SOME FACTORS INFLUENCING SUCROSE % CANE AT HIPPO VALLEY ESTATES

by C. A. JOHNSON

Introduction

Sugar cane was first planted at Hippo Valley in 1959, and the first crushing season started in 1962. The period 1962/64 may be considered as a rapid development stage, the main effort being concentrated on the expansion of cane sections to cope with the anticipated crushing capacity of 330 tons cane per hour programmed for the 1966 season. In consequence, little attention could be paid to the finer points of control, and cutting orders were issued on the basis of cane age and variety.

During the 1964 season difficulty was experienced with fluctuations in sucrose per cent cane. Hence for the 1965 season it was decided to introduce a system of maturity testing over the whole Estate, combined with moisture determinations and drying-off routines, in an attempt to obtain a more uniform quality of cane at the gantry, and thereby higher yields of sucrose per acre.

Figure I shows the sucrose per cent cane for the two seasons, 1964 and 1965. Climatically the seasons were comparable except for a wet February in 1964, which probably had an adverse effect on cane quality during the early stages of that season. It will be seen that a much better overall sucrose content of cane was obtained in 1965, but there still existed periodic fluctuations in sucrose per cent cane which will be dealt with in a section of this paper.

Method

To determine the degree of ripeness of the cane, representative samples were taken section by section and field by field, at regular intervals, for analysis. The preliminary results permitted the fields to be placed in categories, irrespective of age or variety. Promising fields were then sampled at more frequent intervals, and before the crushing season started a cutting programme was prepared based on sucrose

