

FIBRE PER CENT. CANE AND EXTRACTION

By G. C. DYMOND.

A survey of the fibre content of the cane over the past eighteen years at Sir J. L. Hulett & Sons' three factories reveals certain remarkable facts. As will be seen from the following graph, the fibre per cent. cane at Darnall, Amatikulu and Felixton followed an erratic but progressive drop, throughout the period 1928 to 1938. During the following seven years there has been an equally progressive rise! See Graph 1.

The extent to which these two opposite trends can be related to the incidence of non-Uba canes as a group, is shown by picking out the maximum and minimum fibre percentages over the whole period under review.

Fibre per cent. Cane.

	1928.	1929.	1934.	1936.	1938.	1945.
Darnall—						
Fibre per cent. ...	16.48	15.95	15.00	14.61	14.39	16.04
Non-Uba per cent.	Nil	Nil	Nil	36	71	98
Amatikulu—						
Fibre per cent. ...	15.63	15.82	13.25	15.13	14.44	17.13
Non-Uba per cent.	Nil	Nil	Nil	39	72	98
Felixton—						
Fibre per cent. ...	17.03	14.22	14.08	14.16	13.76	16.12
Non-Uba per cent.	Nil	Nil	Nil	53	86	99

From these figures it is apparent that there are other factors than variety canes (as a group) which influence the seasonal percentage of fibre in cane. Such factors, I suggest, may be: age of the cane, rainfall, physical condition, regional characteristics of soil, etc.

The following graph illustrates such local conditions at four representative mills over the past thirty years. See Graph 2.

A simple average of these figures shows that over a long period of years the variation is very small, despite the introduction of initially low-fibred varieties.

Thus the simple averages of the four mills show the following:—

FIBRE PER CENT. CANE.

	Tongaat.	Z.S.M. & P.	Natal Estates.	Illovo.
1915-1930 inclusive	14.96	15.27	15.28	16.62
1931-1945 inclusive	15.08	15.30	15.43	15.22
Period average, 1915-1930 inclusive,	15.53 per cent.			
1931-1945 inclusive,	15.26 per cent.			

The difference is therefore only 0.27 per cent. (The inclusion of the year 1930 in both periods makes no significant difference to the result, the difference then becomes 0.25 per cent).

During the past eight years new varieties of cane have progressively supplanted Uba.

The fibre per cent. cane for this period, despite big fluctuations, averages out to 15.30 per cent., so that over long periods of time the average fibre content of the cane in Natal remains fairly constant despite seasonal variations.

Extraction.

What effect have these extreme fluctuations in fibre had on the extraction? The following graph shows how the extraction has fluctuated over the past eighteen years at Hulett's mills. Progressive improvement at Darnall is known to be due to increased imbibition, better steaming conditions, etc.; that at Amatikulu to capital improvements in plant; and that at Felixton to improvements generally. How has the seasonal fibre percentage affected these results? See Graph 3.

Picking out the extremes from 1928 to 1945, we find the following:—

	1928.		1938.		1945.	
	Fibre per cent. cane.	Extraction.	Fibre per cent. cane.	Extraction.	Fibre per cent. cane.	Extraction.
Darnall ...	16.48	90.10	14.39	90.04	16.04	91.36
Amatikulu ...	15.63	89.09	14.44	93.15	17.13	93.11
Felixton ...	17.03	90.98	13.76	93.46	16.12	93.53

At Darnall between 1928 and 1938 the fibre dropped 2.09 per cent. but the extraction remained the same. During the second period, 1938 to 1945, the fibre increased by 1.65 per cent., but the extraction rose 1.32 per cent. These latter figures can be explained by the facts that imbibition rose from 26 per cent. to 40 per cent. and steaming conditions were improved.

At Amatikulu and Felixton, the improvements in extraction from 1928 to 1938 are known to be due to capital and general improvements, and not to the respective drops of 1.19 per cent. and 3.29 per cent. in the fibre content.

