THE HISTORY AND WORKING OF THE NATAL RATIO

By G. S. MOBERLY

The following paper on the above subject was read by Mr. G. S. Moberly:—

When sucrose payment for cane was inaugurated in Natal in 1927 the method of determining sucrose % cane was laid down by the Fahey Conference Agreement, viz., the first crusher juice was tested for sucrose and this figure was multiplied by the Java Ratio to give the sucrose % cane. At first it was only considered practicable to determine the Java Ratio weekly, and a temporary figure had to be used daily. This was taken as the ratio of the previous week, though in some cases a fixed daily ratio was taken throughout the crop. The sucrose in cane thus determined was altered to the sucrose actually found in the cane at the end of the week by the application of a correcting factor. One variation of the above was tried. This was to multiply the sucrose % crusher juice by the weight of cane for each consignment and from the sum of these figures, and the total weight of sucrose found in the cane, a ratio was established. This ratio was then multiplied by the product, sucrose % crusher juice × tons of cane, which gave the adjusted sucrose in the individual consignments, without the application of a correcting factor. The advantage of this variation was that the ratio was based on sucrose in crusher juice as determined for the consignments, instead of on the sucrose in the four-hourly samples of crusher juice, and it also enabled these figures to be compared, and the accuracy of the testing thus checked.

Before the 1927 season was very far advanced it became apparent that the Java Ratio method was open to a very serious objection whenever the cane was wet by rain. The water adhering to the surface of the cane was washed off by the juice and went almost entirely into the first crusher juice, and lowered its brix. This, of course, raised the Java Ratio, but the increase of the latter was for a whole week, and applied equally to wet and dry days during that week. The position could not be met entirely by adopting a daily Java Ratio, as it often happened that cane was wet for only part of a day. The result was that the sucrose % cane for dry cane was too high at the expense of the wet cane. It therefore became necessary to find some means of overcoming this difficulty, and a committee of millers' and planters' chemists was convened to study the problem.

From a series of experiments initiated by the writer at some of the larger factories, it became apparent that while wet cane caused a drop in brix at the first crusher, the brix at subsequent units was scarcely affected. In one experiment carried out at Empangeni, the cane was thoroughly wetted with a hose pipe on side of the crusher, while that on the other side remained dry. A number of brix readings of juice from the wet and dry sides at the first and second crusher were taken. The average of these readings was as follows:—

	Dry side.	Wet side.
First crusher	19.7	17.4
Second crusher	19.6	19.5

Similar results were found at other factories.

It was therefore suggested that the ratio should be based on the first mill juice (or what was subsequently termed the last pre-maceration juice), instead of on the first crusher juice.

However, it was still necessary to test the first crusher juice for purity in order to apply the Fahey scale of purity bonus and penalty. As the testing of both juices for sucrose would have involved a lot of extra work, it was suggested that the ratio should be based on the product, brix of last pre-maceration juice × purity on first crusher juice. This product was named the Natal Sucrose, and the ratio based on it was named the Natal Ratio.

$$\text{Natal Ratio} = \frac{\text{Sucrose \% Cane}}{\text{Natal Sucrose}} \times 100.$$

Later on a Committee of this Association was appointed to advise the Fahey Mediation Conference of March 1928, and they advised the use of the above

ratio, which was adopted in the amendment to the Fahey Conference Agreement, known as Schedule B.

The Natal Ratio has been in operation for a whole season, but it is difficult to judge the effect of it owing to the fact that 1928 was an exceptionally dry year, hardly any rain having fallen during the crushing months, and of what there was, a great deal fell on Sundays when the factories were not working. I have studied the figures at the four largest factories, and find some extraordinarily conflicting results. In some cases the brix of the L.P.M. juice remained steady during the wet weather, and in other cases it dropped, and there were even cases where it rose. The latter was doubtless due to the day-to-day variation in the cane which makes comparisons very difficult. Another disturbing factor is that sometimes rainfall is recorded from 6 a.m. to 6 a.m., whereas the factory day is from 6 p.m. to 6 p.m.

