The impact of harvesting on the viability of sugarcane production in the Wet West

Andrew Simpson, Paulette Wright and Weston Fray

ABSTRACT

Poor cane quality and subsequent low cane prices that result in marginal returns to farmers prompted a study to ascertain the impact of harvesting on the viability of sugar cane production in the Frome area. Samples of 8-10 mature stalks properly base cut, topped, and free of debris, were taken from certain fields and analysed at the core laboratory for Jamaican Recoverable Cane Sugar (JRCS). Commercial deliveries core sampled from the same fields during the normal course of harvesting (kill to mill times noted) were used for comparison. The results over five annual seasons indicated that the clean samples delivered promptly to the factory had higher JRCS, pol, purity and brix readings compared to commercially harvested canes, which had higher fibre and sediment readings. The average loss in quality from field to factory for the period 2002 to 2007 ranged from a low of 1.79 in 2007 to a high of 2.481 in 2006, with a mean annual value of US $11.9/tc. It can be concluded that inefficient harvesting, in terms of 'kill to mill' delay and the inclusion of extraneous matter, had contributed to significant financial losses. Achieving and maintaining delivery of 80% of the canes in 24 hours with the remainder supplied within 48 hours is absolutely essential if quality in the region of 11 JRCS is to be obtained and cane farming viability sustained in the area.

Keywords: cane quality, farm viability

INTRODUCTION

The Frome sugar factory is located in central Westmoreland which is a part of the Wet West region, one of five ecological regions of the Jamaican sugar industry. Frome sits in the Westmoreland plains and bordering areas of the parish of Hanover. The Frome factory has the capacity to produce 100,000 tonnes of sugar annually, however, in the last 10 years, the factory has struggled to produce 65,000 tonnes of sugar in and crop. The factory receives cane from just under 1,700 farmers producing from 5,693 ha of land plus the 4,548 ha cultivated by the Sugar Company of Jamaica. The harvesting period usually runs from December to May with annual production of some 600,000 tonnes of canes.

Poor sugar cane quality delivered to the factory has been a main contributing factor to the low sugar yields and low prices paid out to farmers. This has resulted in a high cane to sugar ratio over a number of years. In the Frome area sugar yields have been consistently low with annual average JRCS ranging from 8.98 to 10.73 during the last decade, never exceeding the industry average, **Table I,** (Anon; 2006).

Table 1. Mean JRCS at Frome compared to the National Average 1998-2007		
YEAR	**Frome Average JRCS**	**National Average JRCS**
1998	9.23	9.29
1999	9.27	9.52
2000	10.73	11.22
2001	9.44	10.10
2002	9.90	10.05
2003	8.98	9.57
2004	10.49	10.62
2005	10.42	10.46
2006	9.33	9.92
2007	9.47	9.69

The core sampling method (Hylton; 1989) was implemented in 1990 to more accurately determine the quality of canes delivered to the Jamaican factories and to ensure a more equitable method of payment. Core sampling gives a complete analysis of purity, pol, brix, fibre, pol% and sediment in juice to calculate the JRCS. This method of determination is quality based, hence high quality canes attract high prices but the converse is true.

There are a number of factors that may affect the quality of sugar canes. The prevailing weather leading up to harvest is a major factor causing variation in quality (Alexander 1973). Samuels and Landrau (1956) showed that cool air temperature positively influences sugar cane ripening. Shaw (1979) showed that rainfall also impacts negatively on sucrose accumulation by stimulating vegetative growth. During the last quarter of the growing season, low temperature and water stress combine to limit growth and help to increase sugar yield (Alexander, 1973; Wright, 2001). Wright (2001) showed that higher than normal rainfall during the harvesting period was associated with lower than normal cane quality in the Frome area, and may have been largely responsible for many farmers earning low payments. With Frome frequently receiving above average rainfall, an increasing number of farms had become uneconomic and had gone out of production.

This study was initiated in 2002 to determine the impact of harvesting on poor cane quality. The study would also quantify loss to the Frome farmers as a result of inefficient harvesting.

MATERIALS AND METHODS

Sampling was influenced by distance of the field from the factory, weather and the number of growers undertaking harvesting at any given time. Fields to be reaped were identified, documented, and monitored to establish time of kill. Each field was first sampled after burning (kill) by collecting 8-10 mature stalks diagonally across field. Cane samples were properly base cut and topped and taken free of extraneous matter to the core laboratory for analysis to determine brix, pol%, purity, and ultimately the JRCS. The analyses were completed within three hours of cut. Commercial cane from the same field, harvested in conventional manner, was routinely cored at the factory gate and similar readings taken in the core laboratory. Time from kill (burning) to mill was recorded for each load of commercial canes delivered from the fields in question.