This is well exposed in studying the results of the second periods 1938 to 1945.

During this period no important changes were made, yet at Amatikulu the fibre per cent. cane rose from 14.44 per cent. to 17.13 per cent., and the extraction was not affected at all.

At Felixton, over the same period, the fibre per cent. cane rose from 13.76 per cent. to 16.12 per cent.; the extraction again remained practically the same. There are no obvious factors to account for these remarkable results.

Obviously, the old hypothesis that a unit of fibre takes away equal quantities of sucrose under the same milling conditions has no foundation when comparing individual seasons. Within the season a relationship between fibre and extraction did exist prior to 1938, and a certain relationship might be said to exist in recent years, but this does not account for the fact that variations of over 3 per cent. fibre have not affected the extraction from season to season. See Graph 4.

The Quality of Fibre.

From general milling observations the fibre qualities of various canes vary considerably. Thus Co.290 is generally known as the worst milling cane, and Co.281 the best. It is possible that the practical elimination of the former, and the considerable increase in the latter, has had some bearing on the results surveyed above. Thus Uba and Co.290 have diminished from 28 per cent. and 36 per cent. to 3 per cent. respectively during the past eight years at Darnall. Co.281, on the other hand, has increased from 28.5 per cent. to 72.8 per cent. Similar conditions have existed at the other two mills.

Conclusions.

Under the same milling conditions existing during the past eight years, considerable seasonal variations in the fibre per cent. cane have had no practical effect on the average crop extractions. Within the seasons a certain relationship exists, more especially in the early years.

It is possible that the increase in the quantity of Co.281 with its millable qualities, and the diminution of bad milling types such as Co.290, have contributed to these results.

Seasonal fluctuations in fibre are most likely caused by age of the cane, rainfall, physical conditions and regional characteristics of soil, etc.

To-day, fibre per cent. cane, as such, appears to have little influence, if any, on the sucrose extracted per cent. sucrose in cane from season to season.

THE PRESIDENT found these results rather puzzling, but it was often found in life that what was accepted as easy and simple might prove far more complicated. He felt, however, a relationship between fibre and extraction probably did exist and it was shewn that a correlation did exist between them within a season. It was evident that between seasons other influences overlaid this probably fundamental relationship to such an extent that the correlation was obscured. What these overlying causes were was difficult to say. The introduction of new varieties led to a period when very mixed varieties were crushed and that made it even more difficult to determine the effect, if any, of fibre on extraction. Now, however,

since Co.281 had almost completely taken the place of all other varieties, it might be easier again to study the effect of fibre. It appeared, however, that correlation in recent years between fibre and extraction within the season was less than it used to be in days of Uba cane, and it was more difficult than ever to prove anything between seasons.

Mr. DU TOIT said that this paper proved that there were factors other than fibre that affected extraction. These were facts which nobody would deny, but to his mind the paper certainly did not prove that fibre as such had no effect on extraction. Figures were given shewing that the extraction went up at certain factories with a fall of fibre per cent. cane, but on the other hand these factories maintained their extractions or even increased it when the fibre increased very markedly in a later period. That in itself, of course, constituted no proof of the independence of extraction on fibre. He maintained that improvements in plant or management might have taken place and imbibition was probably increased, more imbibition being applied with higher fibred cane. The engineers who were able to maintain the extraction with increased fibre contents should get credit for their valuable work, rather than to deny that fibre played a part in extraction. There was another point—unit values of fibre of different varieties might have a different effect on extraction. This was a point which Mr. Dymond had raised a few years ago when he shewed that Co.281 gave an appreciably better extraction than Uba or Co.290 of the same fibre content. Now Co.281 had progressively increased in the last ten years and Uba and Co.290 had decreased greatly. If then fibre as such played no part, then extraction should simply have increased as a result of the substitution of Co.281 for Uba and Co.290. This increase was not shewn in the figures given by Mr. Dymond and it seemed logical to conclude that the better extraction that was to be expected from Co.281 cane was partly set off by the unfortunate rise in fibre content.