In order to get some idea of the working of the Natal Ratio as a whole, a number of rainy days at Empangeni, Felixton, Amatikulu and Darnall have been considered. Averages have been taken of two days preceding rain, the actual day or days of rain, and the two days following rain.

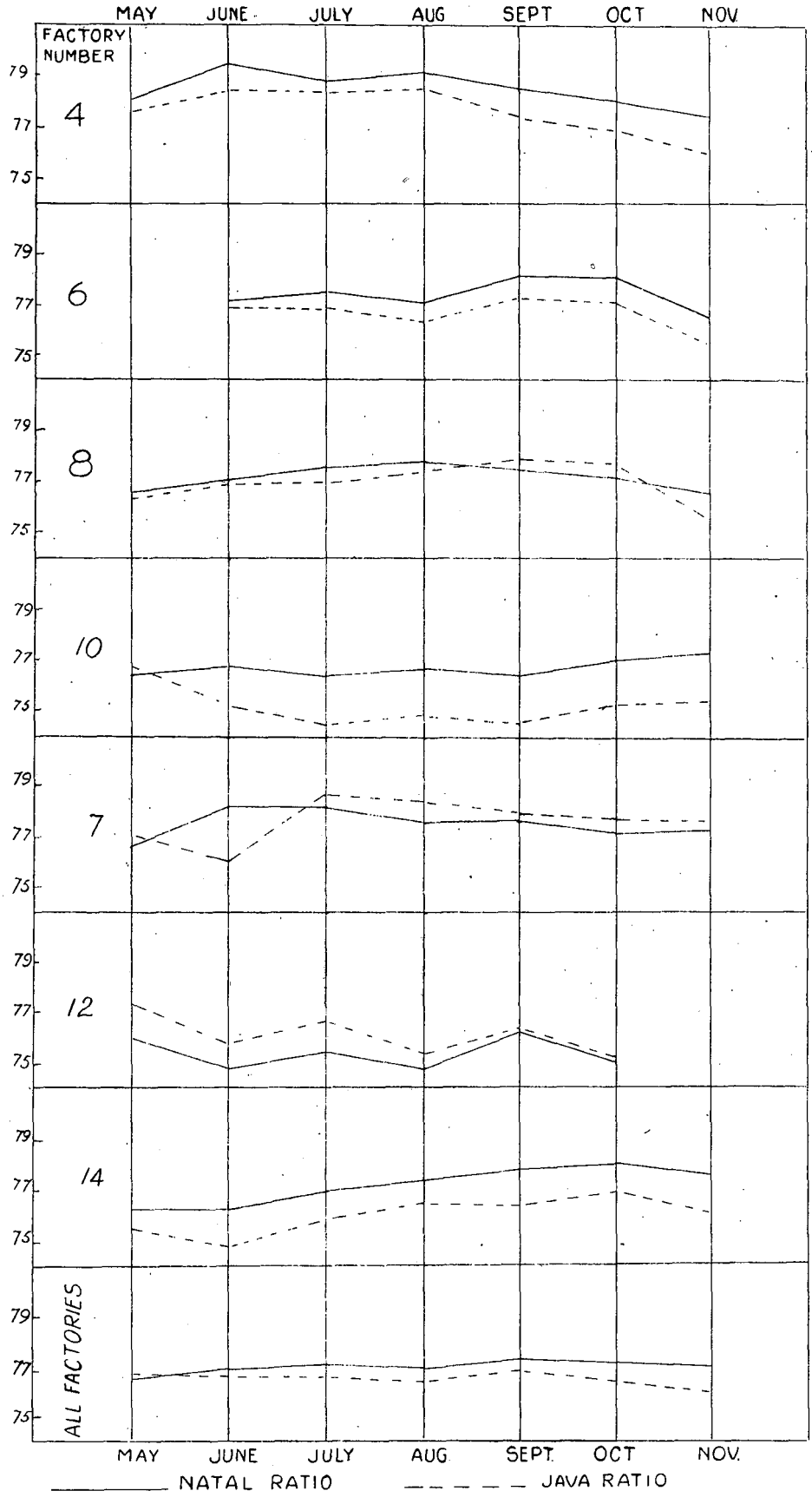
Combined Results at Empangeni, Felixton, Amatikulu and Darnall.

