AN ANALYSIS OF THE 1998-99 RECOVERABLE VALUE (RV) CANE QUALITY SCHEME TO DETERMINE THE VARYING EFFECTS OF GROWING CONDITIONS AND MANAGEMENT PRACTICES ON CANE QUALITY

GM GROOM

South African Cane Growers' Association, PO Box 1278, Durban, 4000, South Africa

Abstract

The 1998-99 cane season saw Tongaat-Hulett Sugar introduce Recoverable Value (RV) cane quality schemes at all their South African sugar mills. These local arrangements are seen as forerunners to an industrial cane quality payment system, and the 1998-99 results are invaluable when analysing the financial impact of an industrial RV scheme on the individual grower. Under an RV payment system certain management practices will need to change. Other factors, however, remain beyond the control of the grower. This paper attempts to differentiate between the effects of management on cane quality and those of growing conditions.

Introduction

In 1996 a cane quality task group was appointed by the South African sugar industry to investigate alterations to the cane payment system, which would improve the quality of cane delivered to South African sugar mills. The estimated recoverable crystal (ERC) cane payment system was seen as an appropriate means of achieving and sustaining cost effective cane quality improvements. Under this system growers would be paid only for the estimated sugar which would be recovered from their cane, which to a large degree is a function of the sucrose, non-sucrose and fibre contents of their cane. In 1997 this ERC formula was modified to take account of the current and possible future values of fibre and molasses, hence the development of the recoverable value (RV) concept.

With no agreement reached for a change to the industrial cane payment system by the end of 1997, Tongaat-Hulett Sugar took the initiative to negotiate local RV schemes at all their mills for the 1998-99 season. This arrangement meant that total mill sucrose proceeds were to be divided among growers according to their individual tons of RV. Much like a vertical slice, these local schemes would ensure that there was no redistribution of growers' funds between mill areas. Within each mill area there would, however, be a redistribution of funds from the poorer quality growers to the better quality growers. To compensate growers for the additional costs incurred through farming for RV, an up-front payment to growers was also negotiated at each of the mills. This payment was essentially the growers' share of the anticipated net benefit to each area after taking account of additional revenue and costs associated with an RV scheme. The RV formula applied by Tongaat-Hulett Sugar was:

RV% cane = Sucrose % cane - 0,35 x non-sucrose % cane - 0,02 x fibre % cane.

As the above RV formula demonstrates, growers are effectively penalised for the levels of non-sucrose and fibre in their cane. The natural response to this is therefore to investigate means of reducing these undesirable components of the cane stalk. Practices such as lower topping, increased ripening, and reduced burn/harvest to crush delays (BHTCD), are all ways in which growers can improve their cane quality and ultimately the overall performance of the South African sugar industry (Cox and Sahadeo, 1992).

The degree by which a grower is a 'gainer' or a 'loser' in financial terms under an RV scheme, depends not only on the quality of his cane, but on how it compares with the quality of his fellow growers. The RV:sucrose ratio is an indicator of where the grower ranks. Growers with an RV:sucrose ratio greater than that of the group average, whether compared to a mill area such as with a local scheme or the entire industry, is a gainer under an RV scheme and vice versa. The local schemes have the effect therefore of protecting growers by ensuring that they are only compared with growers in their region, as opposed to growers in areas with superior cane quality. The converse is also true, however, and means that grower groups can be worse off under a local scheme than under an industrial scheme as a result of their superior cane quality.

There is no doubt that growing conditions play an important role in cane quality. One needs only to look at the range of yields, age of crop, and climatic potentials between the northern irrigated, coastal, and inland regions of the sugar industry. Within each of these regions factors such as soils, topography, irrigation and distance to the mill all influence cane quality. Under similar growing conditions, however, management practices will ultimately determine how the individual performs under a cane quality payment system.

The aim of this paper was therefore to determine to what extent management plays a part in the performance of growers under a cane quality payment system.

Data

All conclusions drawn from this analysis were based solely on the results of the 1998-99 cane season. All five of the Tongaat-Hulett mills were included in the analysis, namely Felixton, Amatikulu, Darnall, Entumeni and Maidstone. More focus is placed on the Felixton group, where individual grower yields were incorporated into a detailed analysis.

