SHORT, NON-REFEREED PAPER

QUANTIFYING THE BENEFIT OF EARLY SEASON CHEMICAL RIPENING AT A MILL SCALE – CASE STUDY OF COMMERCIAL SUGARCANE FIELDS IN THE UMZIMKULU SUPPLY AREA

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Abstract

Chemical ripening of commercially grown sugarcane in South Africa is a well-researched and established method of enhancing sucrose content and reducing non-sucrose content. A search of the literature revealed that there has not been a study quantifying the benefit at a mill supply region scale. The Recoverable Value (RV) payment system used in South Africa incentivises growers to maximise sucrose content while minimising fibre and non-sucrose content in cane produced. The aim of this research was to quantify the benefit of early season chemical ripening for both growers and millers at a mill supply region scale. Quality and yield data obtained from cane samples were analysed from fields that had portions of both ripened and unripened cane. Sampled fields varied in terms of climatic conditions, soil types and depths, varieties, age of cane, ratoon age and topography. The averages of the sampled results were extrapolated to the total ripened area of the mill supply region. The results obtained from this study further demonstrated a significant increase in the RV% of the ripened cane, with an average increase of 2.14 RV percentage units. The estimated net benefit to the sugar value chain from early season ripening was estimated, based on the final 2016/17 Division of Proceeds, at approximately R169/tc, in the Umzimkulu area, for the 2016/17 milling season. Although the work was carried out in the Umzimkulu mill supply area in South Africa, the methodology could also be applied to other sugarcane areas.

Keywords: sugarcane, chemical ripeners, recoverable value, cane quality, mill-scale, South Africa

Introduction

Sugarcane chemical ripening is a well-researched and established method of enhancing sucrose content and reducing non-sucrose content (e.g. Rostron 1985; Solomon and Yang-rui 2004; Eksteen *et al*. 2015). In addition, Rufino *et al*. (2001) and Romero *et al*. (2000) highlight some of the other benefits of chemical ripening, which include bringing forward the start date of the milling season, lower residue content, increased milling throughput efficiency and a lower cane to sugar ratio.

The above-mentioned benefits highlight that the application of chemical ripeners as a farming practice can provide one of the quickest returns on investment. However, limited attention has been placed on increased final sugar production and hence, the revenue gains to the overall value chain.

This study aimed at the development of a simplistic method that quantifies the average benefit of ripening, on a farm level, as well as to the sugar value chain. The work involved extrapolating sampled results from early season ripened sugarcane in the Umzimkulu sugarcane supply area.

Materials and Methods

To quantify ripening benefits to the value chain, a small sample was used to verify that previous research results (e.g. Rostron 1985; McDonald *et al*., 2000; Ngxaliwe and van Heerden 2015), in terms of quality enhancement and change in cane yield, are applicable for the Umzimkulu area. Quantifying the additional benefits of ripening (e.g. bringing forward the start date of the milling season, lower trash content, increased milling throughput efficiency and a lower cane to sugar ratio (*cf.* Rufino *et al*., 2001)), were excluded in this study.

Sample and data collection

Ten commercial fields were sampled in April-May 2015 (9 weeks after ripener application), which represents 2.5% of the total sprayed area. All sampled fields were ripened with fluazifop-p-butyl, but also had small portions of the field that had been left unripened. Reasons for a field having unripened portions include, amongst others, missed section (pilot error or applicator fault), power lines over the field and the proximity to trees and buildings. Two bundles of cane consisting of 12 stalks each were taken per field, one bundle to represent the ripened and one to represent the unripened cane sections. It was necessary to obtain data from the same fields, rather than adjacent fields on a farm, due to fields having different characteristics. The sampled fields varied from each other in terms of variety (N12; N39; N41), age of cane (15 to 24 months), ratoon number (1 to 10), soil types and depths, aspect, topography and altitude. The stalks were cut at ground level, trashed and the tops removed at the natural breaking point. Sample bundles were then weighed and sent to the Cane Testing Service (CTS) laboratory for Direct Analysis of Cane (DAC), to quantify cane quality parameters. All samples were tested at the laboratory between 15 and 19 hours after collection. In addition to the samples, growers provided field and quality results after harvesting the sampled fields.

Data analysis

The sample weights and quality indicator results from DAC were used to determine a proportional change in these factors between unripened and ripened samples. The harvest data provided by the growers were assumed to be representative of a ripened field, since the areas left unripened were very small in comparison. It was also assumed that the management factor, extraction operations and harvest to crush delay remained the same for all sample fields. Using the proportions calculated from the sample weights and DAC, the cane yields and quality data provided by commercial growers were used to estimate what each field would have produced, if it had not been ripened. It was assumed that the harvest date for the sample fields would have remained the same if the cane had not been ripened.

The costs of harvesting, infield-haulage, loading and transport of the cane to the mill are usually charged on a per cane ton basis. Therefore, it was assumed these costs remained the same.

Net benefit analysis

The sampled results were quantified according to the final 2016/17 season Division of Proceeds. The 2016/17 sugar to RV ratio of 91.78% was applied to the total tonnes RV gained from ripening, in order to estimate the total increase in sugar production.

Results and Discussion

As was reported in previous research (e.g. Rostron 1985; Kingston and Rixon 2007; Ngxaliwe and van Heerden 2015; van Heerden *et al*. 2015), there was no difference in the average cane yield (t/ha) between the fluazifop-p-butyl ripened and unripened cane samples. The average yield of the sampled fields was 72.42 t/ha.

