Process of Mixed Massecuites.

Reference has been made above to the use of crystallizers and a few words on the principle of crystallization in motion and advantages of same would not be out of place. A strike of grained massecuite upon being dropped from a pan consists of sugar crystals and molasses, the molasses holding a percentage of crystals in solution. Massecuites of a certain degree of supersaturation for the temperature at which they are dropped allow more sugar to crystallize out on cooling down. If cooling takes place at rest, new crystals will form, the original crystals present in the massecuite having dropped to the bottom of the storage tank and the molasses remaining on top. This new crop of crystals is usually so fine that it cannot be recovered when the massecuite is purged, and passes through the linings of centrifugals along with the molasses. If such a massecuite be cooled in motion, the original crystals at striking point are constantly brought into contact with the supersaturated molasses, the sugar in same therefore builds up on the grain already present. Upon curing, such a massecuite will have parted with most of its sugar in solution; the molasses, therefore, being of lower purity than one in which a high percentage of small crystals would be present, as is the case when cooled at rest.

The advantages of crystallization in motion from a technical point are therefore striking, from the handling of the first products. First molasses are slightly reduced in purity, thereby making the degree of purity of 2nd massecuites more easily maintained at the required purity of 75. This of course yields a lower 2nd run off than would otherwise be the case and at the end of 3 boilings, final molasses is obtained more readily and cheaply. The common method of boiling, etc., followed in Natal's white sugar factories is as follows:—

1st Massecuites.—Boiled from syrup, 1st wash and melted treacle sugar left in crystallizers 12-20 hours, double cured and yielding white sugars.

2nd Massecuites.—Boiled from syrup, 1st wash, 2nd wash and 1st molasses, left in crystallizers from 20-30 hours, double cured and also yielding white sugar.

3rd. Massecuites.—Boiled from 2nd molasses of 50-55 Purity to string, left in crystallizers from 5-8 days, yielding treacle sugar and final molasses of 42-45 apparent purity. The stirring gear of crystallizers is set in motion after the appearance of grain, from massecuite.

This method of boiling 3rd massecuites is very inefficient and should be condemned when the boiling house capacity of the factory allows boiling of same on grain, as previously explained. For proper exhaustion of molasses, the massecuite should be left in the crystallizers for some 12 days, and where possible the temperature not allowed to drop below 125 degrees F., below which point crystallization of sucrose from molasses is comparatively slow.

Before closing it is interesting to remember that a source of great trouble in crystallization in motion is the stiffening of the massecuites upon cooling; and in order to increase the fluidity of the massecuites, it is the common practice to add molasses or water to same. The amount of such dilution should be carefully controlled, any excess dilution might dissolve some of the crystallized sugar, thereby destroying the aim of careful pan boiling and also affecting results from centrifugals.

There being no discussion the Chairman thanked Mr. Ducray for his paper.

DETERIORATION OF CUT UBA CANE

(Paper by G. C. DYMOND, Empangeni.)

The subject of my paper is a particularly complex one, on account of, firstly, the difficulty of explaining and reducing the results of vital functions and the numerous factors which influence them to an exact science; secondly, the magnitude of the limits of error due to sampling even cane from the same field, and thirdly, the basis of the interpretation of the results obtained.

Before proceeding with the actual deterioration and the losses involved in cane between the knife and the mills, it is necessary to have at least some general ideas about plant physiology and more particularly those vital functions of a cane relative to sucrose before as well as after cutting.

A growing cane has for its object in life the storing up of food reserves against the time when the seedling or embryo plant will require nourishment during its initial growth, that is before it has developed its own chlorophyll system. This potential food is useless to it in the form presented, and the plant cells secrete certain wonderfully active bodies called enzymes, which break down the complex food reserves into simpler bodies which can be utilised by the germinating plant.

Deterioration of Cut Uba Cane.

The literature of enzymes grows daily and in a paper of this nature it is impossible to more than touch upon the salient characteristics of substances, the chemical nature of which is practically unknown, but which are so important that they govern the very functions of all life.

Oppenheimer defines enzymes or ferments generally as: "The material substratum of a peculiar form of energy which is produced by living cells, and adheres more or less firmly to them without having its activity bound up with the vital process as such."

In chemistry there are a number of reactions which proceed very slowly by themselves, sometimes apparently not at all, but which can be enormously accelerated by the presence of small amounts of various substances called catalysts. Platinum in the presence of ($S.O_2$) under certain conditions is a catalyst and when such a body is the product of a living organism it is called an enzyme. They are in reality complex colloids allied with inorganic components of an extremely active nature, and explain the occurrence in organisms of reactions which require powerful reagents and high temperatures for their performance in the Laboratory. Thus Lactose is hydrolysed by (HC_1) and also by an enzyme lactase, which weight for weight is 5,000 times as powerful.

One part of the enzyme invertase, which is responsible for the invertion of sucrose into two simpler sugars glucose and fructose, is capable of hydrolysing 100,000 parts of sucrose.