Cane quality data was extracted from the CTS To-date Classification reports for the 1998-99 season. Although these were deemed to be final delivery figures, a relatively small amount of suspense cane was yet to be allocated at the time of accessing the data. Sucrose (relative and actual), non-sucrose, fibre and RV data was used in the analyses.

The hectares harvested, used in determining yield per hectare figures for the Felixton area, were obtained from the Felixton Mill Group Board final estimate.

An anticipated final sucrose price for the 1998-99 season of R938 per ton was used to determine the Rand per ton values of cane, as well as the local RV prices for each mill.

It must be noted that in certain areas the 1998-99 season was characterised by a dry autumn and winter, as well as a declining crop towards the end of the season as a result of both growing conditions and age of crop. Furthermore, no recognition was made of the fact that individual yield figures may have been affected by the age of cane (carry-over or immature), the degree of ripening and the time of harvest.

Procedures

To determine whether a grower will gain or lose under an RV scheme, one can compare his RV% sucrose with that of the mill (under a local scheme) or to that of the industry (industrial scheme). Stated differently, a grower will gain under an RV scheme should the product of his RV% and the RV price exceed that of his sucrose percent and the sucrose price (with no consideration given to additional costs or revenue). The RV price for each Tongaat-Hulett mill was calculated by dividing each mill's total sucrose proceeds by that mill's total tons of RV. With the RV price established, one can compare the Rand per ton of cane proceeds under an RV system as opposed to a sucrose system.

There is, however, an inherent weakness associated with this Rand per ton of cane comparison. As a result of possible lower topping practices under an RV scheme, there is a certain amount of sucrose left behind in the field. Higher topping under a sucrose system would reduce the sucrose % cane but increase the tons sucrose per hectare. A comparison on a per hectare basis is therefore perhaps a more acceptable means of determining the actual gainers and losers under such a scheme.

Nonetheless, due to the complexities of predicting sucrose loss through lower topping as well as sucrose increases through ripening and reduced BHTCD, the assumption is made that the Rand per ton cane basis will suffice for an analysis of this nature. Furthermore it is recognised that the increase in tons of sugar (from a less than proportionate increase in tons of sucrose) as a result of the cane quality improvements will have the effect of improving the industrial sucrose price as well as the local RV prices. It is therefore difficult to predict what the sucrose price would have been without any cane quality improvements in 1998-99.

The following procedures were used to isolate the management factor:

Rand per ton of cane ranking

In an attempt to remove as far as possible the uncontrollable effects of growing conditions from the controllable effects of management, growers in each mill area were grouped climatically and/or agronomically into homogenous regions. Factors such as soils, rainfall, irrigation, location and distance to the mill were all used to determine these groupings. Homogenous regions in Felixton were determined largely by irrigation, rainfall and soil factors. Amatikulu, Darnall and Entumeni homogenous regions where grouped according to soils and geographical location, whereas Maidstone's regions were based largely on geographical location. A description of the regions appears in Table 1.

Table 1. Descripion of homogenous regions

Felixton			**Amatikulu**
1.	Northern Irrigated	-	1. Nyoni South
2.	Heatonville	irrigated (scheme)	2. Nyoni North
3.	Mtunzini	dryland	3. Gingindhlovu East
4.	Empangeni North	dryland	4. Gingindhlovu West
5.	Felixton Flats	dryland (water table)	5. Eshowe
6.	Heatonville	irrigated (riperian)	6. Emoyeni
7.	Felixton Hills	dryland	7. Melmoth
8.	Nkwaleni	irrigated	8. Small Growers
9.	Small Growers	dryland	
10.	Empangeni West	dryland	
11.	Mposa	dryland	
Entumeni			**Maidstone**
1.	Eshowe	Nottingham series	1. Coastal Sands
2.	Eshowe	Umzinto series	2. Coastal Hinterland
3.	Entumeni	Nottingham series	3. Rising to Plateau
4.	Entumeni	Umzinto series	4. Upper Plateau
5.	Small Growers	-	5. MCP
			6. Small Growers
Darnall			
1.	Darnall	Dwyka, Shales, etc	Poor
2.	Darnall	Shales, TMS, etc	Good
3.	Darnall	Coastal Sands	Generally poor
4.	Kearsney	TMS Ordinary soils	Average to good potential
5.	Doornkop	Dwyka soils	Poor to low potential
6.	Doornkop	TMS Ordinary soils	Average to good
7.	Doornkop	TMS Mistbelt soils	Good