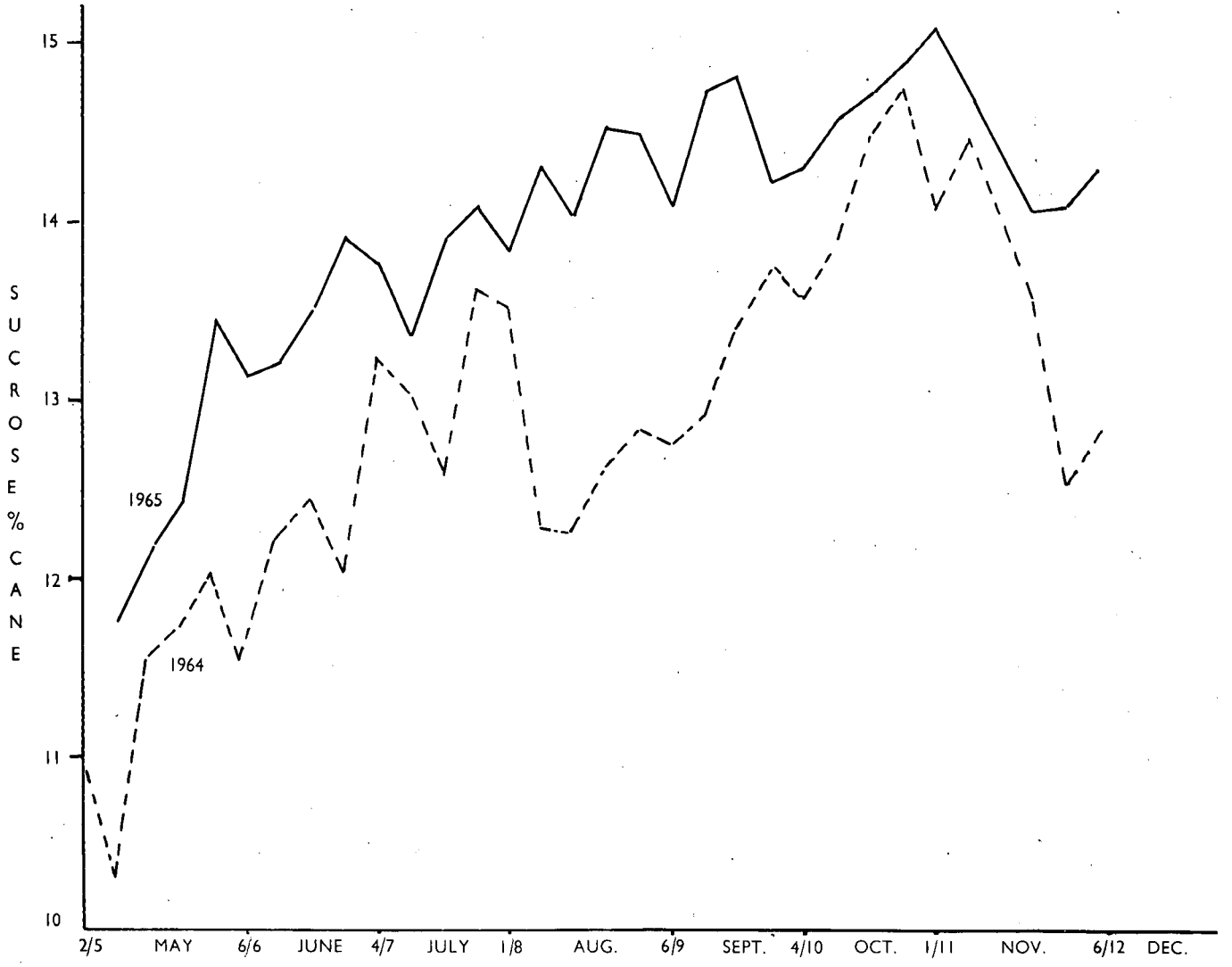

FIGURE I. Sucrose % Cane. Laboratory figures 1964 and 1965 Crops.

per cent cane and juice purity. This maturity testing continued throughout the season, a total of some 3,000 laboratory determinations being made at the rate of 12 to 15 samples per day.

Table I

Pre-season Maturity Tests

Date of Sample	Field No.	Variety	Age Months	Purity %	Sucrose % Cane
2/3	7B	310	11.00	75.0	9.7
29/3			11.75	77.1	11.9
5/4			12.00	83.8	12.7
12/4			12.25	85.4	14.7
16/3	3C	310	10.00	81.2	11.2
31/3			10.50	84.2	12.0
7/4			10.75	83.8	12.6
15/4			11.00	84.8	13.8

Maturity Testing

A random sample of 20 stalks per field was cut early in the morning. If the field contained arrowed or lodged cane, a representative proportion of these canes was included in the sample. After dividing the canes into top, middle and bottom thirds, a composite third was processed in a "Jeffco" shredder. Taking a pre-calculated weight of 327 grams of shredded cane, blending for 10 minutes at 8,000 r.p.m., with 1,000 mls. water and 10 mls. of a 5 per cent solution of Sodium carbonate, after normal clarification, the direct polariscope reading gave the sucrose per cent cane. The remaining two-thirds of the sample was crushed in a small mill, and brix, pol and purity were determined in the normal manner.

Tables I and II show typical progressive readings for individual fields before and after the start of the crushing season.

Table II

Maturity Tests

Date Sample	Field No.	Variety	Age Months	Purity %	Sucrose % Cane
20/5	5C (R)	376	12.50	82.4	12.1
27/5	Irriga-	Redu-	12.70	85.5	12.3
1/7	tion Irriga-	ced Stop-	14.00	86.5	13.6
17/7	tion Harves-	ped	14.50	94.1	16.1
	ted				
25/6	6D (P)	376	16.00	89.0	14.6
16/7			16.75	89.9	15.2
22/7			17.00	90.1	15.9
28/5	7E (R)	376	10.00	85.6	12.9
16/7			11.75	89.6	14.2
13/8			12.50	90.1	15.0
23/7	2C (R)	310	12.00	90.0	15.3
6/8			12.50	90.8	16.3
13/8			12.75	91.0	16.5
1/7	1E (R)	310	12.00	88.7	14.9
26/8			13.75	90.4	16.3
2/9			14.00	90.0	16.5
10/9	8A (R)	310	12.50	89.3	15.4
18/9			12.75	89.5	16.0
1/10			13.25	92.5	17.0

Drying-off

From the preliminary maturity tests, selected promising fields were programmed for harvesting. Depending upon the time of year, the system of irrigation (overhead or furrow), the soil type, and the climate, a tentative reduction in frequency of irrigation was made. This was followed by further maturity tests, and as the ripening proceeded a decision was