	First Crusher Juice.			L.P.M. Juice. Brix.	Natal Sucrose.	Java Ratio.	Natal Ratio.	Sugar % Cane	
	Brix.	Sucrose.	Purity.					by Java Ratio.	by Natal Ratio.
Before	21.10	18.74	88.81	20.75	18.43	75.88	76.77	14.22	14.15
During..	20.62	18.22	88.36	20.64	18.24	77.18	77.30	14.06	14.10
After	20.78	18.44	88.74	20.60	18.28	76.62	76.99	14.13	14.07

From the above it is apparent that with the use of the Natal Ratio there is a smaller decrease in the sucrose % cane than when using the Java Ratio, the decreases being 0.35% and 1.05% respectively. However, when we observe the figures for the days following rain, we notice that with the Java Ratio the percentages rise again, but continue to fall with the Natal Ratio, due evidently to the fact that the water had been absorbed by the cane and caused a greater dilution in the L.P.M. juice than in the first crusher juice, due to the greater pressures of the L.P.M. crushing. Another point is the drop in purity during rain followed by a subsequent partial recovery. This bears out the results of tests made during the 1927 season, and causes a direct loss to planters from causes entirely outside their control.

For the various reasons given the figures quoted are not conclusive. While the use of the Natal Ratio appears to have been fairly satisfactory, it must be admitted that it has not had a fair trial owing to the very dry conditions last year, and I would recommend that it should be continued for another year, when its further continuance can again be discussed, unless it is then possible to supersede it by a ratio based on the fibre % cane.

A diagram showing a comparison between the Natal Ratio and Java Ratio for each month of last year is appended.



COMPARISON OF NATAL RATIOS AND JAVA RATIOS AT CERTAIN FACTORIES
1928

Chairman: This is an excellent paper on the Natal Ratio. It is very good to have the information which is so well set out here and it will be still more interesting to have further results at a later stage when there has been opportunity of tests under more varying conditions.

Mr. Bechard: I have noticed that right through the season when we are dealing with impure juice in cane we found the Brix from the second crusher is always very much higher than usual. In the Factory where I was, the Brix of the second was generally somewhat higher than the first, but when we were dealing with impure cane juice the difference was remarkable, 3 to 4 per cent., and this was always the case when we were dealing with impure cane.

Chairman: You mean with cane of low purity due to drought, I suppose?

Mr. Bechard: Yes.

Mr. Dymond: I can confirm that. We noticed that cane suffering from red rot showed a higher Brix. I put it down to the fact that with the red rot it was more easily broken up.

Mr. Bechard: Another explanation is that the cane being dried perhaps the hardened cells part with greater difficulty with the Brix. The same thing happened with our cane with red rot, we had the same higher Brix in the second crusher. I don't think it applies everywhere though.

Mr. Moberly: I think these things that have been mentioned just now open up rather a large scope of investigation. We don't know very clearly what happens inside the cane when it is crushed and we ought to try and find out something about what happens on the crushing of the cane, that is to say what cells are affected first, how the pith cells and the rind are affected, and what takes place. We know on subsequent crushings we get different compositions of juices. I think that there is a very wide scope for investigation in this matter.

Mr. Rault: I wish to second very heartily what Mr. Moberly has said. There might be another technical problem which will be illuminated by the study of this question. We find that in Java hot maceration water has been tried with great success, which is contrary to the opinion in any of the textbooks a few years ago; but it is admitted that a few years ago when this opinion was given there was not enough study or the methods of studying the various cells was not adequate, and the theory of those days has more or less been modified because it has been found that certain cells do not respond to cold water. Such study under our conditions where we have such a large quantity of fibre would throw a lot of light on the efficiency of maceration in mills generally with the idea of improving our methods of juice extraction.

Chairman: Arising out of what Mr. Rault has said, it was stated at the Conference last year that all the factories with the exception of the carbonatation process factory used cold water for maceration. Some had tried hot water for maceration but had gone back to cold. Is that still the case?

Mr. Jacobs: We are still using cold water.