The part played by enzymes in nature is well illustrated by the special functions they perform in the relatively simple process of digestion.

Their activity commences in the mouth whereby the enzyme contained in the saliva partly converts the non-assimilable starches into sugar. In the stomach the proteids are decomposed by the enzyme pepsin, while in the intestine the fats are decomposed the conversion of albuminous substances completed and the carbohydrates decomposed into available mono saccharoses.

In plants we must conceive of an analogous process; synthesis from simple food material may only take place up to the point at which it is resorptionable, for example during the vigorous growing period of young cane, but during the period of excessive production a maximum of higher products are formed and stored up in large quantities which are not assimilable without reduction to simpler bodies.

Plants actually secret enzymes when required, thus when no more food material is available in a growing plant or when a seed or seedling germinates the necessary proteolytic, saccharifying, cellulose and fat decomposing enzymes are secreted at will.

This may be demonstrated in the juice from a normal very ripe cane. When freshly cut the juice yields no precipitate or only a cloudiness with excess of alcohol, whereas 24 to 36 hours later a copious precipitate is formed.

The objects of a cut cane initial life and the cane still adhering to the parent root, may be likened to a father who saved up all his spared dollars for the son to spend, only in our case the legacy is put to an essential purpose, and it behoves us who think in terms of sucrose content to extract that sucrose at the earliest possible moment after cutting, before the cane has had a chance of a volte face or had time to realise the fact of its metamorphosis.

From these preliminary generalities let us pass to the plane of more practical considerations. A cut cane immediately begins to lose weight, the degree varying with the climatic conditions. From a series of determinations I have found the average loss to be 1.2 per cent of its weight per diem. Generally up to 36 hours and infrequently to 48 hours there is a rise in sucrose. I refer in this case to normal ripe trashed cane free from disease. From then on a rapid drop in sucrose takes place with a rise in the glucose ratio, due to the activity of the enzyme invertase which the cane cells have secreted, its presence together with other ferments, gums, etc., being demonstrated by the addition of alcohol ut supra. With each succeeding day the impurities, or rather the decomposition products of the reserve food materials of the cane increase rapidly causing much of the trouble and low recoveries in an average sugar mill.

Browne and Blouin, as quoted by Noel Deerr, state that the enzymes responsible for the deterioration of cut cane are resident mainly in the tops, and that after cutting these permeate the whole stalk.

To show how such a condition would affect Uba cane the following experiment was carried out in March of this year:

Well topped Uba cane on cutting showed a purity of 90.9 with a glucose ratio of 1.73. After 24 hours the purity dropped to 88.8 with a glucose ratio of 3.82 while cane which had not been topped until just before analysing showed a purity of 87.3 and a glucose ratio of 4.46.

The difference became more marked on each succeeding day.

	Purity	Glucose Ratio	Purity	Glucose Ratio
	Well Trashed Cane		Untopped	
2nd day..	78.8	12.50	73.1	16.28
3rd „ ..	74.9	17.78	73.9	16.93
4th „ ..	74.0	17.35	69.5	24.81
5th „ ..	71.6	20.42	68.5	25.07

In connection with these and all subsequent figures the limits of error are rather considerable. From a number of selected samples of cane taken from one area the average analysis showed:

	Brix	Sucrose	Purity	Sucrose p. c. Cane
Minimum	18.4	17.05	92.7	13.30
Minimum	19.17	17.79	93.4	12.82
Maximum	18.08	16.44	91.3	13.87

Deterioration of Cut Uba Cane.

That is a possible error of 1.09 in the brix, 1.35 in the sucrose, 2.1 in the purity, and 1.05 in the sucrose per cent cane. These unavoidable errors are large but refer mainly to young growing cane, a greater uniformity existing in adult ripe cane samples.

The subject of the deterioration of cut cane would be considerably simplified if the losses involved between the knife and the mills could be grouped under one heading. Unfortunately we have in practice two types of cane, the normal trashed cane and that which has been subjected to fire and it becomes necessary therefore to discuss the two methods and the resulting deterioration along the two lines.

What is the effect of heat on a plant?

Growing plants may be kept for half an hour at 40 degrees C without injury, but an exposure of 10 minutes to half an hour at 52 degrees C as a rule kills them. Death may not be immediate, in fact the plant may be alive especially at the nodes for days, but death will result in the end. Immersed in water death is more rapid, temperatures of from 45-48 degrees being sufficient. The seeds of plants are like the spores of micro organisms, and show considerably more resistance to high temperatures.

The active movement of protoplasm in the cells is arrested after immersion of the plant for 1 minute in water at 60 degrees C, while it loses its normal constitution allowing the acids of the cell sap to transverse it by osmosis, the chlorophyll grains being attacked by the same acids. From this state of immobility known as heat rigor the protoplasm may recover provided the temperature is soon reduced, otherwise death rigor prevails and the plant dies.

