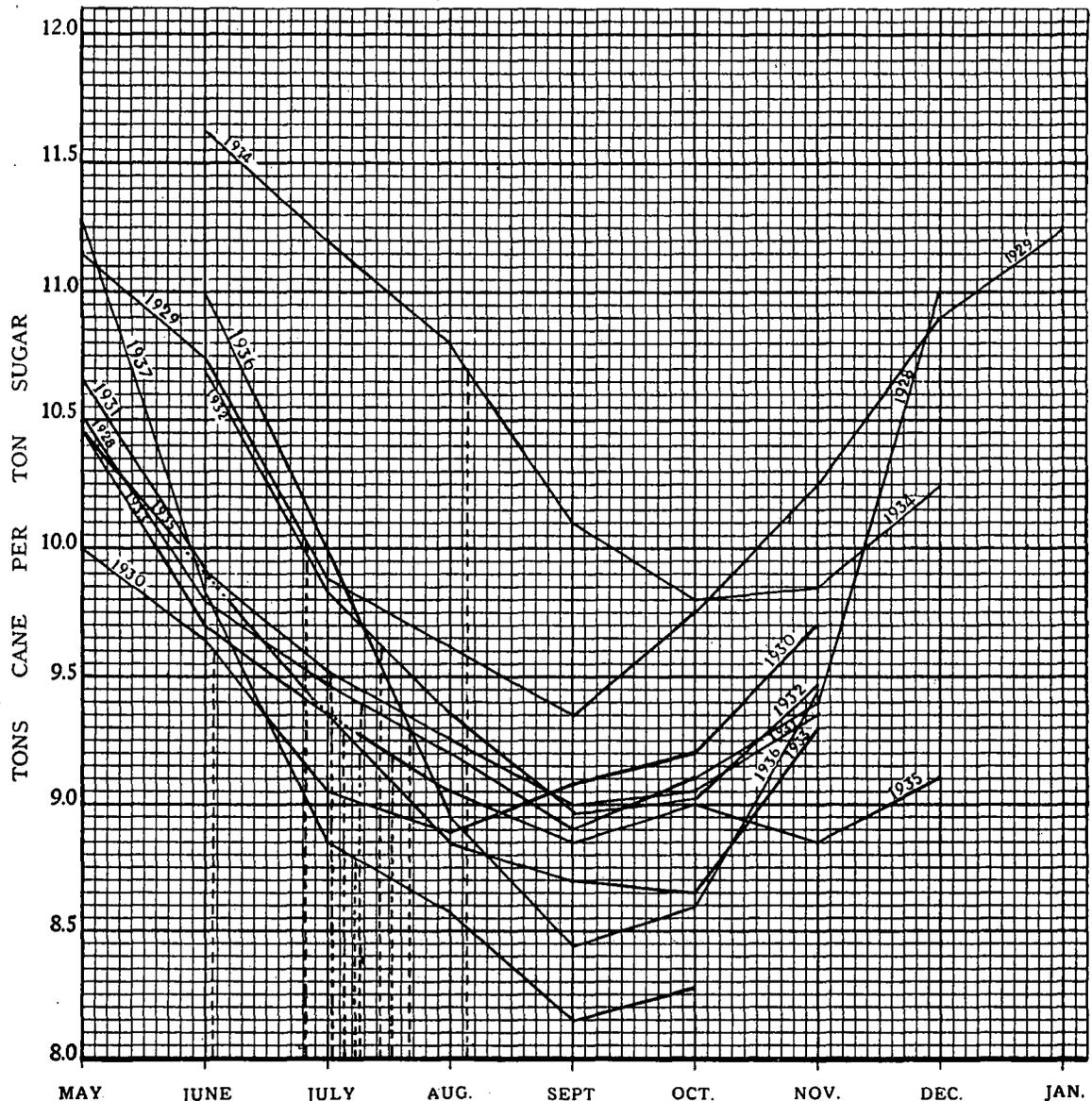# CONVERSION RATIOS

(Tons cane per ton Sugar).

