

Mr. Warner, having been asked to explain the "grading plank" mentioned by him, stated that it was very important to the ordinary farmer. Twenty years ago he was asked to go over a sugar estate and reorganise their tramway system. The manager had asked him if he could not give them something which could be used easily by his Indians so that they would not be continually calling him to lay out the branch lines, and he had done so. It was simply a plank a little over 10 ft. long, with one fixed leg about 3 ft. 6 ins. long, and a movable leg at the other end that enabled you to slide the plank up and down. On the movable side you have the plank scaled off into inches. Ten feet is 120 inches, so that if you slide the length of the leg at one end one inch and then put a level on the top of your

plank, you are running either up or down a grade of 1 in 120. If you alter it two inches it is 1/60, and 3 inches 1/40. So all you have to do is to fix the position for your starting point, set the plank and let the gang go ahead.

With regard to the two-ton truck a great point is the derailment on the field lines, which debars the four-ton truck. As to sleepers, he quite agreed that the whole point is to cover the steel sleepers. There is nothing to beat a steel sleeper. You should also be careful to look after your side drainage; if you allow water to collect in between the lines you are going to have deterioration. If the sleepers are well tarred and covered you will find they are the most economical.

Sucrose Losses of the Uba Cane.

(Paper by Mr. L. E. ROUILLARD, La Mercy.)

From the report of the technical sub-committee appointed to consider and report upon certain recommendations of the Sugar Inquiry Commission, it appears that according to the returns sent by 12 colonial factories for a period of seven years for ten mills, three years for one mill and two years for one mill, the average sucrose recovered on a sucrose content of 12.98 per cent. was 8.67 per cent., and sucrose lost 4.31.

I thought it might be interesting to some of you to obtain a little more light on this perfectly true but somewhat distressing statement, especially so when the recent Java figures give a loss of 2.44 on a sucrose content of 12.6.

The Mauritius figures calculated on the same sucrose content are, I believe, more or less the same.

The only possible explanation for the striking difference between the above results must, of course, be that the raw material is not the same. It seems without doubt unfair to compare the results obtained from two very different varieties of cane, just as it would be unfair for a planter to boast of his crop growing on a rich loam and compare his results with those of his neighbour cultivating on shaly land.

Inefficient returns would be due to rock in one case, as an excess of fibre is the cause of the other. All the factories I have visited in this country are just as good, and many better, than the average sugar factory I have seen in Mauritius, which is the only other cane country I have been to, and I maintain that given the same material the results in both countries would very likely be the same.

I cannot, therefore, call the factories inefficient. That they are not wholly fitted to deal with the Uba is possible, but this is another matter.

The factories were built on the supposition that Natal was a cane country; it turned out to be entirely a Uba country, and unfortunately the Uba does not yield its sucrose except under the strongest compulsion, which cannot be applied in a day.

Before going into the question of manufacture, it is of course essential to give some attention to the cane and to follow the struggle it has to go through before finally reaching the rollers. Seldom well treated, it must indeed possess a wonderful vitality to come out victorious, under sometimes the most atrocious climatic conditions imaginable, and in spite of all to contain on an average of many years 13 per cent. sucrose.

Considering the length of the cutting season, eight months or more, the deterioration through burning too large patches at once, the delay in transport, the damage due to droughts, the fact that the cane is never properly topped, and the trash and dirt adhering to it, I have no hesitation in saying that the Uba will hold its own against most of the other varieties on the point of sucrose content.

According to Geerligs, the percentage of sucrose in cane varies from between 11 to 16. It is known that under good conditions the Uba will sometimes contain the highest limit mentioned.

Sucrose Losses of the Uba Cane.

It goes without saying that certain varieties of cane are very poor, others are naturally rich, and selection plays a great part in the improvement of species.