All absorptive and excretory functions, respirations, enzymic processes, turgidity, germination, growth and reproduction are directly dependent upon the temperature of the body of the plant.

If a sample of cane is placed in a convenient receptacle and the contents intermittently pasteurised by heat and the receptacle sealed, the cane will keep indefinitely. What has been done? It is merely the principle employed in numerous fruit canning and other industries. The micro-organisms have been destroyed together with the enzymes of the plant cells invertase being completely destroyed in a liquid medium at a temperature of 75 degrees C, while the death rigor has rendered the plant cells incapable of secreting more.

In burning cane this process is imitated to a degree, the degree fluctuating with the intensity of the fire, while under natural conditions we have no sealed receptacle to maintain immunity from subsequent extraneous bacterial infection.

In other words we must assume that a normal cane fire will disrupt those natural functions of a cut cane by destroying the normal processes of the cane cells by death, and will kill at least most of the organised ferments whose habitat is the surface of the cane, the quality of these actions being proportionate to the intensity of the fire.

The organised ferments of those produced by the presence of micro organisms cannot be considered as normal products of decomposing cane, since they are not products of the vital functions of the cane cell. Nevertheless they play an important part in disease and in the final decomposition of the cane. Normally the cells or cellular tissues of the higher plants are, whilst in a healthy condition, free from micro-organisms. This is not the case for example in that condition of the cane so common after drought, red rot; for here the infected area swarms with all kinds of micro organisms. The spores of fungi, wild yeasts, etc., are always to be found on the surface of the cane protected from the sun's rays by the enveloping trash. That certain fungoid hyphae are capable of penetrating into the plant tissue and then through the cell membranes has been proved, but it does not always follow that the parasite will develop until suitable conditions arise.

We see, therefore, that the difference between normally cut cane and that cut after burning is a fundamental one. The former is alive and ready to reproduce itself whereas the latter is dead. Whereas the former will by means of its enzymes rapidly break down its complex reserve materials, the latter awaits the invasion of extraneous micro organisms whose advent may be accelerated or retarded by climatic conditions or other natural causes.

Another factor which has a large bearing on the rate of deterioration in either variety of cane, but principally in burnt cane is the sucrose content. Young cane with a low sucrose content burnt or unburnt rapidly deteriorates. In mature ripe unburnt cane the greater the concentration the slower the rate of the catalysed reaction. A reaction is slowed up when the products are toxic to the enzyme, an acceleration taking place when these products are removed. Thus if anything happens during the course of the reaction which diminishes the amount of enzyme present, either actually by destruction or effectively by paralysing its activity the result will be a progressive diminution in the rate of the reaction.

The effect of an enzyme poison illustrates the above. If a sample of normal hand trashed cane be sprayed by a one per cent. sol. of Na F, absorption in some way takes place whereby the action of the enzymes present is slowed up. Cane so treated dropped from 90.9 to 88.8, to 87.6, to 85.1, to 85.3, to 80.7 on five successive days, whereas unsprayed cane showed a progressive drop from 90.9 to 71.6.

The effect of concentration and increased sucrose content is very noticeable in burnt ripe cane which already had a high density juice with a high sucrose content. Such cane keeps its quality well for an extended period in so far as the figures relate to the sucrose content of the cane itself and not to the original sucrose per cent acre. I shall have occasion to refer to this comparison of sucrose per cent cane and sucrose per cent acre later on.

Deterioration of Cut Uba Cane.

Comparison in the Loss in Weight.

As already mentioned I have found that trashed cane loses about 1.2 per cent by weight per diem. Under the same conditions burnt cane loses 2.1 per cent. This loss fluctuates within wide limits being mainly proportionate to the intensity of the fire.

Two planters A and B each have a crop of 5,000 tons representing 200 acres at 25 tons per acre. A hand trashes and B burns and they both handle four acres per diem representing 100 tons of freshly cut cane. Each man's cane reaches the weighbridge 24 hours after cutting.

Each day A's cane weighs on delivery 98.8 tons and B's 97.9, a small amount but on the crop A is credited with 45 tons more than B. The actual losses being A 60 tons and B 105 tons. Is is assumed that B has burnt daily sufficient for his day's consignment. Had he burnt sufficient for a longer period his loss would have been proportionately much greater. These are merely fair average figures, but in cases where cane has been subjected to a very fierce fire and handled days later, the loss in weight will rise to very serious proportions. I may safely say that the planter is inflicting on himself very heavy losses by the bad practice of burning more than is sufficient for his daily cut.

It was suggested at this Conference last year that the whole question of the two practices was fundamentally an economic one. I was not in a position at that time to query the manner in which the balance sheet had been made up.