The growers in each homogenous group were then ranked according to the variance between the Rand per ton of cane under RV and that under sucrose. Relative sucrose and RV figures were used in the analysis as these form the basis of the cane payment system.

Rand per ton variance plotted against yield

A more advanced method of analysing the figures was to determine whether a correlation existed between the degree

by which growers gained/lost and their yields per hectare harvested. For this exercise only figures from the Felixton area were used. These were obtained by dividing their tons of RV by the number of hectares actually harvested in the 1998-99 season.

The fundamental assumption made in this analysis is that, without expert knowledge of each and every individual's farming system, yields are ultimately the best indication of good management practices.

Before drawing any conclusions, cognisance must be taken of the factors that can affect Rand per ton cane figures resulting in the characteristic scatter of results and 'outliers' as depicted on the XY charts in Figure 1.

Stressed cane. Under dry conditions cane growth is impeded and a natural ripening takes place. This results in lower tons cane but a high sucrose % cane, and more often than not, a good quality cane. Similar results can also be achieved from cane stressed as a result of poor management practices, such as a lack of weed control. In both these instances there will be a negative correlation between yields and the Rand per ton cane variance, resulting in the outliers depicted on a number of the charts.

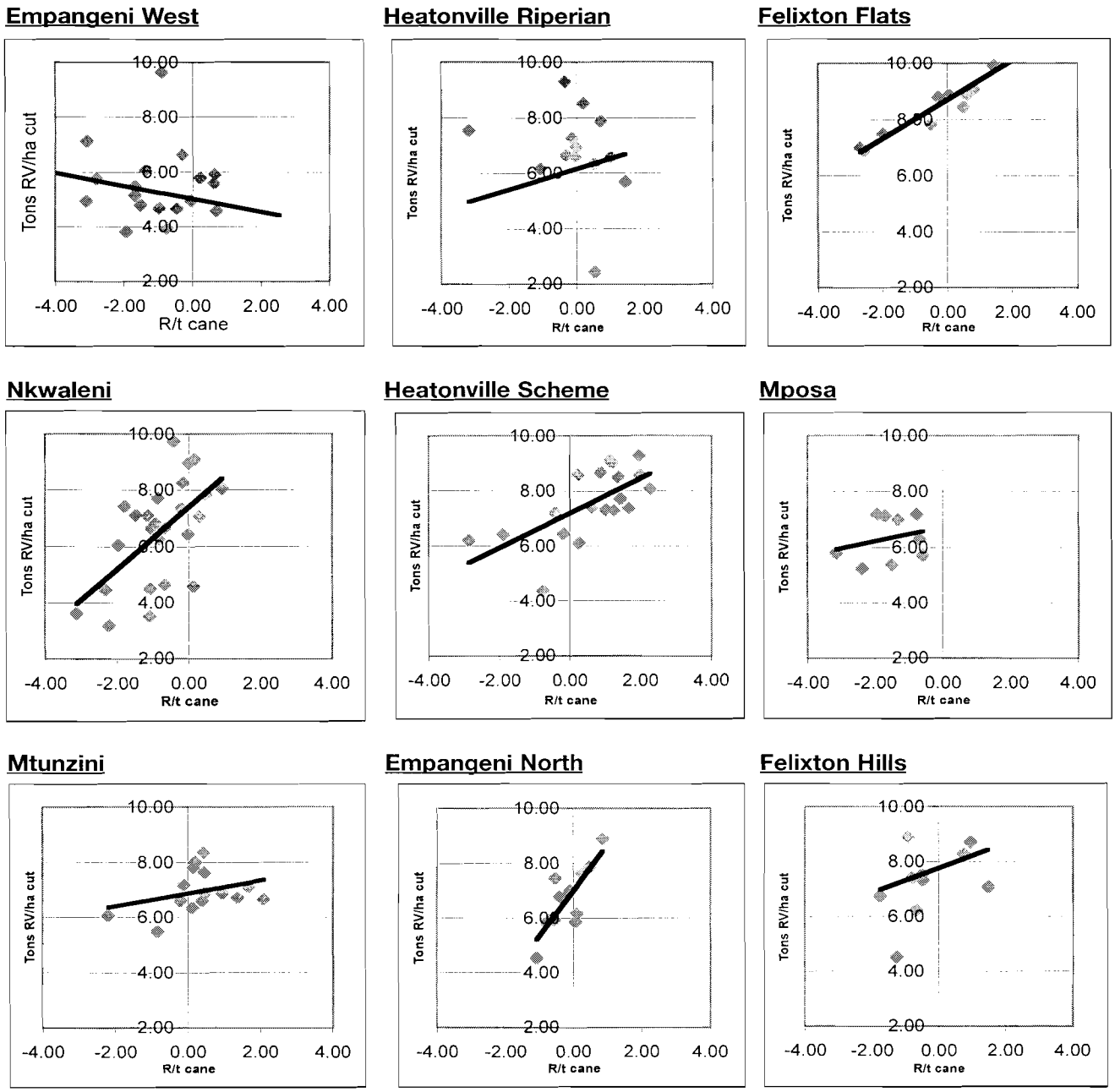

Figure 1. Felixton RV R/ton gain/loss(X) vs Tons RV/Ha cut(Y)

Table 3. Local RV prices (Rand).

Mill	RV % sucrose	Local RV price	Industrial RV price
Felixton	90,60	1 035,32	1 025,60
Amatikulu	92,05	1 019,04	1 025,60
Entumeni	92,95	1 009,16	1 025,60
Darnall	91,76	1 022,25	1 025,60
Maidstone	91,07	1 029,98	1 025,60

Table 4. Felixton correlation coeffcients.

