

## “EXPERIMENTS IN THE HARVESTING OF BURNED CANE. PART III. P.O.J. 213 CANE”

By H. H. DODDS and P. FOWLIE.

During the past two years the writers have carried out certain experiments in the keeping qualities of Uba cane after burning the standing crop. This is a common practice in certain parts of Natal, especially in the Zululand area, and it was considered of importance to trace the rate of changes in cane so treated compared with hand trashed and unburned cane.

In these series of experiments it was shown that the rate of loss in weight and sucrose depended on the season of the year, being much greater in December with a mean temperature of 72° F., at which time the period of active growth has recommenced, than two months earlier with a mean temperature of 69° F. and the crop still more or less dormant.

In both cases there was a greater loss in sucrose in the unburned cane than in the burned cane, and a much more rapid falling off in purity in the unburned cane.

Further, in the case of burned cane there was an initial period of four or five days during which there was no appreciable deterioration in sucrose or purity, while the unburned cane appeared to deteriorate from the very beginning.

Cane burned and left standing kept even better than the burned harvested cane, remaining practically unchanged in composition for about nine days, after which a slow loss in sucrose and fall in purity set in, evidently associated with renewed growth in the cane.

All these experiments were done with the standard Natal Uba variety, which is supposed to be a cane of good keeping qualities. The experiments to be described were done with P.O.J. 213, which is regarded as a cane of rapid degeneration after cutting.

The cane was planted in October, 1928, and harvested in December, 1929. It is, of course, rather unusual to harvest cane at 14 months in this country, except sometimes in irrigated or in naturally moist soils, but the cane appeared to be sufficiently advanced. The rainfall for the period of growth was 53.79 ins., which is somewhat over the average rainfall for the period, 48.97 ins. It must be remembered that the cane was rather less mature than is generally the case in this country when cane is harvested—usually at 20 or 24 months. The total yield of cane was 25 tons per acre.

As in the earlier series, three adjacent typical blocks of cane were selected for experiment. In one section the cane was trashed by hand as usual, not being burned, and was weighed off after cutting into bundles of 500 lbs. weight each that were left lying on the ground. In another section the standing cane was burned, then harvested and weighed into bundles of 500 lbs. weight and left on the ground as before. In the third section the cane was burnt and left standing in the field.

Every second or third day a bundle both of the burned and the unburned cane was weighed and analysed, and a sample of the burnt cane left standing analysed simultaneously.

The average loss in weight per day was a little greater in the hand trashed cane than in the burnt cane, 1.18 per cent. per day against 1.08 per cent. This difference, however, cannot be regarded as significant in view of the fluctuations in the average daily loss in weight from day to day.

In the sucrose analyses, there were, as before, irregularities in the rate of change of sucrose content as indicated by the samples analysed, as is only to be expected from the results of hand mill analyses of small (10 kilo) samples of cane. Taken as a whole, however, the results show the general trend of the change in sucrose content with time, fairly regular curves being obtained.

It is very evident that with P.O.J. 213 there is a more rapid loss in sucrose from unburnt than from burned cane, the unburnt cane, as in the case of Uba, showing a regular diminution of sucrose from the time of cutting. The average loss was about 2½ per cent. of the original sucrose present in the cane per day, not a very rapid loss, but much greater than that of Uba cane similarly treated, which was from 0.7 to 0.1 per cent.

In the case of the burnt cane a definite increase in sucrose content over the first week is indicated, even after making allowances for loss in weight and consequently increased concentration.

This was indicated also in our earlier experiments with Uba cane, but the increase in original sucrose was so small in those cases as to be well within the limits of the large experimental error. In the present series, however, the increases are too great and too regular to be accounted for in this way and point to a real and considerable increase in indicated sucrose. This

remarkable result, however, needs to be confirmed and tested analytically by double polarization, the results hitherto being based on pol or single polarization, and it is conceivable that the burning may result in some dextrorotatory substance other than sucrose.

In any case, as with Uba cane, there was a period of about a week before the apparent sucrose content of the burnt cane fell below the original, but with the unburnt cane there was a steady fall in sucrose right from the start.

The fall in sucrose per cent. cane of the burnt cane left standing, also as with Uba, was much less than with the harvested cane, whether burnt or not.

The results of the purity test show that the unburnt cane, as with the Uba cane in the 1927 series of experiments, showed a steady drop in purity from the beginning, at an average of 1.9 per day, compared with an average daily loss of purity from Uba cane of 1.3 to 1.5.

Also, as in the case of the Uba experiments, the purity of the burnt cane kept constant for about a week, after which there was an average falling off of about 2.2 per day in purity.