The planter at present is not very much concerned with the chemical changes in the juice of his cane after it has been cut, provided its quality does not deteriorate below the standard of 'marketable cane' nor does he care whether the practice of burning his cane is deleterious or otherwise to the quality of his cane; he is only concerned with the effect on his weights and the little known value in hard cash of the trash to his soil, and it depends just how much these factors are credited with on his balance sheet before the practice of burning can be shown to be economical to the planter.

The effect on his weights I have already dealt with, but the value of the trash cannot be reduced to an exact figure. Its manurial value as I showed in my paper last year is in terms of Potash, Nitrogen Lime and Phosphoric acid about 4/5d. per ton of dry substance or approximately 12/- per acre, which is considerably less than any of the other by-products of the cane. It has, however, very important values of a physical nature which vary with the nature of the soil, such are its moisture conserving properties, its ability for opening up heavy lands making the soil more porous and friable, its potential humus value especially to sandy soils. its retarding action on the growth of weeds, etc. All these points must be considered in attempting a balance sheet, and when a fair average is struck I think you will find that in the long run in so far as the planter is concerned, the balance sheet will show a marked credit on the hand trashing side.

Passing from these more or less physical conditions of weights and agricultural problems of husbandry, we come to the more complex conditions of the deterioration of cut cane, burnt or unburnt, in other words the quality of the cane as it affects the millers.

During the 1920 crops in Zululand there occurred four large fires in August and October and two in November respectively. In August cane was taken off on the 8th, day with a purity of 92 dropping on the 9th, to 89 and on the 10th to 87.4.

From the October fire we received cane up to the 9th day with a purity of 91.6. In the November fire cane showed a purity of 92 on the 1st., day dropping to 86.7 on the 7th, 86 on the 8th day, and 82 on the 9th, while the last fire of the series showed a purity of 90 on the 7th day, 86.6 on the 9th, and 85.1 on the 10th day.

These figures relate to cane burnt and left standing. No records are available of the climatic conditions prevailing during these periods, nor the sucrose contents of the cane on the successive days, but by applying a factor of .78 to the available figure we find that the sucrose per cent cane from the 1st fire rose from 13.47 on the 2nd., day to 14.49 on the 3rd, and then gradually dropped to 14.18 on the 9th, and 13.52 on the 10th. The other instance show a like rise and fall, the rise up to the 6th, day being in excess of the original sucrose per cent. It is here that I would lay stress on the fact that the sucrose percentages refer to the sucrose per cent cane and not to the sucrose per cent acre, a very different thing, for whereas the sucrose content of cane may be in excess of that existing on cutting, there may be and in fact always is after 2 or 3 days a loss on the original sucrose per cent acre.

In the following records I would emphasise this point that except where especially mentioned sucrose contents refer to the cane.

Numerous investigations were carried out during the last two years on the contentious point of the relative keeping qualities of trashed and burnt cane, the comparisons including loss in weight, purity, sucrose and glucose contents, waxes, gums, fibre, acidity, fermentative qualities, effect of poisons, sunlight, etc. In every case burnt cane showed better keeping qualities than trashed cane, comparisons varying between wide limits and were proved to be dependent on four factors:

(1) Ripeness of the Cane.
(2) Intensity of the Burn and to a lesser degree.
(3) Disease,
(4) Climatic conditions.

For comparative purposes let us briefly compare the rates of deterioration in a normal ripe 18 month

Deterioration of Cut Uba Cane.

old plant cane, free from disease and burnt with an average intensity.

Two hours after cutting the purity was 93.69; glucose ratio .76 and sucrose per cent 15.98, the burnt being to all intents and purposes the same.

Twenty-four hours later the sucrose per cent cane had risen to 16.79 in the trashed and 16.31 in the burnt, a gain of sucrose per cent sucrose in original cane of 2.9 in the trashed and a trace in the burnt.

On the 2nd. day the sucrose was 16.57 and 17.36 respectively, a gain of .51 per cent and 4.68. Glucose ratio 2.07 and .95.

Third day, the sucrose per cent original sucrose became a loss; thus the trashed showed 15.13 Sucrose a loss of 9.42 and the burnt 16.10 a loss of 4.49 Glucose ratio 8.20 and 2.48 and purity 84.7 and 91.3 respectively.

On the 6th, day:

Trashed cane lost 6.5 p.c. in weight and burnt	8.63 p.c
Purity 79.6	90.8 p.c.
Glucose Ratio 15.58	3.99 p.c.
Suc. p.c. Cane 14.38	15.72 p.c.
Loss over original Sucrose 15.88	8.49 p.c.

The figures for this and other typical experiments will be found at the end of this paper, it being impossible to quote all the results obtained orally.

The above example refers to mature cane, but in the case of young cane, growing cane, or flat cane which does not, as a rule, reach that period of quiescent ripeness, deterioration in both trashed and burnt cane runs almost on parallel lines.

If we now apply the results of this experiment to an average crop of 100,000 tons of cane, we find that the tons of indicated sucrose would be 15980 provided the cane was crushed immediately after cutting.