Mr. RAULT also found the effect of fibre on extraction rather puzzling. It was often necessary to put aside the old ideas of mathematical relationship between fibre and extraction based on the hypothesis that every part of fibre carried away exactly the same quantity of sugar. It was often found that when fibre and sucrose were both high the extraction was at its optimum. It appeared as if there might be a better correlation between extraction and sucrose per cent. cane rather than between extraction and fibre by itself. For years now they had suffered at the mills because cane was delivered with so much trash and other extraneous matter adhering to it. Towards the end of last season a determined attempt was made to get cleaner cane. The field workers co-operated and for five weeks cane in a

much better condition was delivered at the mill. The fibre immediately fell by one per cent. and the extraction increased by more than half a per cent., while the capacity of the mill also increased. Individual mill performance tests indicated that the improved extraction was as much a result of the nature of the fibre as the total quantity of fibre. He attributed the improvements in results largely to the elimination of extraneous matter. A further result was a general improvement in the boiling house part of the factory. It was difficult to explain this unless impurities were introduced in the trash as soluble dirt. The experiment was so successful that in future they would insist on clean cane, notwithstanding the lowering of the basic cane cutting task.

It had also been found that some of their best crushing rates corresponded with periods of high fibres, so that high fibre content by itself was not always an impediment to crushing rate per hour. As a result of the drought conditions last year and the dying canes, as well as crushing mixed varieties, their crushing rates between consecutive shifts of 8 hours fluctuated widely from, for example, 150 tons to 135 tons per hour. It was therefore impossible to adjust conditions to suit one particular variety of cane.

Mr. FELTHAM agreed with Mr. Rault that fibre by itself could be misleading especially if you did not have the whole picture. In Mr. Dymond's paper, fibre and extraction were given but not the imbibition and rate of crushing per hour, and these items could affect the extraction and thereby influence the effect of fibre on extraction.

Mr. BUCHANAN said that with an ideal mill in which all stresses and strains, and all pressures and resistances to pressures were fixed, it would probably be found that there was a relationship between fibre and extraction, but in actual practice the milling frame was most elastic and if the engineer and those connected with the milling train paid particular at-

