To indicate the progress made in factory recovery, extraction and overall recovery, the following tabulated figures are given :—

Season.	Mill extraction.	Boiling house recovery.	Overall recovery.	Ratio of cane to sugar.
1932 ...	89.10	81.41	72.53	10.26
1933 ...	88.63	78.72	69.77	10.26
1934 ...	89.37	82.12	73.89	12.04
1935 ...	90.19	84.45	76.17	9.38
1936 ...	90.86	84.61	76.87	9.33
1937 ...	90.30	86.33	77.96	8.76
1938 ...	89.51	88.68	79.37	8.66
1939 ...	90.73	88.70	80.48	8.72
1940 ...	91.89	89.60	82.33	8.42
1941 ...	92.63	89.84	83.22	7.86

Moisture per cent. Bagasse.—This showed a decrease of about one per cent., and would have been even better had trouble not developed in No. 5 mill, causing the moisture to rise considerably over a period of four weeks.

Clarification.—Clarification was normal throughout the season.

Filtration.—The Oliver Campbell filter performed its duties very satisfactorily and is undoubtedly a great asset from the manufacturing point of view. The only trouble experienced was due to a shortage of bagacillo at times, particularly when No. 5 mill was not functioning properly, and the moisture in bagasse rose to 54 per cent. and higher. This caused the screw at the boilers to clog and bagacillo could not be obtained in sufficient quantities. Provided sufficient bagacillo is available, the filter works and handles all the scums comfortably, allowing plenty of time to shut down the filter and wash out frequently, which is essential.

Chemicals Used in Manufacture.—A big saving in lime and sulphur has been noticed since the installation of the Oliver Campbell filters. No lime is now necessary in the scums prior to filtering, and in consequence less sulphur is required to neutralise the excess lime previously necessary to induce good filtration. More phosphoric acid is now used, but this is due to more white sugar being made.

Boiling House.—The work in this department has been greatly facilitated by the installation of a new 800 cub. ft. calandria pan; also by the installation of a spray cooling system, for the cooling of injection water, in place of the cooling tower previously used. The latter would only cool the water 9°F. as against 25°F. obtained with the spray system. The chief advantages gained were (1) better vacuum, (2) economy of water.

Quadruple.—A good deal of entrainment took place, particularly in the third and fourth vessels. It is proposed to install the cone type save-all to combat this trouble.

Boiling House Losses.—A summary of the three main losses is tabulated below to show the progress achieved over the last eight years:—

Season.	Losses in molasses (A)	Losses undetermined (B)	A+B	Losses in filter cake.
1934 ...	—	—	14.58	1.40
1935 ...	—	—	12.92	1.10
1936 ...	—	—	12.87	1.12
1937 ...	8.72	2.80	11.52	0.53
1938 ...	7.66	2.04	9.70	0.44
1939 ...	7.49	2.28	9.77	0.48
1940 ...	7.41	2.09	9.50	0.06
1941 ...	7.18	2.15	9.33	0.08

It will be noticed that the losses in molasses, and the losses in molasses and undetermined losses, have been gradually decreased. The low losses in filter cake in 1939 and 1940 are due to the installation of the Oliver Campbell filters.

UMZIMKULU SUGAR CO., LTD.

Report by C. L. Steyn.

There has been no change in the process of manufacture, nor has any new machinery been installed that would have influenced the manufacturing efficiency.

Weather and Cane Quality.—The protracted drought (25.29 inches of rainfall for the year) has been the worst on record and adversely affected the manufacturing quality of the cane. All varieties were affected; but Co.290 appears to have suffered most.

Milling.—The conditions of working and mill settings were identical to the previous season. The decrease in extraction and increase in moisture per cent. bagasse were due to the poor quality of the cane. The crushing of these drought-stricken canes was a tough proposition. Although 87.18 per cent. of "soft canes" was crushed, these canes had developed crushing-resistant properties under the prevailing drought conditions and they were very hard. This can partly be attributed to the large proportion of nodes. These hard canes also gave rise to an increase in the moisture per cent. bagasse and increasing the hydraulic pressure on the top rollers had little effect.

Boiling House.—The clarification of the juice proceeded normally and the mud volume in the settlers was not excessive. At the triple effect some difficulty was experienced. Gummy substances from the partly dead cane were probably the cause.

At times the capacity of the evaporator was so reduced as to necessitate a "slowing down" of the crushing plant.

Vacuum Pans.—These operated satisfactorily and at no period was there any difficulty in boiling the massecuites.

Centrifugals.—Excessive viscosity caused the output of the centrifugals to be reduced to 40 per cent. at times. As each charge remained longer in the basket there was a loss in recovery as a result of erosion of sugar. The viscous massecuites imposed an excessive strain on the conveyor drive and some trouble occurred through breakages. Reheating of massecuites would have improved conditions considerably, but this facility is as yet not available.

THE GLEDHOW-CHAKAS KRAAL SUGAR CO., LTD.

(GLEDHOW ESTATES).

Report by F. L. Chiazzari.