After one day in the trashed there would be a gain of 463 tons and practically nothing in the burnt. The second day there would be a gain of 81.5 tons and 748 respectively. But on the 3rd., day trashed cane would show a loss of 1587 and the burnt 717.5.

Seventh day 2737 and 1064 respectively.

Now these figures are only of value to the experiment in question, but from a series of such investigations taken throughout the year, the statement can be made that the maximum quantity of sucrose can be obtained by crushing from 36 to 48 hours after cutting.

I find that my paper has already reached the limit of length and the question of the comparison of juice from trashed and burnt cane in factory work is a subject in itself.

In summarising therefore the results of these investigations, the following conclusions may be drawn.

(1) That normal trashed cane deteriorates rapidly after 48 hours, the rate of deterioration being at its minimum in ripe cane, and at its maximum in immature cane.

(2) That the rate of the deterioration is increased when the cane is diseased.

(3) That deterioration or enzymic action takes place mainly during the hours of sunlight, the action during the night being comparatively insignificant.

(4) That cane cut and untopped until crushed, deteriorates with greater rapidity than cane which has been topped immediately before or after cutting.

(5) That cane which after cuting is sprayed with a one per cent solution of sodium or ammonium fluoride, in some ways absorbs the poison which is toxic to the enzymes, resulting in a maintenance of those qualities existing in the cane on cutting for a longer period than cane not so treated.

(6) That healthy mature cane burnt with an average intensity, so that the interior of the stalks reaches 75 degrees C will keep far longer than the same cane which has been trashed.

(7) That the fluctuation in keeping qualities of burnt cane are largely influenced by the intensity of the fire.

(8) That the higher the original sucrose content of burnt cane the better its keeping qualities.

(9) That cane which is badly infected with red rot deteriorates very rapidly. That burning such cane may even accelerate the rate of decomposition owing to the fact that the micro-organisms are not killed, and by breaking down the cell membranes of the healthy portions of the cane by heat, the action of the organised ferments is accelerated.

(10) That a low intensity fire, that is a fire put in when the trash is wet, may accelerate the rate of decomposition owing to the fact that invertase is only destroyed at a temperature of 70 degrees C.

(11) That after the maximum period of 48 hours there is a loss in sucrose per cent acre in both burnt and trashed cane.

(12) That if the practice of burning must be continued the planter will save many tons weight of his crop if he will burn only sufficient for his daily cut, while in-so-far as the miller is concerned there is no department in the Sugar Industry in which an efficient organization and control of the crop is more likely to be well repaid.

DETERIORATION OF CUT UBA CANE.

MR. DYMOND'S TABLES.

(1) RIPE CANE. AUGUST, 1922:

	Loss in weight.		Purity.		Glucose Ratio.		Sucrose p.c. Cane.		Sucrose lost p.c. Sucrose in original Cane.	
	Trashed.	Burnt.	Trashed.	Burnt.	Trashed.	Burnt.	Trashed.	Burnt.	Trashed.	Burnt.
On cutting			93.69	92.75	.76	.69	15.98	15.87		
1st day..	2.07	2.67	93.7	92.8	1.2	.81	16.79	16.31	2.9	trace
2nd „ ..	3.05	4.28	91.3	93.3	2.07	.95	16.57	17.36	.51	4.68
3rd „ ..	4.35	5.87	84.7	91.3	8.20	2.48	15.13	16.10	—9.42	—4.49
4th „ ..	4.71	5.6	80.1	90.9	15.57	2.82	13.96	16.28	—16.72	—3.18 *
5th „ ..	5.6	7.12	79.9	90.8	15.57	3.40	14.17	16.00		
6th „ ..	6.50	8.63	79.7	90.8	15.58	3.99	14.38	15.73	—15.88	—8.49
7th „ ..	7.04	8.21	79.4	89.8	13.91	3.19	14.25	16.10	—17.13	—6.66 *
8th „ ..	7.92	10.54	78.9	89.4	15.72	4.65	14.47	15.74	—16.61	—11.26
9th „ ..	8.97	13.2	77.8	87.7	17.47	4.85	14.18	15.92	—18.23	—12.93

* Climatic conditions.

(2) CANE WITH LOWER SUCROSE CONTENT, AND WELL BURNT, DECEMBER, 1923:

	Loss in weight.		Brix Clerget Purity.		Glucose Ratio.		Sucrose p.c. Cane.	
	Trashed.	Burnt.	Trashed.	Burnt.	Trashed.	Burnt.	Trashed.	Burnt.
On cutting			89.7				13.84	
1st day	1.1	3.2	93.1	91.7	1.98	1.76	14.68	14.64
2nd „	2.1	5.8	86.3	88.6	3.69	2.40	13.71	15.82
3rd „								
4th „	3.7	9.8	85.5	87.9	5.43	4.47	14.52	15.24
5th „	6.4	20.5	78.2	87.2	16.11	4.0	12.78	19.42
6th „	8.6	20.7	80.5	86.3	17.95	5.27	14.36	16.98
7th „	8.5	24.7	77.6	82.7	18.99	11.3	12.80	16.45
8th „	11.0	28.2	77.5	84.8	16.56	9.47	12.45	15.93
9th „	—	—	78.7	82.6	18.11	8.93	—	—

Variations due to Climatic Conditions and the Intensity of the Burn.