The burnt cane left standing showed no appreciable change in purity until 12 days had elapsed, after which there was an average fall in purity of 1.5 per day for a further 10 days. At the final test, however, 34 days after the cane was burnt, the purity and sucrose content had taken a slight upward turn to 74.6 and 7.17 per cent. respectively.

The Brix of the unburnt cane rose shortly after cutting and remained at a higher level for the remainder of the experiment. There was also an increase in the Brix of the burnt cane after harvesting, which only persisted, however, for 12 days, after which it fell below the original Brix.

The Brix of the burnt cane left standing showed a slight increase that persisted only for five days, after which there was a steady fall.

The reducing sugars, as was to be expected, were, in general, inversely proportional to the purity.

The fibre content as a rule showed little change over the first week of the tests, thereafter widely fluctuating.

#### Summary and Conclusions.

In general, it may be said that similar relative differences are found in the keeping qualities of burned compared with unburned with the variety POJ.213 as with Uba.

Thus in the case of the unburnt POJ.213 cane there is a diminution of sucrose content from the second day after harvesting about  $2\frac{1}{2}$  times as fast as with Uba cane. The POJ.213 burnt before harvesting shows a rise in sucrose more marked than in Uba and maintained over the first week, after which it falls at the same rate as the unburned cane.

Also in purity the unburnt POJ.213 cane shows a steady deterioration from the beginning, about half as fast again as with Uba, while the purity of the burnt harvested cane remained constant for about a week before beginning to deteriorate.

With POJ.213, even more than with Uba, it is necessary to get unburned cane to the mill as soon as possible after harvesting, while with burnt cane there is a period of grace of about a week during which little or no deterioration ensues.

While we believe that the burning of cane is objectionable agronomically, if the increase in sucrose after burning indicated in these experiments can be substantiated, this objection will be outweighed in the case of POJ.213 cane. Nevertheless, if the burning of cane is to be countenanced, adequate means must be taken to maintain the supply of organic matter in the soil by means of green manuring and the like.

With POJ.213, as with Uba, where cane has accidentally been burned in larger quantities than can be transported to the mill within a few days, the surplus should be left standing, when it will keep longer than after being cut.

NATAL SUGAR EXPERIMENT STATION,  
SOUTH AFRICAN SUGAR ASSOCIATION,  
MOUNT EDGECOMBE.

April, 1930.

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CHAIRMAN: This is largely a repetition of the results obtained last year and the year before. Unfortunately we have not yet received from the printers the diagrams which show graphically the changes that are expressed in the tables. In general the curves follow the same curves as for Uba cane, except that, as you will have gathered from the paper, deterioration is rather more rapid with the P.O.J. 213 than with Uba, and that there is a bigger increase indicated in the sucrose after burning.

Mr. PALAIRET: This rather shows that we have a lot to learn about the morphology of the cane. We should like to know how the sucrose behaves if burnt cane is left standing in the field for a different number of days, then cut and crushed two days later, which is rather the experience at present. It would be interesting to see how the purity in the field when cut and the purity at the mill 48 hours later compare. I hope the Experiment Station may consider the possibility of touching on that point.

CHAIRMAN: We carried out an experiment on those lines with Uba cane last year.

Mr. BOOTH: I think I am voicing the opinions of the gentlemen present when I congratulate the gentlemen upon this work. Of all the tedious work that falls to the chemist's lot the worst is this deterioration in burned cane, and I think we have just had the final word in the matter. I thank you, personally, and I feel sure my colleagues will join me in thanking you.

Mr. DYMOND: Am I right in assuming the thermal death point of cane to be about 70° C.? I ask this question because the intensity of the fire

**BURNING vs. TRASHING EXPERIMENT—DECEMBER, 1929.**

“ A ” THRASHED CANE. P. O. J. 213.