Figure 1 illustrates the ripened versus unripened proportionate quality ratios for each field. A value above one indicates that the ripened cane sample had a higher value than the unripened cane sample. All the samples indicated an increase in sucrose and a decrease in non-sucrose content, which agreed with previously reported results (e.g. Rostron 1985; McDonald *et al*. 2000; Solomon and Yang-rui 2004; Eksteen *et al*. 2015; Van Heerden *et al*. 2015). Fibre content was more variable with seven samples displaying a decrease in fibre. These factors resulted in the RV% of all the ripened samples being higher than the unripened samples. Based on the average RV% increase being 22%, the average increase in RV% was calculated to be 2.14 percentage units. However, it is important to note the variance in results, which can be attributed to diverse climatic conditions and field characteristics of the sample fields.

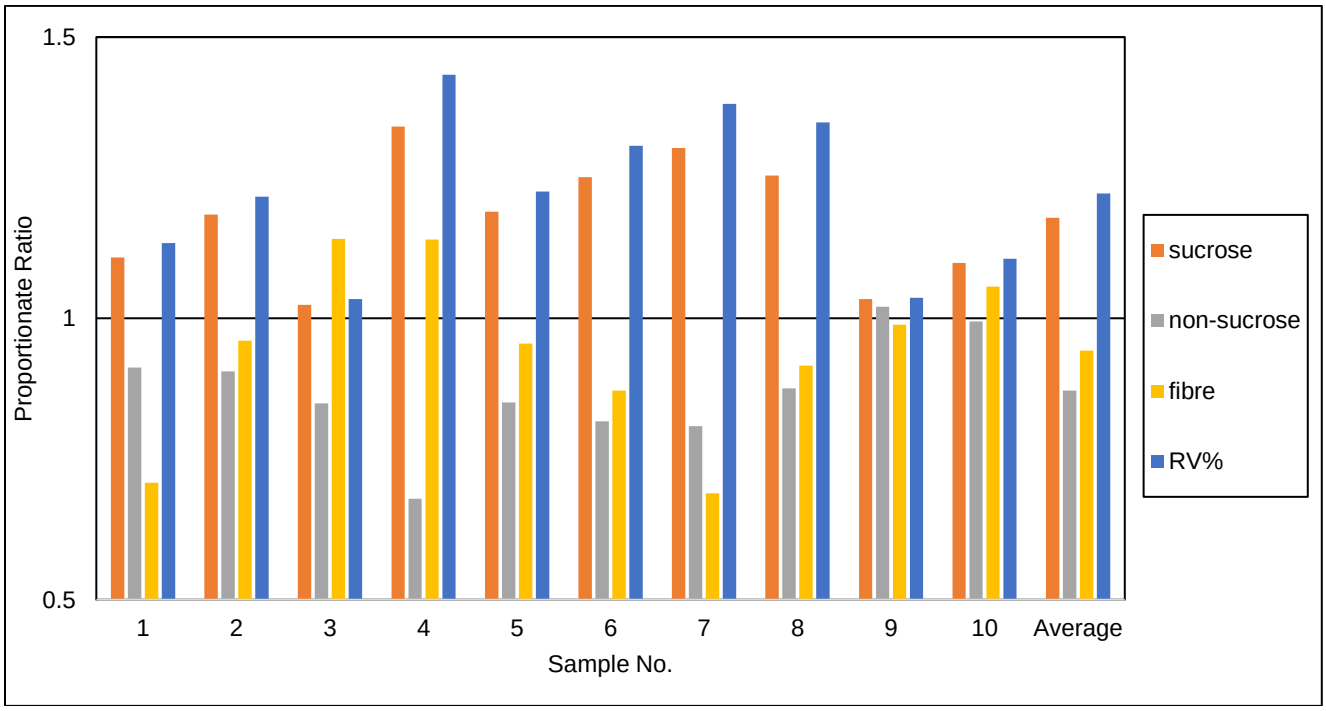

Figure 1. The proportionate sucrose%, non-sucrose%, fibre% and RV% ratio between ripened and unripened cane samples. Values above 1 (solid line = 1) indicate a higher value in the ripened sample.

Table 1 displays the financial benefit of early season ripening, in the 2016/17 season, to the Umzimkulu value chain. The total benefit was based on the averaged sampled proportionate ratio for RV%, which is extrapolated for the total chemically ripened spray area. The total value of the additional RV tons to the value chain is estimated at R23.5 million for the Umzimkulu area, in the 2016/17 season. The net benefit is estimated to be R11 403/ha, after considering the ripened cost.

Table 1. Estimated benefits from chemically ripening sugarcane in the Umzimkulu supply area - 2016/17 season.

Area sprayed (ha)	1 970
Average yield (t/ha)	72.42
RV unit increase	2.14%
RV increase (t RV)	3 050
Sugar to RV ratio	91.78
Sugar increase (t)	2 799
Avg. notional price	R8 966
Value of additional sugar	R25 096 520
Cost of ripening (per ha)	R476
Total cost of ripening	R937 720
Net mill scale benefit	R24 158 800
Net mill scale benefit per ha	R12 263
Net mill scale benefit per tc	R169

Conclusions

The results obtained from this study agree with previous research that demonstrates that chemical ripeners increase sucrose content and reduce non-sucrose content. Ripening as an agronomic input has a relatively short interval between cost of application and crushing of eight to twelve weeks. This research further demonstrates that ripening provides a quick and substantial return on investment. Ripening increases profitability for both grower and miller, and should continue to be exercised under favourable climatic conditions. This methodology can be applied in other milling areas. It is noted that this study had a small sample size and was conducted over one season only. Similar studies over a longer period are required to reduce result variability.

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