X = Rand per ton gain/loss Y = tons RV per hectare cut	
Felixton Flats	0,95
Empanheni North	0,80
Heatonville Scheme	0,66
Nkwaleni	0,59
Mtunzini	0,32
Felixton Hills	0,29
Mposa	0,27
Heatonville Riperian	0,18
Empangeni West	-0,24

The net Rand per ton gain/loss per mill area was always zero, as there was a redistribution of funds only among growers within each area. The up-front payments negotiated at each of the mills were excluded from this analysis.

Upon initial analysis of the range in the Rand per ton of cane figures, it can be broadly stated that the range of results between homogenous regions could be attributed to growing conditions, whereas the range within the regions was influenced largely by management practices.

Results of the second analysis are contained in Figure 1, which displays a number of charts with the Rand per ton variance plotted against tons RV for homogenous regions in the Felixton area. A trend line is inserted onto each XY scatter chart so that any correlation can be observed. Table 4 summarises the correlation coefficients for the same charts.

The XY charts and correlation coefficients showing the relationship between yields and Rand per ton gain/loss, further supported the initial findings. In the majority of cases, a positive correlation exists between the Rand per ton cane variance and yields, indicating that management plays a significant role in cane quality. Five of the regions exhibit correlations of greater than 0,30, which indicates a good to strong positive relationship. The high degree of scatter on the charts and the low correlation coefficients for certain regions, can largely be attributed to the factors affecting cane quality.

For the final analysis, six growers from the Maidstone mill area were selected to determine whether the system developed by Eric Hulbert to analyse the influence of management within homogenous regions would support the results depicted above. Table 5 summarises their individual results for the 1998-99 season.