Days after cutting	0	2	5	7	9	11	12	15
Weight of original 500 lbs., heaps	500	492	465	453	447	434	425	419
Loss in weight—lbs.	—	8	35	47	53	66	75	81
Percentage loss in weight	—	1.60	7.00	9.40	10.60	13.20	15.00	16.20
Sucrose per cent. Cane	11.79	11.76	10.83	11.09	10.74	9.62	9.11	6.43
Sucrose per cent. original weight	11.79	11.57	10.07	10.05	9.60	8.35	7.74	5.39
Fall in Sucrose per cent. of original	—	1.86	14.58	14.75	18.57	29.17	34.35	53.43
Fibre per cent. Cane	12.60	12.50	12.50	12.30	13.30	12.90	14.60	18.40
Java Ratio (calculated)	80.00	77.60	78.80	77.80	75.50	74.70	75.70	63.90
JUICE: Brix	16.10	17.10	17.70	17.60	18.20	17.60	18.30	17.20
Purity	91.60	88.70	77.70	81.00	78.10	73.20	65.70	58.50
Reducing Sugars	0.38	0.92	2.58	1.90	2.20	2.73	3.96	4.76
Reducing Sugar ratio	2.58	6.07	18.80	13.30	15.50	21.20	32.90	47.30
Hours sunshine since preceding test	—	8.60	26.00	14.20	8.60	16.80	12.10	22.30
Mean temperature since preceding test	—	73°	75°	75°	74°	68°	69°	75°
Mean humidity since preceding test	—	79	69	67	75	65	71	71
Rainfall in inches since preceding test	—	0.05	0.04	0.03	0.42	0.06	—	—

Average loss in weight per day = 1.12 %.

## BURNING vs. TRASHING EXPERIMENT—DECEMBER, 1929.

“B” BURNT CANE. P. O. J. 213.

Days after cutting .. .. .	0	2	5	7	9	11	12	15
Weight of original 500 lbs. heaps .. .. .	500	494	470	451	448	445	440	411
Loss in weight—lbs. .. .. .	—	6	30	49	52	55	60	89
Percentage loss in weight .. .. .	—	1.20	6.00	9.80	10.40	11.00	12.00	17.80
Sucrose per cent. Cane .. .. .	11.42	13.33	13.16	12.64	11.05	11.05	9.75	7.74
Sucrose per cent. original weight .. .. .	11.42	13.17	12.37	11.40	9.88	9.83	8.58	6.36
Fall in Sucrose per cent. of original .. .. .	—	+ 15.32	+ 8.31	1.75	13.48	13.92	24.86	44.30
Fibre per cent. Cane .. .. .	12.10	12.40	12.50	12.60	16.00	13.40	15.50	16.90
Java Ratio (calculated) .. .. .	78.20	81.20	81.40	78.80	75.00	75.30	74.10	70.80
JUICE : Brix .. .. .	16.20	17.80	17.70	17.60	17.00	16.90	16.10	15.90
Purity .. .. .	90.20	92.20	91.40	91.10	86.60	86.90	81.70	68.8
Reducing Sugars .. .. .	0.50	0.47	0.47	0.63	0.90	1.09	1.66	2.85
Reducing Sugar ratio .. .. .	3.42	2.86	2.91	3.93	6.11	7.43	12.60	26.10
Hours sunshine since preceding test .. .. .	—	8.60	26.00	14.20	8.60	16.80	12.10	22.30
Mean temperature since preceding test .. .. .	—	73°	75°	75°	74°	68°	69°	75°
Mean humidity since preceding test .. .. .	—	79	69	67	75	65	71	71
Rainfall in inches since preceding test .. .. .	—	0.05	0.04	0.03	0.42	0.06	—	—

Average loss in weight per day = 1.04 %.

**BURNING vs. TRASHING EXPERIMENT—DECEMBER, 1929.**

**"C" BURNT CANE LEFT STANDING. P. O. J. 213.**

Days after cutting	2	5	7	9	11	12	15	22	34
Sucrose per cent. Cane	11.49	11.85	10.43	9.54	9.23	9.60	8.68	6.47	7.17
Fall in Sucrose per cent. of original	—	—	—	—	—	—	—	—	—
Fibre per cent. Cane	14.80	15.80	14.80	13.20	16.70	12.00	13.30	15.50	13.60
Java Ratio	77.90	78.40	76.90	73.90	71.20	76.60	76.70	72.00	74.60
JUICE : Brix	16.20	16.40	14.90	14.50	14.60	14.00	13.30	12.10	12.50
Purity	91.00	92.10	91.10	89.00	88.80	89.50	85.10	74.20	76.90
Reducing Sugars	0.036	0.43	0.46	0.55	0.64	0.51	0.81	1.58	1.15
Reducing Sugar ratio	2.44	2.85	3.39	4.26	4.94	4.07	7.16	17.60	12.00
Hours sunshine since preceding test	8.60	26.00	14.20	8.60	16.80	12.10	22.30	54.10	86.60
Mean temperature since preceding test	73	75°	75°	74°	68°	69°	75°	74°	74°
Mean humidity since preceding test	79	69	67	75	65	71	71	75	67
Rainfall in inches since preceding test	0.05	0.04	0.03	0.42	0.06	—	—	0.03	1.05