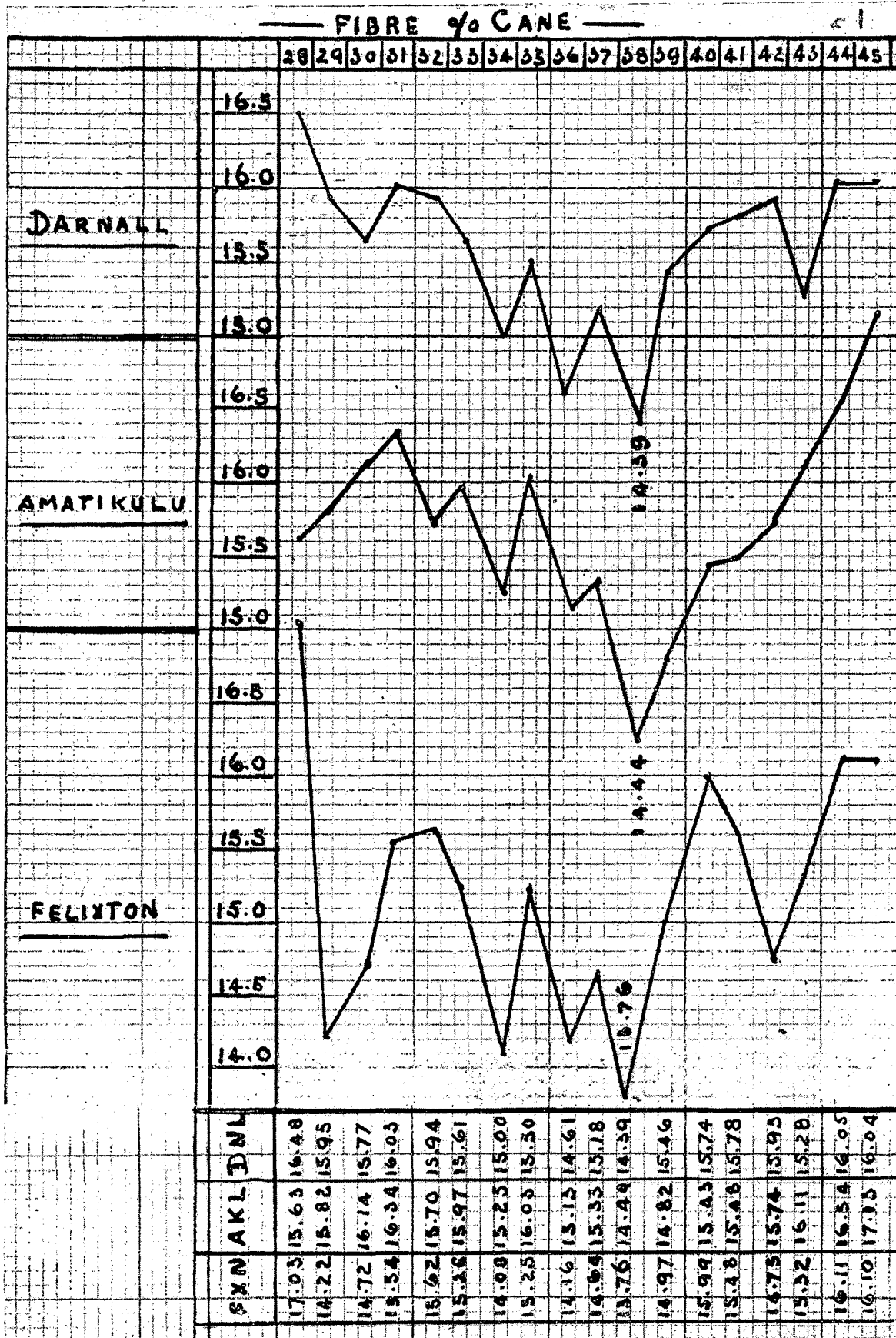
tention to the mill settings, etc., then within the limits of fibre per cent. cane which was likely to be met with in a day's or week's crushing, the effect of fibre would be overcome.

Mr. DYMOND, in reply to a question, said that he had pointed out in his paper that there was a relationship between fibre and extraction within seasons, but not from season to season. One outstanding point, however, was the fact that in the years when we had 100 per cent. Uba the effect of fibre per cent. cane on extraction within seasons was far more regular than was the case now, although there still seemed to be some sort of relationship.

He agreed with most speakers that there were other factors influencing extraction, but he contended that the effect of imbibition and the relatively small changes in milling practice could not obscure the effect, if real, of such a large variation of fibre per cent. cane amounting to three per cent. in the figures he used. He therefore concluded that whereas quantity of fibre was thought to affect extraction in the past we should rather concentrate on the quality of fibre in future. We in this country became aware of the latter factor as a result of the introduction of new varieties. We know to-day that Co.281 with its long fibres was easy to mill, but that Co.290 was difficult because of the shortness of its fibres, which did not grip in the mills and consequently gave a poor extraction.