All the same, my experience leads me to believe that the sucrose content is mainly governed by soil and climatic conditions. Leaving out the natural difference which exists between flats cane and hill cane, a poor or rich sucrose content depends entirely on the reserve of water in the ground to carry us through the dry winter months. You all know as well as I do that it is impossible to rely on the rainfall at any time of the year. Besides our dry winter or dry spring or summer may at any time completely set aside our best expectations.

In my opinion, the most favourable conditions from the factory point of view are a fairly wet season and a moderately dry winter for the complete maturity of the cane. A shower in mid-winter may have an influence on the crop beyond the belief of anyone not directly connected with the industry. It is said by Noel Deerr, in his new edition of "Cane Sugar," that "The Uba is characterised by a very high percentage of reducing sugars." This statement is certainly not correct, and is very likely based on the report of a visitor in Natal during a very dry winter.

I have seen on one occasion (it was in 1913), cane so bad in the month of June that I considered it advisable to cut and leave a whole field on the ground.

After a very heavy rainfall in March, we had practically no rain for three months, and the cane completely withered and contained almost nothing but glucose. The other fields were bad, but of course not to the same extent. From the mill figures which I noted, the average purity of mixed juice for the month was 74.58, and on one particular day the average purity was 59.22, and glucose ratio 28.20.

To deduce from these figures that the Uba contains mainly glucose would certainly not be right. On the contrary, in a normal year the glucose ratio is extremely low on the North Coast, but generally higher on the South Coast on account again of different climatic conditions.

Speaking generally, our dry winter is extremely favourable up to a certain limit, beyond which the loss in sucrose through deterioration of the cane is considerable, but the Uba somehow gives us a moderate crop when other varieties would hopelessly fail.

Having considered the sucrose losses, which must always remain beyond our control, I will now pass on to those which are more or less known.

As nature is never at rest, it must be taken for granted that from the time the cane is dead, whether it is burnt or cut, disintegration sets in, and the first

substance to be affected is sucrose. The loss at first is naturally slight, and may even escape detection, but the total losses before crushing must sometimes be very high.

It is natural therefore to find a higher sucrose content and better returns from the factories organised to cut, transport, and crush their cane in the quickest possible time.

The chemical report starts from the moment cane are weighed, and any loss through delay in crushing after this is not accounted for as losses, but reduces the sucrose content of the cane.

The sucrose content is also affected by trash or dirt of any kind adhering to the cane.

Cane with 5 per cent. foreign substance, and supposed to contain 13 per cent. sucrose, would in reality contain 13.65 per cent. under clean normal conditions. Anyhow, the sucrose content depends on the weight registered at the weighbridge. The losses from this point are included in the returns, and occur anywhere and everywhere, whether they are detected or not, i.e., whether known or unknown.

Losses in Factory.

The main losses are in the megass, the filter presses and the so-called exhausted molasses, which are very often only exhausted by name. I specially mention these losses, because they are greater with the Uba cane than with the other varieties, and are the only losses which may to a large extent depend on the nature of the cane in two identical factories.

All the other losses, such as fermentation continually at work in gutters and pipes, losses by inversion which are very often the penalty of white sugar manufacture, losses by entrainment, evaporation, a partly cooked strike, which is not exceptional, and mechanical losses generally, cannot be attributed to a special variety of cane.

Some of them are unavoidable, but when in excess the usual thing is to put the blame on inferior machinery.

Mills.

It cannot be denied that the tonnage of cane crushed per hour, independent of the settings of the mills, is governed by the proportion of dry substance or fibre. A high fibre content, by increasing the output, increases the cost of production. It is also evident that a greater percentage of megass not properly crushed will entail a heavier loss of sucrose. Besides, a hard, fibrous cane will necessarily wear out the rollers quicker and tend to increase the losses.

It takes a crusher, shredder and four sets of mills to reach the average extraction of 29 Mauritius factories, 12 years ago, with very ordinary crushing plants of rarely more than three sets of rollers.