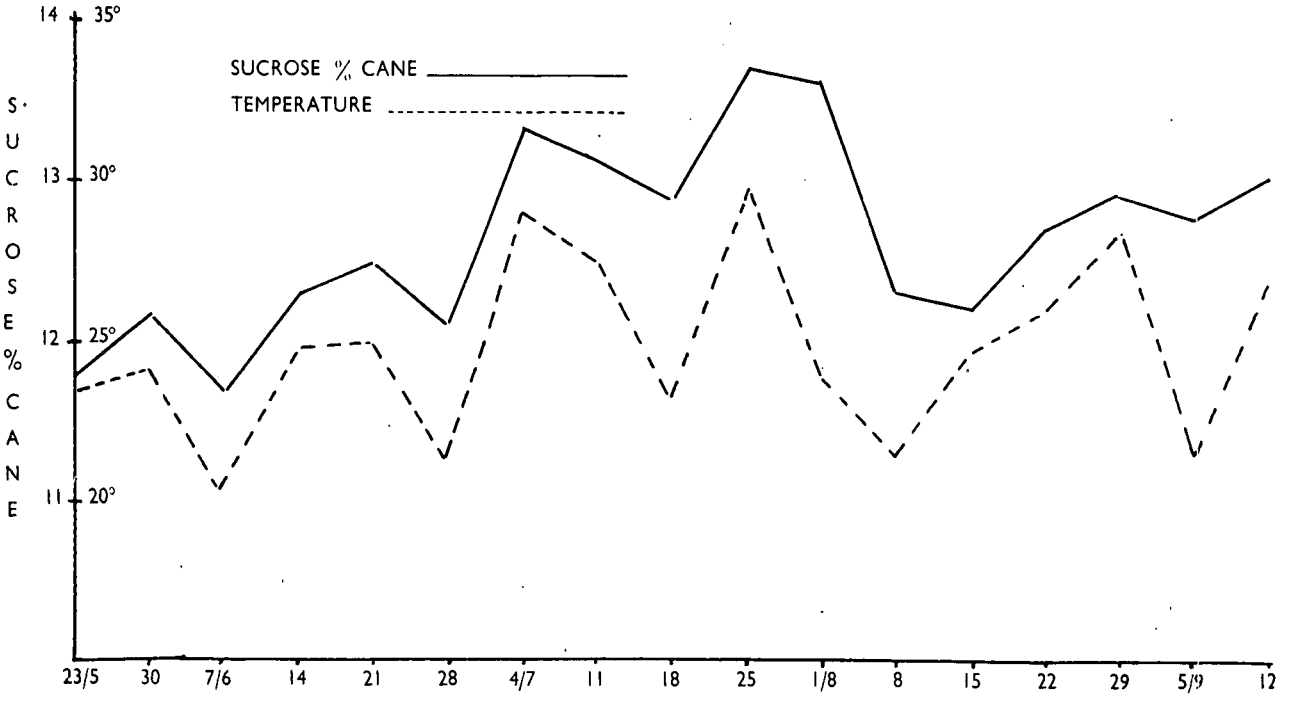

FIGURE 2. Average Weekly Sucrose % Cane: Diurnal Temp. Range 1964.

taken on when the last irrigation should be applied. Water was withheld entirely for periods of two to six weeks prior to harvesting. Table III shows some typical drying-off routines.

To assist in this timing of drying-off, moisture determinations were made using the 4th/5th internode. Representative samples of six tops were cut, as far as possible from stalks of identical stages of top growth. The 4th/5th internode tissue consists of the section of the stalk between the intercalary meristem immediately above the 4th and 6th leaf attachments. The samples were quartered, weighed, oven-dryed at 85° C and a direct moisture determination made. With ample water at the time of maximum growth, the moisture content is approximately 92 per cent. With drying-off the moisture content falls slowly to 90 per cent, after which dehydration becomes rapid as irrigation is withheld. Table IV shows some typical moisture determinations, together with the sucrose per cent cane of the samples.

Temperature Effects

There is no doubt that cutting on a maturity basis has helped to eliminate some of the big fluctuations in sucrose per cent cane, but a number of smaller variations are still to be seen in Figure 1. Analysis of temperature data has shown, for the past two seasons, a strong correlation between sucrose per cent cane and diurnal temperature range one calendar month before harvesting.