The data were collected throughout the entire crop for five years from 2002 to 2007 except in 2005. The number of fields sampled varied each year and were 132, 124, 29, 139 and 88 respectively. A t-test was used to determine if differences observed between the means of the standard and commercial samples were statistically significant, and the results subjected to an analysis of variance.

RESULTS AND DISCUSSIONS

If field samples are an indicator of potential JRCS, then test results obtained from commercial deliveries are an indicator of the level of cane deterioration occurring in the harvesting/delivery process. Over the five-year period of the study, this loss of quality ranged from 1.79 to 2.68 JRCS points (<0.001), **Table 2**. Mean JRCS of field samples was12.14 ± 0.67 compared to 9.71 ± 0.91, p<0.001, for commercial deliveries.

Table 2: Comparison of mean JRCS of standard vs commercial canes from each field sampled in Frome area between 2002 and 2007.

Category/Year	2002	2003	2004	2006	2007	5-Yr. Mean
Field Samples	12.27	11.30	13.09	12.26	11.78	12.14
Commercial deliveries	9.94	8.68	11.06	9.78	9.99	9.71
Difference	2.33	2.62	2.03	2.48	1.79	2.43
# of Samples	264	248	58	278	179	
% Potential loss	18.99	23.2	15.51	20.23	15.2	20.03

Table 3 shows the average JRCS for commercially harvested canes and the sugar price for each corresponding year of the study. This information was used to calculate the price of cane using the following formula:

$$CP = SP \times FRI\ (JRCS \times RF - FF);$$

where CP = Cane Price; SP = Sugar Price; FRI = Factory Recovery Index; Jamaican Recoverable Cane Sugar; RF = Relative Factor and FF = Factory Fraction. In all calculations a Factory Recovery Index of 0.0091 was used.

Table 3: Sugar price, average JRCS and corresponding price per tonne cane, 2002-07

Year	Sugar Price $	Average JRCS for Frome	Price/Tonne $
2002	27,787	9.89	1529.71
2003	31,387	8.98	1478.12
2004	31,387	10.50	1903.93
2006	36,838	9.32	1831.20
2007	38,877	9.69	2067.85

Even while acknowledging that the quality of commercially harvested cane with all its trash and dirt and some degree of staling could never measure up to carefully selected, properly cut and

cleaned, cane samples that are promptly tested, the challenge must be to manage harvesting to minimise the deterioration between killing and milling. That deterioration is quite costly, estimated at between US$9.18/tc in 2007 and US$16.85/tc in 2002, **Table 4**. This is a considerable loss representing in 2002 more than 50% of the average cane price. With harvesting cost usually being roughly 30% of cane price in the Frome area, a deterioration of this magnitude is eroding the profitability of cane production. Looking at the value of the loss of quality, against the cost of harvesting, in the worst instance (2002) the deterioration would have paid twice over for cost of harvesting, **Table 5**.

Table 4: Potential cane price with major harvesting inefficiencies eliminated, 2002-07

Year	Sugar Price $	Potential JRCS	Price/tc J$	Potential J$ Saving/tc	US$/tc Equivalent	Deterioration as %Cane Price
2002	27,787	13.1233	2347.29	818	16.85	53.50
2003	31,387	11.2899	2137.88	660	11.39	44.65
2004	31,387	12.5279	2483.20	579	9.44	30.40
2006	36,838	11.8019	2663.17	832	12.63	45.43
2007	38,877	11.4807	2701.36	634	9.18	30.66

Table 5: Value of cane deterioration as a percent of harvesting cost

Year	Value of Potential Savings J $	Harvesting Cost per tonne cane J $	Value of Savings as %Harvesting cost
2002	**818**	**360**	**227.2**
2003	**660**	**430**	**153.5**
2004	**579**	**423**	**136.9**
2006	**832**	**517**	**160.9**
2007	**634**	**621.95**	**101.94**

CONCLUSIONS & RECOMMENDATIONS

Although this study was not designed to quantify the impact of various factors influencing deterioration observations of the harvesting revealed that the process was often plagued by lengthy ‘kill to mill’ periods, improper base cutting (stumping), poor topping, little or no piling and extraneous matter in the pile load. It can be concluded that inefficient harvesting, in terms of ‘kill to mill’ delay and the inclusion of extraneous matter, in the Frome area has contributed to significant financial losses. It seems reasonable to believe that, given the quality of cane detected from field samples, an average JRCS in the region of 11 should be achievable. With proper organisation and cooperation, delivery of 80% of the canes in 24 hours with the remainder within 48 hours, could also be achieved, thus adding to the likelihood of improved quality.

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