(3) YOUNG IMMATURE CANE. JANUARY, 1923:

	Purity.		
	Trashed.	Burnt.	Sucrose per cent Cane.
On Cutting...	85.2	—	10.56
3rd day.....	76.8	78.9	
4th day.....	72.5	74.1	

(4)	Purity.				Glucose Ratio.			
	A	B	C	D	A	B	C	D
On Cutting.....	90.9	—	—	—	1.73	—	—	—
1st day.....	88.8	91.5	88.8	87.3	3.82	1.60	3.72	4.46
2nd day.....	78.8	82.6	87.6	73.1	12.50	9.75	4.85	16.28
3rd day.....	74.9	84.8	85.1	73.9	17.78	7.05	6.27	16.93
4th day.....	74.0	84.4	85.3	69.5	17.35	7.89	8.12	24.81
5th day.....	71.6	82.7	80.7	68.5	20.42	7.42	10.0	25.07

A Well topped. B Burnt. C Trashed and Sprayed with 1 p.c. NaF. D Not topped until analysing.

DISCUSSION ON THE PAPER.

Mr. Patrick stated that they apparently knew that on burnt cane up to 48 hours there was a rise in sucrose in the cane and asked if that complicated matters with the mill in getting that increased sucrose out due to the cane being 48 hours old.

Mr. Dymond replied that there was no actual rise in the sucrose per acre as there was a loss in weight of cane at the same time. Mr. Patrick wished to know if that gave rise to further milling difficulties and Mr. Dymond replied that it naturally did as it was much easier to mill cane immediately after cutting than 48 hours afterwards, because it had more impurities later. The older it was the greater the impurities and the more difficulty in treating. Mr. Patrick then asked Mr. Dymond what he meant by the expression "marketable standard" and Mr. Dymond replied that he was afraid he could not answer that in any shape or form.

Mr. Forrest in referring to the ratio of loss between burnt and trashed cane, when cut, asked if cane though burnt but not cut lost in the same ratio as that which was cut. It seemed to him that although a man might exceed his daily cutting by a few tons when burning, the cane which was not actually cut would not lose its weight at the same ratio as that actually cut.

Mr. Dymond replied that he had no figures on the question of burning and leaving it standing in the field. But it naturally lost in weight. The greater the fire the greater the loss because the surface cells were broken, and there was always evaporation. As far as deterioration was concerned, the few figures available showed that big experiments had been carried out on this question of burning cane and leaving it standing, and it was found the deterioration went on almost as rapidly left standing as cut, because the cane was dead in any case whether it was cut or not.

Mr. Booth stated that Mr. Dymond had gone to great length in getting out figures and he thought his patience and industry were to be commended. He made a point with regard to the difference between burnt and trashed cane. That was very interesting, but in his (the speaker's) own investigations he had cause to differ somewhat from that. Some two years ago he had made investigations into the deterioration of cane, burnt and trashed. He made them more or less in duplicate. He took a certain section of a field of flat cane and loaded it into two trucks indiscriminately. One he burnt and the other was hand trashed. The hand trashed gave a sucrose of 14.8; the burnt sample gave 14.3; he could not find the reason for this at the time, and it naturally puzzled him.

With regard to the comparative difference in deterioration his finding more or less coincided with Mr. Dymond's although the rate of deterioration in trashed cane was not so much as Mr. Dymond had found, as he had found it was rather a close race. In the trashed cane the sucrose rose about ¼ per cent. but the burnt cane did not rise. It started 14.3 and continued until about the second or third day when it started to fall. The trashed cane seemed to work up on the contrary side and when it reached the maximum it fell rapidly. As to the loss in weight his figures coincided with Mr. Dymond's very much.

But reverting to this difference, which he put down to the actual loss in burnt cane; Mr. Dymond had said that immediately a fire was put through cane it sterilised it so to speak. That may be so, but he had two cases in point to quote. He could not find a reason for a long time why this difference between 14.8 and 14.3 should stand until last year. He had occasion to work a good deal in the field and check the burning, extent and intensity of the fire. They all knew it had been a very dry season and his consideration were the keeping qualities of the cane. He found on going through these flat canes, particularly the first ratoons and plant cane, that the cane was sweating. On running his hand along the cane he had got a handful of glue. He had not the time or opportunity to investigate the matter. He found on reading the International Sugar Journal that some other Chemists had gone into the matter. He was quite satisfied that in certain cases, especially, the fibre was low, that the cane did sweat appreciably. Applying that figure to a crop of 150 tons there was a very large loss of sugar.