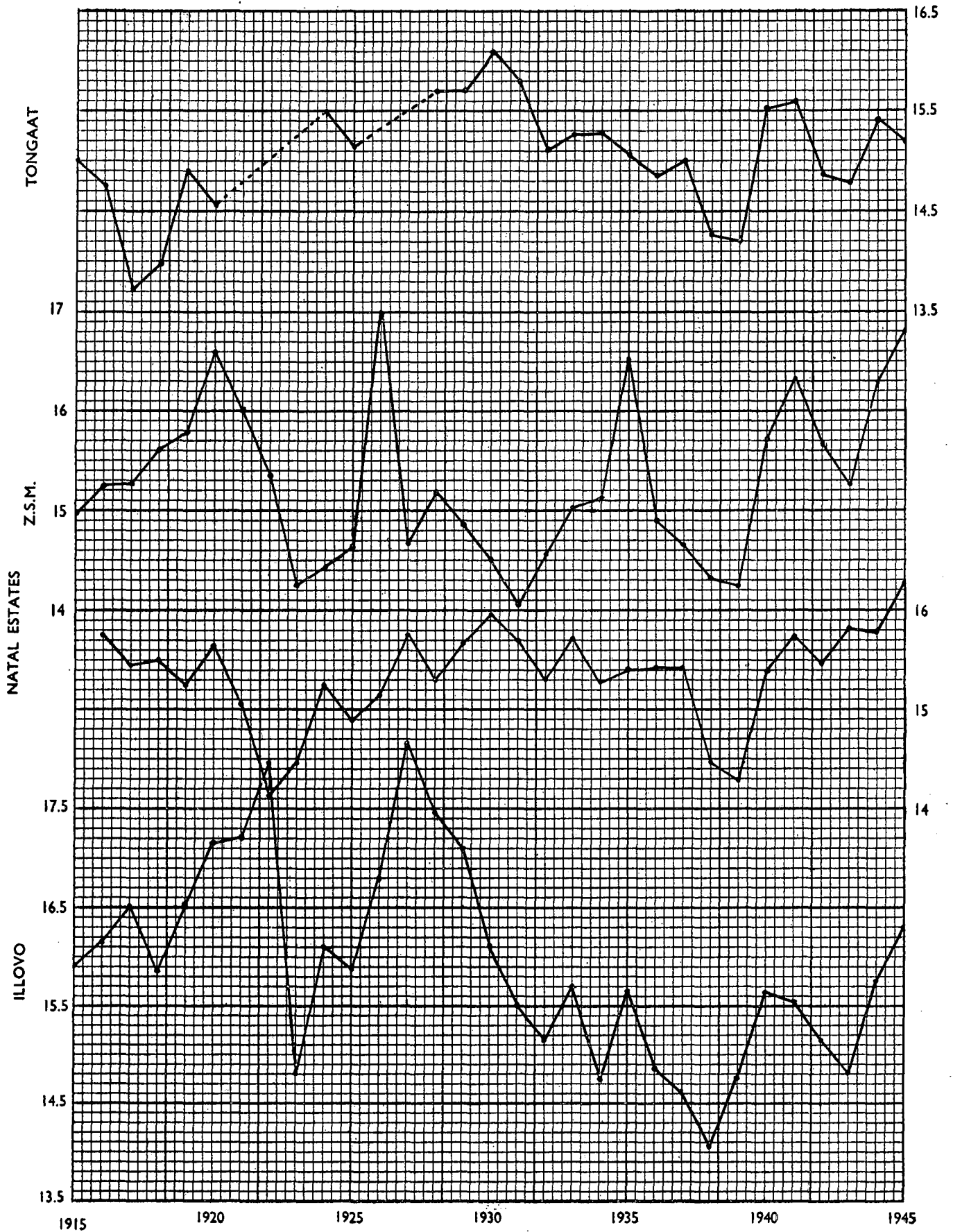
In reply to Mr. Dick, Mr. Dymond said that it was true that the hourly throughput of cane had increased far more at Darnall than at the other mills. These were admittedly complicating factors, but their effect could be ignored compared to the theoretically expected influence of fibre.

Mr. Dymond recommended to the Chemical Control Committee that consideration be given to reporting imbibition per cent. fibre rather than the present imbibition per cent. cane as he thought the first was the more correct and relevant figure.