## C. L. WATERS.

The object of the following study is to indicate a method by which the Conversion Ratio (Tons cane per ton sugar) for the whole season can be estimated early in the season, so as to enable estimates to be made of the tonnage of cane to be cut to yield a given output of sugar for the use of Mill Group Boards, and for other purposes.

In compiling this graph and the accompanying data, the intention has been to bring to the fore a little more forcibly the usefulness of this sort of information, which could be expanded in many directions in the future. We are all familiar with the ratio (tons cane per ton sugar), but have not always considered how it may be used to the best advantage.

The graph represents the monthly conversion ratios for 10 years (1928-1937). A table of rainfall for the same period is also given.



| Year | RAINFALL. Jan.—May | June—Dec. | Total | Year | Final Conversion Ratio | Month Obtained |
|---|---|---|---|---|---|---|
| 1928 | 17.14 | 13.66 | 30.80 | | | |
| 1929 | 23.03 | 25.11 | 48.14 | 1928 | 9.39 | August |
| 1930 | 16.06 | 23.09 | 39.15 | 1929 | 10.06 | July |
| 1931 | 13.37 | 15.20 | 28.57 | 1930 | 9.59 | July |
| 1932 | 35.99 | 16.33 | 52.32 | 1931 | 9.53 | August |
| 1933 | 12.81 | 19.18 | 31.99 | 1932 | 9.61 | August |
| 1934 | 25.30 | 20.58 | 45.88 | 1933 | 9.29 | August |
| 1935 | 20.74 | 24.75 | 45.49 | 1934 | 10.67 | September |
| 1936 | 30.14 | 21.66 | 51.80 | 1935 | 9.19 | August |
| 1937 | 17.16 | 22.74 | 39.90 | 1936 | 9.26 | August |
| | | | | 1937 | 8.79 | August |

The middle of May has been taken as the starting point of the curves, that month representing two working weeks. The vertical lines indicate the point on the graph where the conversion ratio during the earlier part of the season was the same as for the whole season. It will be noticed that eight of the ten cases occur within well defined limits, namely, between the ninth and eleventh weeks. There are two exceptions, namely 1930 and 1934.

Referring to the table of rainfall it will be observed that in 1930 the rainfall for the months February to May was 7.90 inches, which was the lowest ever recorded since 1924. This must have had a marked effect on the growth of the cane, causing an early sucrose peak to be realised, thus causing the season's conversion ratio to be reached a month earlier i.e. the 6th week.

In 1934 the rainfall in April and May was higher than for any other year except 1932. This promoted a vigorous growth of cane, thus delaying ripening. At the same time the destructive effects of repeated attacks by locusts had the effect of delaying the sucrose peak. As a result the season's conversion ratio was reached much later than would normally have been the case. Actually this did not occur until the 15th week.

It is impossible to give an actual date or period when the conversion ratio for the whole crop is first reached at any given factory, but an approximate figure may be found by averaging the ratios for the 9th, 10th and 11th weeks, and then averaging this figure with the ratio for the week ending nearest to the 1st August. This result resembles the average conversion ratio for the whole season, as accurately as it can be foretold for a normal season.

The periods taken may vary slightly at individual factories, the weeks chosen being perhaps one week earlier or one week later than those given.

The calculations are far too numerous to be published, but may be briefly summarised as follows:—
9.22 represents the mean of the actual final conversion ratios. 9.20 represents the mean of the averages of the 9th, 10th and 11th weeks, averaged with the week-ending nearest the 1st August.

For three factories over 9 years, representing 35.05% of all cane crushed, the average difference between the means of the actual and the calculated conversion ratios for the 25 examples considered is only 0.02.

The standard variation is $\pm 0.22$. This means that in nineteen cases out of twenty the error in the calculated ratio will probably be less than $\pm 0.44$, and in ninety-nine cases out of a hundred it will probably be less than 0.66.