Coming to another side of the question, last year all the hillsides of Zululand were drought stricken and he was compelled to ask some of the planters to trash their cane instead of burning it, because he found out in passing a fire through this district that it was in such a condition that the action of it seemed to kill that cane stone dead so to speak. It gave a 73 per cent purity when the cane was trashed and it was only 63 per cent when burnt due to the inverting action, which rather contradicted in his opinion Mr. Dymond's hypothesis that the cane was sterilised.

Mr. Dymond stated that the example he quoted referred to mature ripe cane.

Mr. Booth replied that Mr. Dymond was under the impression that flats cane did not ripen up. He could assure him that the tops were almost falling off of their own accord. That was a practical test of ripeness.

Mr. Dymond stated that he was quite willing to delete the word "flat" cane. As regards the question of sweating to his mind an average intensity fire melted the wax and this ran down and appeared as the sweating action. Certain gummy matters were secreted by the cane cells, and it would appear that it was this gummy matter or wax. With regard to Mr. Booth's remarks concerning cane on a hill which

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deteriorated more quickly than when trashed, that was the big question of the intensity of the fire. If the fibre was so intense that it broke down all the surface cells of the cane the entrance of micro organisms and the fermentation set up would increase very quickly. It took some time probably, if these surface cells were not disrupted, for these micro organisms to penetrate into the cane to cause an effect on the purity. That was how he would describe it.

He had mentioned certain experiments which he had carried out with cutting cane and sterilising it. If that cane was not properly pasteurised on opening up the receptacle in say a month's time it would be found to be blown up as a tin of foodstuff was sometimes found to be blown, and there were all these anaerobic bacteria throughout the cane which are able to live without oxygen. The effect of the yellow fungus "aspergillus" was more apparent than real in the first stages because the fungus, being an aerobic bacteria, did not penetrate into the cane until that had been sufficiently disrupted, and it was the micro organisms that could not be seen which penetrated more quickly than the fungi.

Mr. Ladlau stated that, in reply to a question from Mr. Forrest as to the difference between burnt cane left standing and burnt cane cut, Mr. Dymond had said it was dead in any case and the effect would be the same. During the floods when the railway bridge was washed away, a neighbour of his had two truckloads of burnt cane, one he had already loaded and the other was on the ground near by. He saw no chance of getting that to the mill so he took it back and planted it, and most of it grew. That was an absolute fact. Mr. Dymond had said it died. He thought that fact disproved his statement. He would like to know if Mr. Dymond could tell him what would be the difference in weight between trashed cane which was cut early in the day, delivered to the mill and weighed the same day, and cane which was not weighed until three days after it had been cut.

Mr. Dymond replied that he had mentioned a figure which he had arrived at as being one to two per cent loss per day. That was what he had found from a series of investigations on the loss of weight in trashed cane. If cane was sent in three days late it would be losing one to two per cent per day of its original weight. With regard to burnt cane left standing it went on losing weight. It might not be dead; the heat might not have penetrated to the centre of the cane. The cutting of cane opened up another wound, whereby infection could enter. Directly it was cut it deteriorated more rapidly than if left standing, but from the moment of burning deterioration started and the loss in weight started. With regard to burnt cane being planted and growing, that was quite possible. It depended again on the intensity of the fire; it may not kill the cane. Parts of it may have been enclosed by trash and sufficiently alive to germinate.

Mr. Patrick suggested that Mr. Dymond was on the safe side in his figures on the loss in weight. Some years ago he had taken a burnt stick and a stick that had not been burnt, and had weighed them every 24 hours for a week. He found that for the first three days there was practically no diminution in weight on the trashed cane and after that there was a considerable drop. On the other hand in the case of the burnt cane it came out at nearly seven per cent drop and a further 10 per cent on each succeeding day, and on the third day there was an enormous drop. He thought therefore, that Mr. Dymond's figures were very much on the safe side.

Mr. Dymond replied that he had taken an average figure and he should have mentioned a minimum and maximum figure. The figure he had mentioned had been the average of a series of experiments on the loss on burnt cane. He had found cases in which the loss was 20 per cent after three days, but that was a fairly hot fire. The truck which he had mentioned as having 19 per cent sucrose was burnt black and the loss in weight must have been in the neighbourhood of 30 per cent.

Mr. Johnsoon stated that these figures were rather confusing to practical results. Recently in the Amatikulu area the cane had been transported from Amatikulu to Darnall, which had involved a tonnage of something like 70,000. They were all aware of the distance and the enormous amount of cane which usually fell off the trucks. Strict account had been kept of the difference between the two weighbridges. In discussing this matter and going into the loss they were informed it was something like 1.67 per cent. That cane sometimes took two or three days to arrive at the mill. When they came to work out these figures they did not tally exactly with what Mr. Dymond had said. These technical figures were rather confusing to some of them, but when it came to practical results it appealed to them more distinctly.