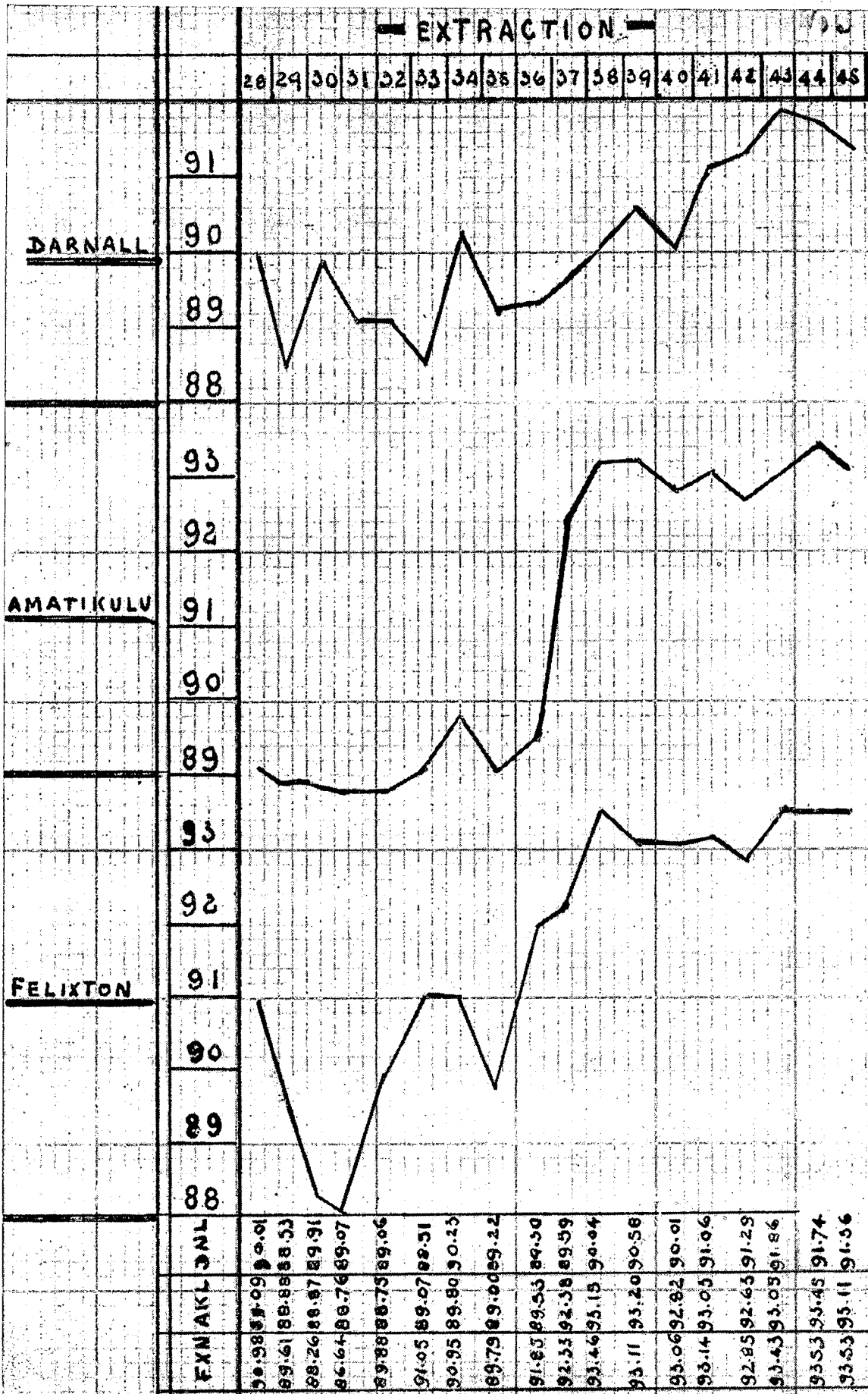


Graph 1.