**BURNING vs. TRASHING EXPERIMENT—WEATHER RECORD.**

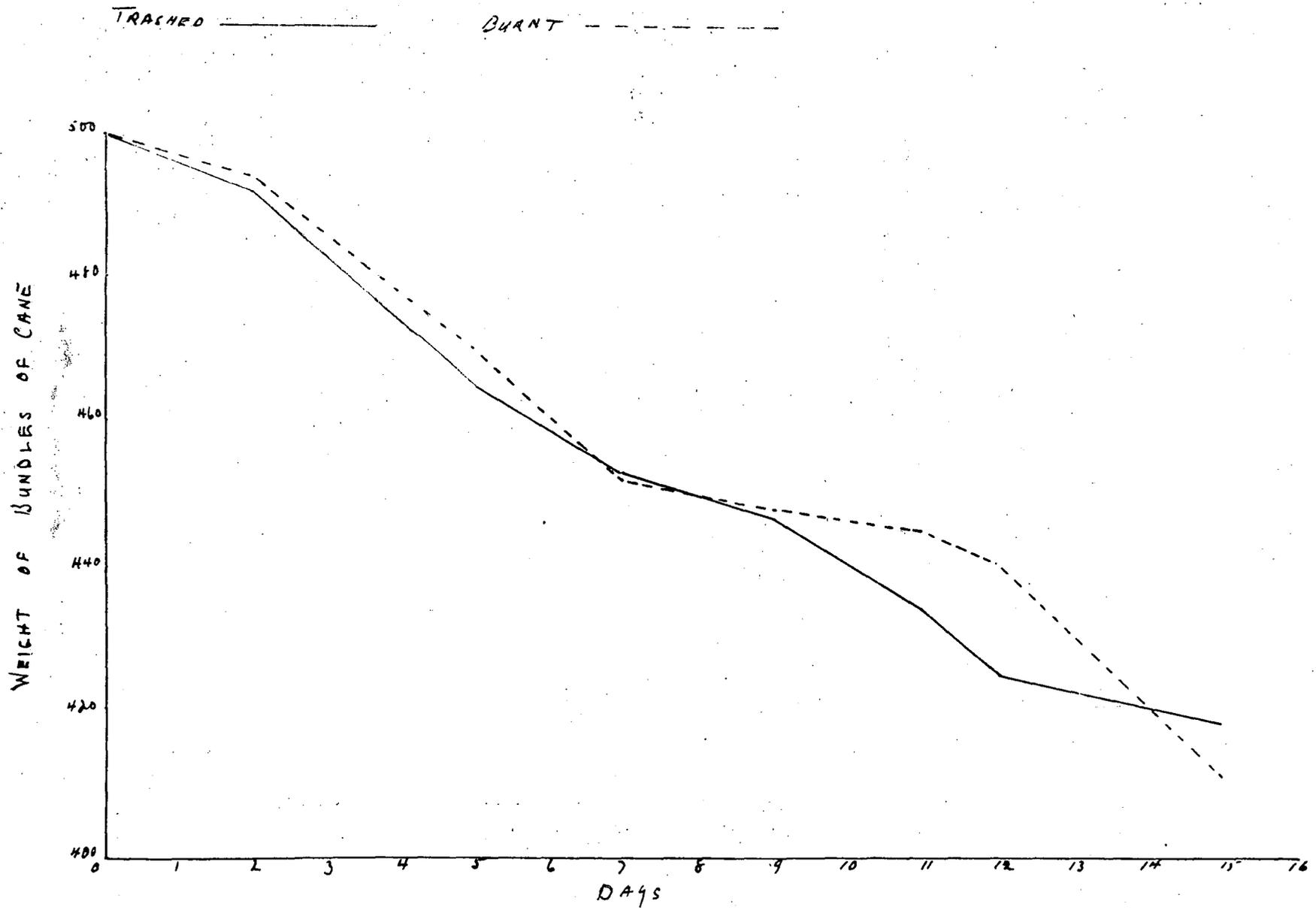
**December, 1929.**

**P.O.J. 213.**

DATE.	Hours Sunshine.	TEMPERATURE.		HUMIDITY.		Rainfall, Inches.	Days from beginning of Experiment.
		Maximum.	Minimum.	8.30 a.m.	1 p.m.		
Thursday, 12/12/29 ..	8.6	85.0	68.0	67.0	63.0	0.03	2
Friday, 13/12/29 ..	0.0	76.0	64.0	93.0	69.5	0.02	
Saturday, 14/12/29 ..	11.6	79.0	66.0	70.0	69.0	—	5
Sunday, 15/12/29 ..	7.8	87.0	69.0	78.0	61.0	—	
Monday, 16/12/29 ..	6.6	80.0	—	66.0	75.0	0.04	
Tuesday, 17/12/29 ..	8.6	85.0	69.5	70.0	81.0	0.03	7
Wednesday, 18/12/29 ..	5.6	79.0	69.0	63.0	67.0	—	
Thursday, 19/12/29 ..	8.1	83.5	66.5	66.5	70.5	0.41	9
Friday, 20/12/29 ..	7.6	74.0	62.0	81.0	80.5	0.01	
Saturday, 21/12/29 ..	9.2	74.5	62.0	57.5	65.5	—	11
Sunday, 22/12/29 ..	7.6	75.0	62.0	81.0	—	0.06	
Monday, 23/12/29 ..	12.1	81.0	59.0	71.0	64.0	—	12
Tuesday, 24/12/29 ..	6.6	82.0	64.0	77.0	59.0	—	15
Wednesday, 25/12/29 ..	6.4	81.0	65.0	74.5	—	—	
Thursday, 26/12/29 ..	9.3	81.0	69.0	59.5	6.05	—	
Friday, 27/12/29 ..	12.1	81.5	68.0	67.0	64.0	—	22
Saturday, 28/12/29 ..	10.8	82.0	63.0	55.0	53.5	—	
Sunday, 29/12/29 ..	11.1	85.0	65.0	67.0	—	—	
Monday, 30/12/29 ..	9.4	82.0	68.0	65.0	61.0	—	22
Tuesday, 31/12/29 ..	8.7	87.5	68.0	62.0	50.0	—	
Wednesday, 1/ 1/30 ..	0.0	76.0	67.5	97.0	83.5	0.03	
Thursday, 2/ 1/30 ..	2.0	79.5	67.0	83.5	75.0	—	