Sucrose Losses of the Uba Cane.**Of the Total Losses.**

Half of the difference from the Java figures quoted must be attributed to the crushing alone. According to Browne, the average composition of cane fibre is as follows:—

Ash	2.30
Fat and Wax	0.71
Cellulose	50.00
Gums or Pentosans	29.22
Lignin	15.72
Protein	2.05

Besides the above substances, pectin is found in the juice to the extent of .2 per cent., and more in unripe cane. Considering that the general average of fibre, for Hawaii, Cuba and Mauritius is 11.87, and if we take the Uba at only 16 per cent., the increase is nearly 35 per cent., and the impurities in the juice must increase in the same proportion.

Whether it is due to an excess of the same impurities, or as some people believe to a special substance peculiar to the Uba, the fact remains that the ordinary methods of treatment of juice adopted elsewhere for other varieties have failed up to now to give the same recovery here.

Whatever the amount of time used in tempering maybe the juice never settles so well, and the proportion of scums is always considerable. A large filtering area is necessary to deal with the scums, and the difficulties experienced in filtering are well known.

It is generally believed that wax is the main cause of this trouble, although in practice old ratoons which are generally covered with wax give a juice which filters more or less readily, whilst the juice from cane cut after the spring, with a new growth on, is sometimes impossible to filter.

Pectin and other gums seem to be more responsible for this most worrying state of things.

With bad filtration, leakages, and in any case a large proportion of slimy cakes, the losses in scums are naturally high.

It may happen that through over-liming hot scums to help filtration, which should as far as possible be avoided, the formations of organic lime salts will interfere with proper crystallisation in the pans, but as this will be reflected in the final molasses, I will now examine this important question.

Molasses.

In order to explain the formation of the inevitable bye-product known as exhausted molasses in the manufacture of sugar, it is necessary to describe briefly the composition of cane juice. The juice is not a simple solution of sucrose, but a very complex liquid consisting of sucrose, glucose, albuminoids, gums, salts, and so on. Sucrose is known as a crystalloid, and it is interesting to note that it is the only crystalloid used as food, all the other sub-

stances existing in the juice are colloids or behave as colloids.

To go fully into the difference between crystalloid and colloid is not my object, but in a word a crystalloid produces crystals by evaporation, and a colloid, usually amorphous, forms a jelly in setting, the name being derived from the Latin "colla," meaning glue. After extracting sucrose by boiling and reboiling, sucrose decreases in the residue and colloids increase up to the point of a permanent combination between the two when crystallisation becomes impossible, and the product is thrown out as exhausted molasses.

In theory, this colloidal condition should only occur when the relative proportion of sugar to salts reaches a certain stage.

As the percentage of salts in final molasses is more or less constant, it is clear then that the quantity of molasses will be governed by the proportion of salts left in the syrup, but it is also evident that if we do not remove from the juice, through deficient clarification, substances more liable than others to stimulate the formation of a jelly in setting, trouble will ensue. We will obtain a product in which crystallisation is hampered and a large percentage of molasses will be thrown out before they have reached the real limit of exhaustion.

This is to a large extent what happens generally, and although an excess of salts in the Uba juice tends to produce more molasses, the difficulties experienced in the manufacture generally are followed by abnormal losses of sucrose at the last stage.

In technical language, purity means the percentage of sucrose in 100 lbs. of dry substance in the juice. The dry substance of the juice of 85 purity contains therefore 85 lbs. sucrose and 15 lbs. glue.

If, for any cause, a juice of 85 purity drops to 80, this loss not only means a clean loss of 5 lbs. of sucrose per 100 lbs. of dry matter, but it means also an increase of 5 lbs. of glue, which will naturally prevent the crystallisation of a greater proportion of the remaining sucrose.

After severe droughts or large fires, the drop in purity is such that it is next to impossible to cook the juice into anything else than a jelly, for the reason that the juice in the cane delivered to the mill has already reached the colloidal state.