Figures 2 and 3 show the positions for the 1964 and 1965 seasons respectively.

If the temperature graph is plotted one month in advance, it is possible to predict a drop in sucrose per cent cane, and this was done on five occasions this last season. With the temperature range recorded in advance and the field maturity figures, amendments will be made to the cutting orders next season as follows:

Table III

Drying-off routines: Furrow Irrigation

Soil Type	Average depth of soil in feet	Available moisture per foot of soil in inches	Pan Factor		Normal irrigation cycle at 1.8 in./application		Drying-off cycle	
			May	Oct.	May	Oct.	May	Oct.
Sandy Clay Loam. Derived from Paragneiss	2.0	1.7	.092	.218	14 days	6 days	1.8 in. — 14 days 1.8 in. — 21 days Nil — 28 days	1.8 in. — 6 days 1.8 in. — 12 days Nil — 14 days
Heavy Active Clay. Derived from Basaltic Larvas	1.5	3.0	.092	.218	19 days	8 days	1.8 in. — 19 days 1.8 in. — 28 days Nil — 28 days	1.8 in. — 8 days 1.8 in. — 14 days Nil — 21 days

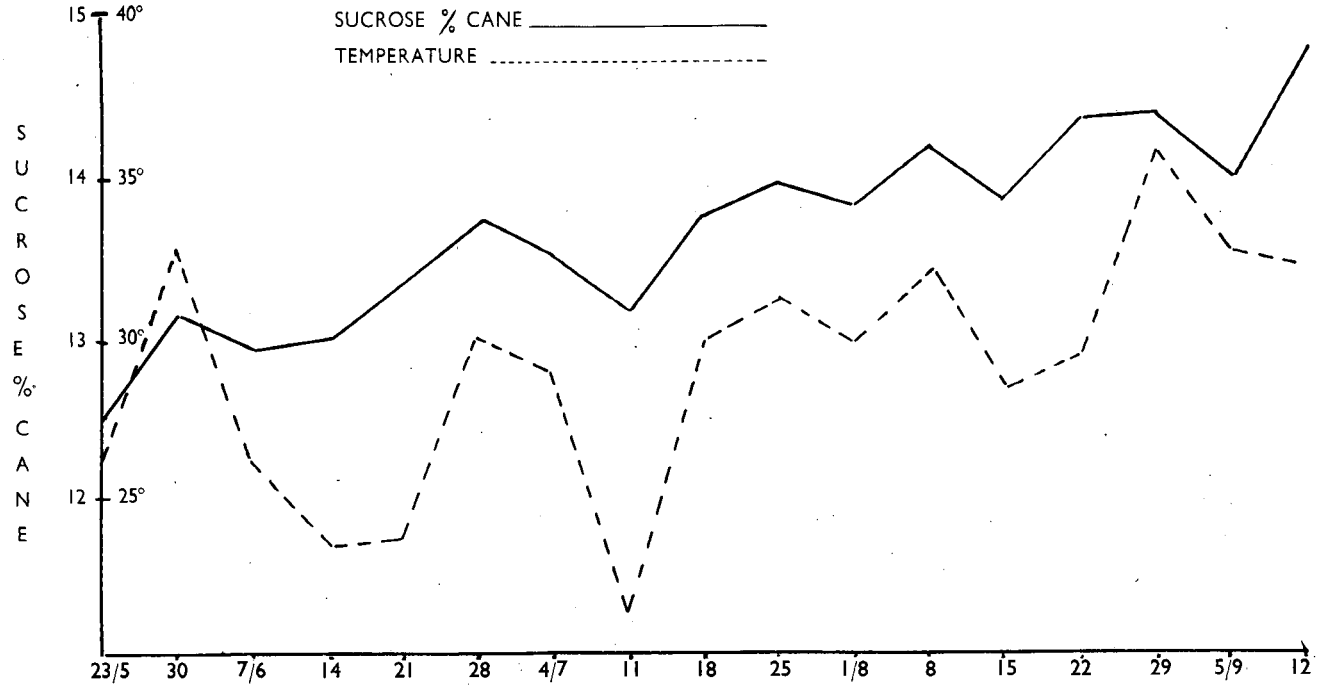

FIGURE 3. Average Weekly Sucrose % Cane: Diurnal Temp. Range 1965

For periods where the diurnal range is less than 25° F, cutting will be switched to suitable mature fields of N:Co.310 of known high sucrose.