Quality of Cane.—The season was characterized by a large proportion of drought-stricken cane, consequently quite a few consignments contained dead cane, and when burned were often wholly charred. In this respect it was noticed that Co.290 was mostly affected. Furthermore, higher topping was practised and young bull shoots were included in an endeavour to increase field yields. Towards the latter part of the season, when some young immature cane was being milled, the clarification was difficult and phosphoric acid had to be increased.

The season started with the highest sucrose ever recorded for that time of the year, and this position was maintained up to the peak week ending 6th September, when 15.05 per cent. was registered. Thereafter an alarming decrease occurred and in eight weeks the sucrose dropped to 12.53 per cent. Two weeks in particular revealed falls of 0.57 and 0.54 per cent. respectively. Over the same period the mixed juice purity dropped from 86.8 to 84.9.

Factory Performance.—The pans boiled remarkably well and all massecuites purged freely except for an occasional third. The massecuites were, however, more viscous than last year. In spite of removing a large percentage of molasses forming bagacillo the molasses per cent. cane showed an increase over last year. The crop was concluded with the record boiling house recovery of 89.27 per cent.

The extraction was disappointing, and this was due to the cane being affected by the low rainfall. The crusher and first mill were not expressing as usual, and these two units are the first to feel the strain of difficult milling cane.

The only new machinery installed was a Peck strainer. It helped appreciably, for apart from diminishing an "undetermined" loss in the form of weighed bagacillo, the Dorr clarifiers appeared to give a better clear juice. Gumming-up of the screen was common trouble and steaming-down carbonized and hardened rather than removed the matter. Running for a few hours in a 10 per cent. solution of caustic soda, followed by a hosing down with hot water, gave good results, however; but it was often found that this had to be repeated every three days or so.

CENTRAL FACTORY, LTD.

Report by J. D. Millar.

The past season was, from a pan boiler's point of view, about the worst for many years. It was extremely difficult to get a uniform grain of fair size. The difficulties were probably due to drought-stricken and over-ripe cane being milled.

The VICE-PRESIDENT, in opening the paper for discussion, said he thought in future a whole morning session should be set aside for dealing with the Annual Summary and mill reports.

Mr. RAULT agreed with the Vice-President. He welcomed the fact that more information was now available as a result of individual mill reports. New ideas were brought forward and they would be tested out. He suggested that the various items might be subdivided and discussed as such.

Mr. Rault pointed out that the severe drought resulted in lower yields of cane per acre, but the purity of the juice was

not very low. It was difficult to correlate cane quality and rainfall. The fibre per cent. cane was higher than in the previous season, yet the extraction was better. Theory once more was not borne out by experience.

Tests with an experimental Herisson crystallizer indicated that a massecuite could be treated systematically with a very large amount of water without dissolving sugar or increasing the purity of the molasses. Better exhaustion and better yields were obtained.

Boiling house recovery had gone down somewhat this season, but that was due to the very large percentage white sugar that was made at his factory.

Mr. BOOTH agreed with Mr. Rault that these unofficial factory reports were of the greatest value and, after being summarized, should be put on permanent record. As Mr. Buchanan said in the Chemical Control Committee, personal contact was very necessary, and he thought that when transport difficulties came to an end, future meetings for discussion of factory reports should be held. It was the only real method of getting the points of view on many phases of factory work.

These reports had taken considerable time and trouble to write and should not be pigeon-holed, as they were as valuable and instructive as any information that came in front of the Congress.

Mr. MOBERLY gave the experience of the Central Board in connection with laboratory refrigeration of mixed juice samples. The idea was to eliminate the night-shift by keeping the juice samples in a refrigerator. The juice was not frozen but brought to a temperature as low as 3°C. The addition of a preservative was also tried. The preservative used was mercuric iodide in formalin, as recommended by the S.A.S.T.A. and the best results were obtained by using 1 ml. The results of the experiment

were, however, disappointing. Deterioration was checked, but definitely not prevented.

Mr. Moberly thought that there must necessarily be a correlation between climate and working quality of the juice. The correlation between weather conditions and purity, and the correlation between purity and working quality, however, was not at all obvious.

Mr. DYMOND said that the Central Board would have obtained better results if smaller samples had been used and the brix done by refractometer. This was done in the original experiments at Darnall.

Mr. DUCHENNE mentioned that he had preserved samples of juice overnight by using mercuric iodide and that no change of purity had been observed. This preservative had given satisfaction since 1930.

Mr. BIJOUX said that their experience at Darnall had been that it was necessary to freeze the juice. Under these circumstances they kept juice for more than a week and there was no deterioration. It was necessary, however, to melt and mix the juice before analysing it, as the top and bottom parts differed in composition.

Mr. DODDS pointed out that purity of juice was not much affected during the earlier parts of the season, but we had refreshing rains in March and April. After August, however, the purity of the juice fell off very rapidly indeed, and that was just the time that the drought made itself felt seriously.

The speaker thought that the differences between colorimetric and potentiometric pH determinations referred to by Mr. Viger in his report was a matter which concerned the standardization of the indicator, and it should be taken up with the suppliers.