LOSS OF WEIGHT OF TRAINED CANE COMPARED WITH QUANT CANE

P.O. J. 213  
DECEMBER 1929



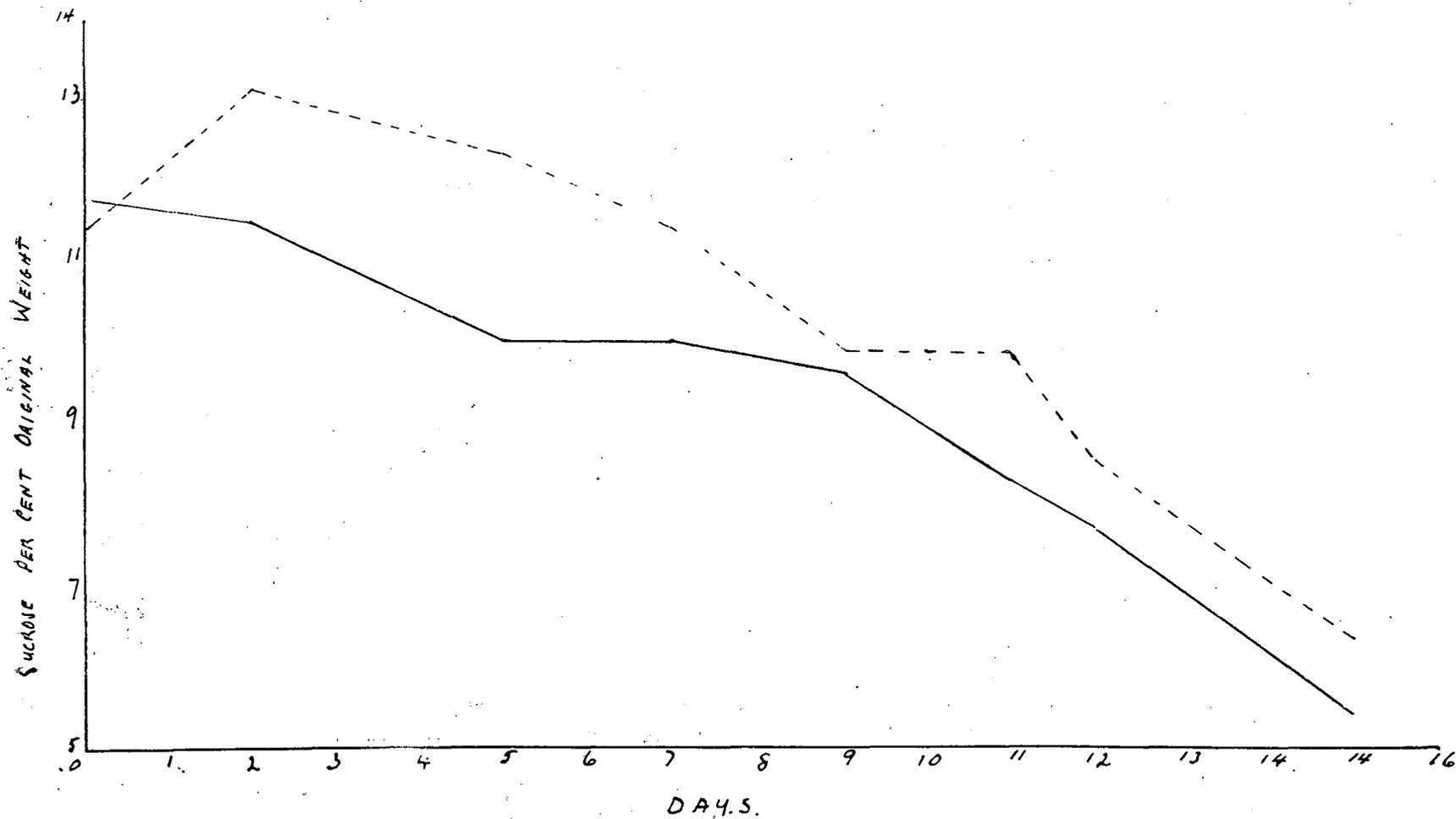
SUCROSE PER CENT OF ORIGINAL WEIGHT OF