For periods where the diurnal range in greater than 30° F, cutting will be switched to mature fields of N:Co.376.

At temperature ranges between 25° F and 30° F cutting of both varieties will continue on a normal maturity basis.

In this way it is hoped to be able to maintain cane at the gantry with a more constant sucrose per cent cane, which in turn will be reflected in smoother running of the factory, and a higher overall recovery.

Table IV

4th/5th Internode Moisture Determinations

Sample		Moisture %	Average Moisture percentage and sucrose % cane	
6C	a	88.8		
	b	89.2		
	c	88.3	89.0%	13.66%
	d	89.3		
	e	88.8		
	f	90.7		
7A	a	90.0		
	b	88.6		
	c	88.9	88.2%	13.39%
	d	90.0		
	e	87.5		
	f	87.5		
4A	a	88.0		
	b	88.0		
	c	84.6		
	d	90.0	87.8%	15.06%
	e	91.7		
	f	86.7		
2A	a	83.3		
	b	82.3	81.4%	17.06%
	c	81.0		
	d	80.9		

Results and Discussion

Due to the many variable factors involved, it is always difficult to assess the benefits of one individual practice in agriculture, but there is no doubt that by careful routine analysis and correct drying-off, the yield of sugar per acre can be raised. Correcting for mill efficiency and overall recovery, there has been an 8 per cent increase in sugar production from the same acreage of cane, with slightly lower yields of cane per acre in the last season compared with the 1964 results. How much of this can be attributed to the above exercise is difficult to say.

Conclusions

To obtain maximum yields of sugar per acre per month, correct drying-off is essential. Maturity testing and plant moisture determinations play an essential part in the drying-off routine.

Summary

Routine maturity testing for sucrose per cent cane continued throughout the season. Stalk moisture determinations were used in conjunction with the maturity figures in planning drying-off cycles. A correlation was found between diurnal temperature range and sucrose per cent cane.

Acknowledgments

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References

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Mr. du Toit: The sucrose percent cane is low at the start of the season, rises in the middle of the season and then falls again. Mr. Johnson says they start the season by cutting N:Co 310, which has a consistently high sucrose content.

But it is difficult to decide when to cut a variety which starts with a fairly poor sucrose content and never increases appreciably.

It is very important to establish correct drying-off times and the pattern of ripening of the different varieties.

Mr. Johnson: Figure I indicates exactly what happened in the 1964 and 1965 seasons.

There were carry-overs of cane in both seasons but in 1964 it was all milled in the first month and caused the big drop in sucrose. In 1965 the carry-over was spread more evenly throughout the season, which was started with N:Co 310, then N:Co 376 and back to N:Co 310.

Mr. Andries: I do not see how you can phase varieties unless you cut at 12 or 24 months, If you cut at 14 months you will be out of phase with that variety the following season.

I agree with Mr. du Toit that you will get your best average sucrose by cutting the high sucrose varieties at their optimum periods.

Mr. Johnson: Last year we cut 8,000 acres of plant cane at 14 months but this year we will cut 17,000 acres mostly at 12 months so phasing will not be difficult.

I would like to mention that by maturity testing and drying off it is quite possible to induce both higher sucrose and higher purity in 10 months old cane.

Mr. Andries: In the Big Bend area of Swaziland it would be quite impossible to cut cane at 9 months, particularly if it was well topped.

I think it would only be feasible in our case to ripen the cane between 9 and 12 months if it was all harvested between August and October.

Mr. Johnson: It is in September that we have the widest diurnal temperature range which should have an effect on sucrose in October and November but cloud effect must also be considered.

Mr. Glover: I think that temperature is also important because when the temperature drops at night growth slows down a lot and sugar demand for growth may not be as high as normal. If a bright day follows, considerable sucrose is made which may not again be distributed for growth on a succeeding cold night and so the sucrose will build up in store.