Mr. Dymond replied that one could understand that in a railway truck where the cane is well packed, there were not the means of evaporation as in a small open cane truck. All his experiments had been made in connection with small cane trucks. Another point he had not mentioned was that burnt cane after rain may increase in weight. Being somewhat more porous than hand trashed cane owing to the disruption of the cane cells it appeared to take up moisture to a certain extent, varying of course with the period it had been wet.

Mr. Booth mentioned that last year the actual loss on the cane which came from Umhlali to Tongaat was about one ton per truck.

Mr. Mahon stated that no doubt the scientific side of Mr. Dymond's paper was much appreciated, but he would like a word from the ordinary layman's point of view. Mr. Dymond had stated the comparative loss to a planter burning cane on a 5,000 ton crop would, at the end of the year, amount to about 45 tons, which, taken at an average computed

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value of £1 per ton would mean a direct loss of £45 in his crop. In computing the cost of delivering trashed cane as against burnt cane, the expense of the trashing would be very much greater. He wished to know if Mr. Dymond had gone so far on the financial side in his investigations as to the value of trashed cane versus burnt cane to the mill, and how much more could be paid per ton for trashed cane.

Mr. Dymond replied that he was sorry he had not been able to deal with finances up to the present. If his Company were to allow it he would be pleased to do so.

Mr. Edwards stated that the last question was a very interesting one. It was a question which would have to be settled sooner or later. The general idea was that the trashed cane was much better for the mill than burnt cane. The authority for that idea was that sometimes burnt cane sent to the mill was very old whereas trashed cane by the time it reached the mill could not possibly be cut for as long a period as burnt cane. He asked Mr. Dymond if any experiments had been carried out on the question of the clarification of juices from burnt and unburnt cane.

Mr. Dymond replied that except in very small quantities they had never dealt with trashed cane at his mill and consequently he was not in a position to compare the milling qualities of burnt versus trashed cane. Whilst he had been at Empangeni they had always dealt with burnt cane. They had had very little trouble in clarification and especially in the filter press, as compared with other mills that he had seen.

With regard to crushing burnt cane, he had seen cane at Tongaat with trash on it such as they never had in Zululand. It stood to reason that in crushing burnt cane they must get a better extraction because they had not got that trash to deal with. But he had no experience of milling or treating the juice from hand trashed cane.

Mr. Ladlau remarked that the answer given to Mr. Edwards about trashed cane was not quite correct. There was the difference between properly trashed cane and cane which was simply chopped down and topped. He would like to ask Mr. Dymond the difference between burnt and trashed cane.

Mr. Dymond in replying stated that he had said in the last paragraph of his paper, that they could overcome this question of burning and hand trashing if there was a proper organisation and they could get the cane to the mill, whether hand trashed or burnt, within a short period. Then there might be very little difference between the two. If the mill could handle the cane up to 36 or 48 hours after cutting it would not matter very much to the mill whether it was burnt or trashed. It was a question for the millers to see that they did get properly trashed cane. It was a question of organisation.

Mr. H. J. Edmonds stated that in his experience in Hawaii trashing cane was done a few months or weeks before the cane was actually cut. He did not know anything about it from a miller's point of view but from the planting and cultivating point of view he thought if the cane was trashed say two or three months or even six weeks before it was cut all that trash would be returned to the soil, if lightly hoed in or covered with soil taken from the stools. Then when the cane was cut there was no necessity to burn as the stools were perfectly clean and it was easy to cut. He would like to propose that it be tried in this country. He had not seen the Uba cane trashed here but he knew it was not possible to do it in dry weather, but why not do it in wet weather.

Mr. Dymond pointed out that the cost of trashing Uba was considerable and the returning of the trash in the way suggested was not very feasible. It would only increase the cost of hand trashing if they had to trash the cane and then cut it several weeks later.

Mr. Hamlyn said he was going to remark that it would be a very sorry day for the planters if they were able to go through their fields and trash the cane beforehand. He liked to see his cane in such a state that there was not a yard between the plants.

Mr. Warner stated that many years ago when they had an abundance of cheap labour it was a practice on the South Coast to as far as possible trash their cane in wet weather. That went on for quite a long time, but he did not think it was carried on to-day to anything like the extent it used to be, so he presumed it had not been found to be of practical value.

A question had been asked as to the relative cost of trashed and burnt cane. His district has been through a state of evolution from burning cane to almost entirely trashing cane. He did not pretend that the figures were of considerable value, they may not have handled their labour to the best advantage, but it was generally agreed that the additional cost of trashing as compared with burning cane was something in the neighbourhood of from 2/- to 2/6d. a ton.

The Chairman congratulated Mr. Dymond very heartily on his paper. He had shown very great pluck in reading a paper on such a contentious subject. He thought they would all agree that his pluck had been justified by his paper. He congratulated him with more satisfaction in that he thought he was the only South African educated gentleman who had read a technical paper at this Congress. (Applause).