TRASHED CANE COMPARED WITH BURN T CANE

DECEMBER 1929

TRASHED CANE —————

BURN T CANE - - - - -

P. O. J. 213

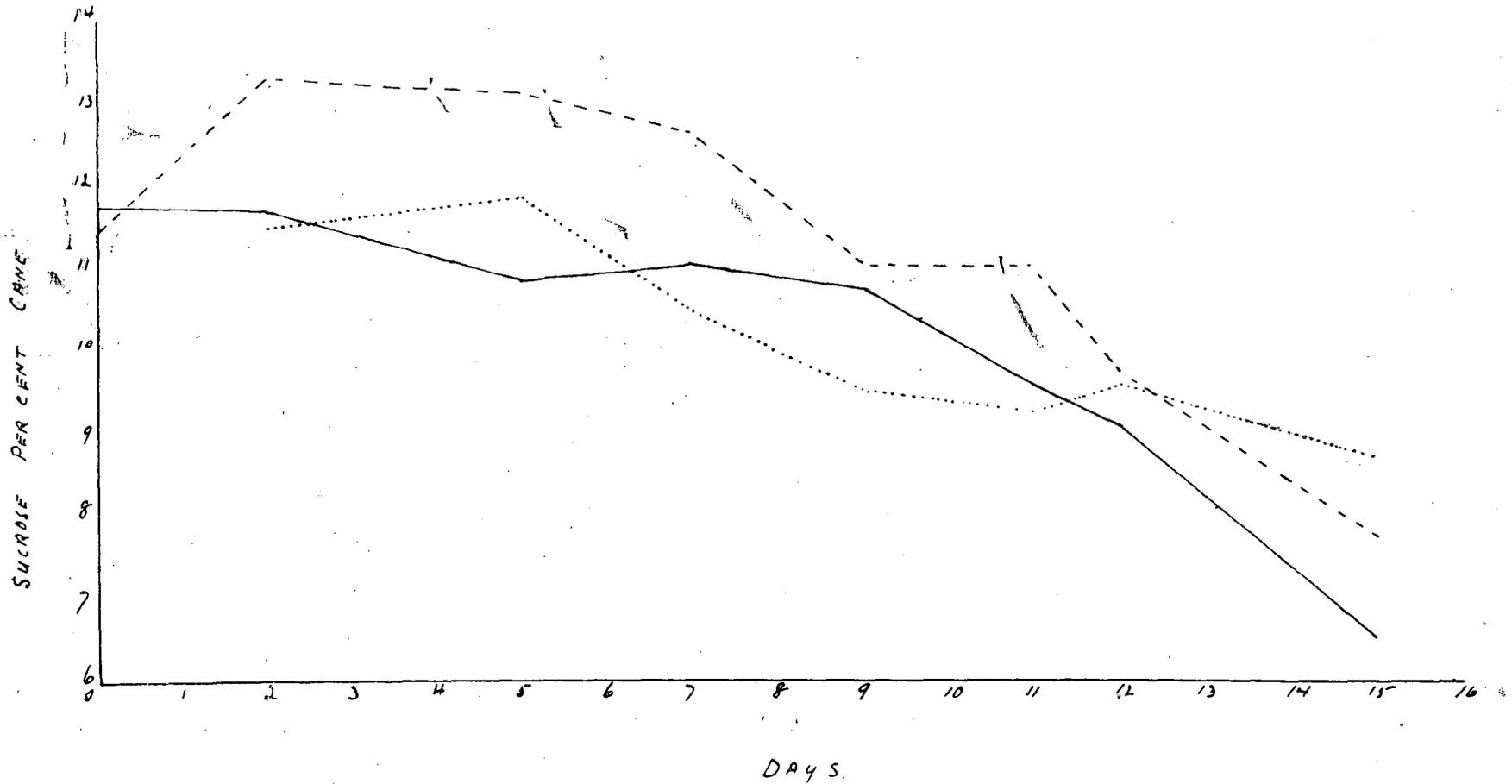