On a crop of 30,000 tons of sugar with a conversion ratio of 9.0 (= 270,000 tons of cane) an error of $\pm 0.44$ in the ratio is equivalent to 13,200 tons of cane which is the extreme error likely to be met with in one out of twenty cases. This is equivalent to 4.9% of the total weight of cane or 245 tons of cane in the case of a grower with a quota of 5,000 tons. This may not at first sight appear to be very satisfactory, but it must be remembered that in most cases the error will be much less, and in any case the result is likely to be very much more accurate than that at present attained by guesswork, or by merely taking the figure of the previous year.

It would moreover be an easy matter for the factories to collate such information for the benefit of the Industry as a whole.

Before concluding this paper a few tentative suggestions regarding obtaining the conversion ratio in exceptional or abnormal years might be useful.

A brief study of the period which elapses between the conversion ratio when it was first obtained and the peak period (approximately 7 weeks) would be of benefit. If this amount of time was deducted from the peak in an abnormal year, the approximate conversion ratio could be obtained. This method has one drawback, namely in having to wait for the peak period. Secondly a study of rainfall statistics would give one an idea as to the trend the sucrose content is liable to take, and by applying a ratio for a like period, one could approximate to the conversion ratio within reasonable limits.

## Summary.

To assist in estimating the quantity of cane necessary to produce a given output of sugar, a method is described for forecasting fairly early in the season what the average ratio of cane to sugar for that season is likely to be.

Amatikulu.

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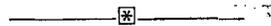
The PRESIDENT: Thanked Mr. Moberly for reading the paper in the absence of Mr. Waters and in declaring it open for discussion said that it raised a question which many of us had from time to time to assume.

Mr. SCHWIKKARD: Pointed out the value of the paper, particularly in relation to the work of the Mill Group Boards. In the past owing to the difficulty of arriving at an estimate of the conversion ratio there had resulted frequent amendments of planters' quotas, which had very seriously hampered their work.

Mr. BIJOUX: Wanted to know whether the conversion ratio would not be adversely affected by rainfall and by milling efficiency.

Mr. BECHARD: Said he had helped Mr. Waters to produce this paper as he believed it would overcome the difficulty of forecasting the ratio of cane to sugar early in the season. Mr. Waters' figures were based on practical findings, and though owing to the change over to new varieties and other changing conditions the formula might not strictly apply, it was nevertheless of value in that it would lead the way to further development in a different direction.

Mr. MOBERLY: Referring to Mr. Bijoux's question said that the conversion ratio was affected by milling efficiency, but it was not nearly as large a variable as sucrose per cent cane. With a certain degree of measureableness you could assume that the overall recovery, whether great or small, would follow something like the normal seasonal curve, but you could not predict that in the case of sucrose per cent. Mr. Bechard had said that with the change of varieties the estimation of conversion ratio would be upset. With regard to the new varieties of cane of you had worked out the method of prediction of the conversion ratio from the results of ten years of Uba and then come to a condition where you started off with Uba and finished up the season with 60% non-Uba, if there was a difference in overall recovery between these varieties, the estimate would be disturbed. However, the proportionate change in overall recovery (say 76 to 80) being less that in the case of sucrose (say 11 to 14) the main thing to watch would naturally be the sucrose per cent cane. Thus the chief factor determining the conversion ratio was sucrose per cent cane and the chief upsetting factor as far as it was concerned was rainfall over a particular period.

Mr. BECHARD: Referred to a paper by Mr. Beater in 1936 in which the writer showed the correlation between sunshine and sucrose. Mr. Bechard suggested that in future we might be able to arrive at a time when it would be possible to forecast the actual ratio very accurately.

Mr. BIJOUX: Said he had tried to work out a formula but failed owing to lack of the necessary apparatus.

The PRESIDENT: Concluded by thanking Mr. Moberly (in Mr. Waters' absence) for bringing this subject up to the Congress.