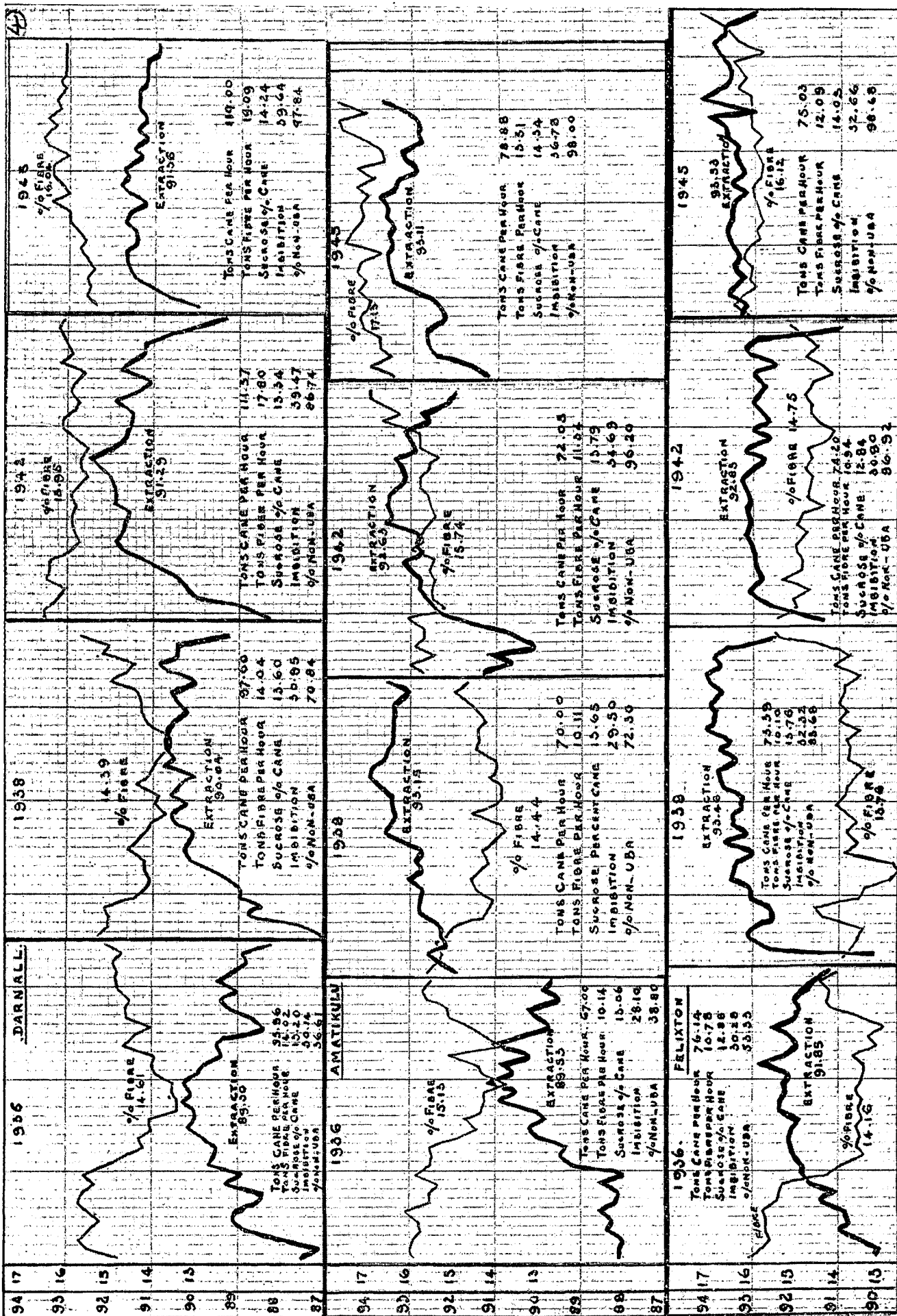
FIBRE PER CENT. CANE FOR TONGAAT, Z.S.M., NATAL ESTATES AND ILLOVO FROM 1915 TO 1945.



Graph 2.



Graph 3.



Graph 4.