SUCROSE CONTENT OF TRASHED CANE COMPARED TO BURNT CANE

P. O. J. 213

DECEMBER 1919

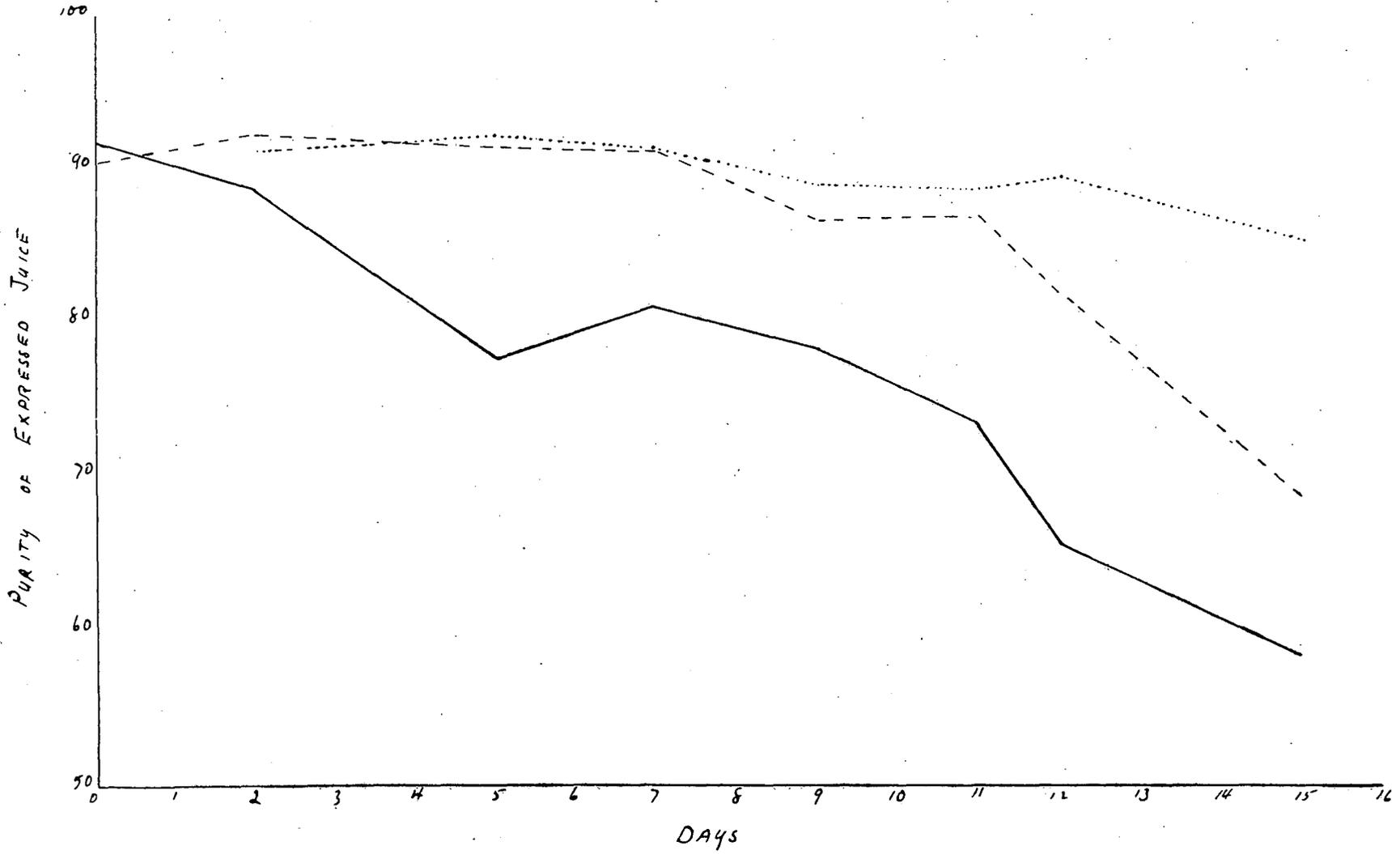
TRASHED ————— BURNT - - - - - BURNT WITHOUT HARVESTING. ....