Following the maxim, "When you live in a glass house it is dangerous to throw stones," I have not the slightest intention to criticise anything.

I have limited myself to a mere statement of the difficulties with which we have to contend. That they do exist cannot be doubted, but it must also be frankly admitted that there is ample room for improvements requiring still more ample capital to carry them out.

L. ERNEST ROUILLARD, B.Sc. (Edin.).

DISCUSSION.

Mr. Warner asked if Mr. Rouillard had any data which would give the probable loss over a period of 24 hours of sucrose between the time of cutting and milling.

Mr. J. Armstrong wished to know the difference, if any, in sucrose content of burnt cane as compared with trashed cane.

Mr. Piccione asked whether it was Mr. Rouillard's experience that it did not necessarily follow that the sucrose content is at its maximum when the cane is at its highest.

Mr. Johnson asked what dates Mr. Rouillard considered the best for milling the cane to minimise the loss and get the best result.

Mr. Piccione also referred to Mr. Rouillard's remarks that during the wettest part of the season the cane sucrose has been at its highest, and stated that he understood that on the Umfolosi flats after wet weather the sucrose content goes down.

Mr. Mortifee asked whether cane a few hours after being burnt was less useful to the miller than trashed cane.

Mr. G. S. Armstrong expressed his pleasure at having heard Mr. Rouillard's paper, which was an excellent one, and he felt sure they were all very grateful to Mr. Rouillard for what he had put before them.

Mr. Rouillard, in replying to the various questions put to him, stated that Mr. Warner's question was a very difficult one to reply to. He had seen cane which showed practically no difference 24 hours after cutting. As a matter of fact, cane sometimes keeps quite good until a point is reached, when the loss may be tremendous. Cane may have on the Saturday a ratio of 3 per cent. glucose, and on the Monday drop to 5 or 6 per cent. after three or four days, but within the first few days it is extremely difficult to fix a limit. In winter the cane will remain longer.

Mr. Rouillard referred to a case in his experience where they had a fire and for four or five days the cane was perfectly sound; there was practically no difference between the burnt cane and any other cane as regards purity and sucrose content, but after

five days it started to drop; up to eight days it was fairly good, but then it came over rather bad. If burnt cane was sent to the mill in reasonable time he had not the slightest objection to it from the millers' point of view.

From the agricultural point of view it was very vital however. As far as the La Mercy Company is concerned, Mr. Rouillard did not allow planters to burn their cane on account of the injury to the soil, which would thereby deteriorate considerably. He considered the results they have at La Mercy to-day were due to the fact that cane has never been burnt. It was only occasionally, after the third ratoon, and the soil has been under cane for about eight years, that he considered burning would not be harmful because it then cleaned the land.

With regard to the best period for cutting cane, Mr. Rouillard considered that in a normal season the most suitable period was from July to November; as a rule the cane is then fully ripe, the density is high and the cane weighs more, generally speaking. Sometimes, however, high density does not mean high sucrose content, because high density is sometimes due to reversion of sugar into glucose. As regards fertilising and soil conditions: hill cane has better sucrose content than flats cane because of the excess of moisture, but as regards fertilisers it is very difficult to say that it would improve the sucrose content. As a matter of fact, in Havana often the best sucrose content is obtained from the unmanured plots.

If you fertilise your plants you will have better returns and more sugar per acre, but not more sucrose per 100 lbs. of cane. The reason for the low sucrose content of cane on the flats was due to the growth and water. From his small experience Mr. Rouillard said he had found that the canes were always poor because they were never properly matured. It is difficult for them to mature when there is water around. They never come up to hill cane, say up to 15 or 16 per cent. They are healthy and fine to look at, but the sucrose content is bound to be poorer because of the excess of moisture. The remedy, generally speaking, would be drainage. It is a question of maturity.

The Chairman thanked Mr. Rouillard on behalf of the Association for his paper.