PURITY OF EXPRESSED JUICE FROM TRASHED CANE COMPARED WITH BURNT CANE

P.O.J 213  
DECEMBER 1929.

TRASHED ————— BURNT - - - - - BURNT WITHOUT HARVESTING ·······



has a very great effect upon the subsequent keeping qualities of the cane. In other countries everybody is very much against burning cane. In such countries the cane is usually hand trashed, and there is very much less trash than with us, so that when they do burn the intensity of the fire is very much less than with Uba. It has been shown that with a poor fire the cane will deteriorate very rapidly, because the cane is not dead, whereas with an intense fire the cane is killed and subsequent deterioration must emanate from extraneous infection. I think this is a very important point, and I wish the Committee on Cane Burning would carry out more experiments with regard to the intensity of the fire.

CHAIRMAN: I quite realise the importance of the point raised by Mr. Dymond. We cannot yet regard the matter as closed because further experiments need to be done with different intensities of burning, but up to the present I should say that all our experiments have been done with a decidedly mild type of burning. It is not easy to get a very severe fire where you are dealing with small blocks of cane, as at the Experiment Station; but in connection with these experiments, as you know they have been growing some of this variety (P.O.J. 213) at Umbogintwini, and I requested them to burn a quantity of it when the field was harvested last season and to send us regular supplies for analysis. Unfortunately, owing to pressure of work, none of us was able to be present at the burning, so I could not say whether or not the cane was more severely burned than in our own experiments. The samples were sent by train and they arrived at such irregular intervals that we could not take the results into account in systematic experiments, so I have not made any reference to the results of these Umbogintwini experiments, but I may mention that there were indications that the falling off, both in sucrose and purity, in the burned cane from Umbogintwini, was much more rapid than with us. So evidently there is more to be learned in this matter, and probably, as Mr. Dymond said, it is a question of the intensity of the burning. It is important because, unquestionably, the accidental burning of cane is usually severe, and it is conditions such as these we ought to study rather than the light burning which we get in our small scale experiments at the Station. I can endorse Mr. Booth's remarks that these analyses are very tedious. I find the interpretation and working out of the figures quite tedious enough, but this Association owes a debt of gratitude to those workers in the laboratory, who have carried out the very tedious chemical analyses

involved. I would like particularly to mention in this connection Mr. Kahn, Assistant Chemist at the Experiment Station.

Mr. DYMOND: There is one other important matter. In work of this nature I would point out that it is important that samples of cane, more especially those which are hand trashed and which are to be kept over extended periods, should be topped at the time of sampling. If this is not done the samples will deteriorate very rapidly. This rapid action is ascribed to certain enzymes which are located in the tops and which permeate the whole stalk after cutting.

Mr. FOWLIE: In the case of our experiments the canes were all topped at cutting time, just in the ordinary way in which you top before sending the cane to the mill.

Mr. BECHARD: Planters come to us and ask whether they should not keep their cane after burning. It is a very difficult thing to advise upon. I know of one case where a man burns enough to last for four or five days. I would like to see some research on the extractability of the cane that has been thus kept. In some experiments I carried out the sucrose increased, but the juice lodged in the cane, and if this is the case it might more than counterbalance the slight increase in sucrose, therefore, the apparent sucrose deserves further consideration. There is also the question of Naudet "plus sugar." I have had occasion to do some work on this, but I am not yet ready to report upon it, but I hope to bring the matter up at the next Congress. I have found an average increase of 0.35 in sucrose on double polarisation. This has been well sustained by Miss Zaphiry, who has studied the question. My line has been to try to establish the possibility of enzymary action, and so far I am inclined to think it is an enzymary action.

The Congress adjourned at 1 p.m.

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The Congress resumed at 2.30 p.m.

CHAIRMAN: The next paper on the programme is a paper on "Varieties of Sugar Cane." I have appended a few notes regarding each of the varieties. The tests are based on hand mill samples and each one is therefore liable to considerable error, but I think each of the series is of value as I have explained later on in the paper.