Grower A delivered mature or ripened cane (high DM% cane), with more than 50% of his DM consisting of Bx (good topping, effective burning/trashing). The high purity indicates fresh cane. Grower B delivered less mature cane, with a lower Bx%DM and purity indicating excessive extraneous matter and longer BHTCDs. Grower C, although delivering cane with a lower DM% cane (less mature) than grower D (and the regional average), achieved a higher Bx%DM and purity. Grower D in this case perhaps delivered more tops and trash and had longer BHTCDs. Cane delivered by Grower E was again more mature, cleaner and fresher than that of grower F. In this analysis growers A, C and E were from the top of their respective homogenous regions in terms of Rand per ton of cane rankings, whereas growers B, D and F were from the bottom.

When the best growers from region 2 (coastal hinterland) and region 4 (upper plateau) were compared, it was clear that coastal growers were disadvantaged by higher fibre (high DM% cane but lower Bx%DM) and lower purities.

As with the previous two analyses, this analysis of the components of the cane stalk identified a trend in each homogenous region which points towards certain management practices that can be implemented to improve cane quality. Therefore, although there is clearly a quality bias in favour of inland and irrigated cane, management practices within each homogenous region certainly do play a significant role in improving cane quality.

It must be emphasised at this point that severely drought stricken cane would display similar characteristics to cane that is poorly topped and delivered after a long delay, in that fibre and non-sucrose levels would be abnormally high as a

Table 5. Composition of cans stalk analysis (Maidstone).

		Percentages		Indices (homogenous regions)			
Gr	Region	DM%	Bx%DM	P%	DM%	Bx%DM	P%
A	4	30,37	52,5	87,9	1,00	1,04	1,05
B	4	29,39	49,6	81,3	0,99	0,97	0,99
C	3	29,88	50,3	85,8	0,97	1,00	1,02
D	3	31,75	45,7	80,8	1,03	0,91	0,99
E	2	31,72	50,7	84,6	1,07	0,99	0,99
F	2	30,78	46,6	80,8	1,01	0,93	1,00

Maximising yields. Certain growers prefer to maximise their yields as opposed to their input/output or cost/benefit ratios. Over-fertilising, for instance, will generally result in increased yields in terms of tons of cane, but a decrease in quality (Stevenson *et al.*, 1992). In this instance tons cane in particular may be higher yet the grower may be a loser in terms of cane quality. Again this will produce a negative correlation between yield and Rand per ton cane variance.

Components of the cane stalk

A system of analysing the influence of management within each homogenous region was recently developed ([1]personal communication). The system can also be used to highlight any obvious quality differences between regions. This 'rule-of-thumb' analysis attempts to isolate the effect of management on cane quality by focusing on factors such as extraneous matter and BHTCDs. The process looks at the actual (not relative) sucrose % cane (S%), dry matter % cane (DM%), brix % dry matter (Bx%DM) and purity (P) of an individual's cane, relative to that of his homogenous region.

To determine the S%, DM%, Bx%DM and P indeces, each individual's data is expressed as a percentage of that homogenous area's data. This eliminates most of the geographic and climatic influence on cane quality. If, for instance, the Bx%DM index is greater than 100, the individual has clean cane relative to the group and vice versa. As a rule of thumb, a grower whose Bx%DM index is greater than his DM index is making more of an effort to reduce fibre or extraneous matter than the rest of his group. The interpretation of the performance of a grower relative to his groups proceeds as follows:

Dry matter %. As growth is more accurately measured using DM accumulation (Bond and De Haas, 1990), a very high DM% cane, and hence a low moisture content, indicates mature or ripened cane. Conversely, a low DM% cane is found with younger cane that is still growing vigorously.

Brix % dry matter. This figure indicates the usefulness of the dry matter. A high Bx%DM suggests that most of the DM is useful (either sucrose or non-sucrose) and is not fibre or extraneous matter. A low DM% cane with above average Bx%DM suggests low levels of fibre and extraneous matter as a result of accurate topping and effective burning/trashing. A high DM% cane with a markedly low Bx%DM suggests an abundance of fibre and extraneous matter.

Purity. This measures the usefulness of the Brix. Above average purity indicates a high level of sucrose as opposed to non-sucrose (fresh cane). Low purity suggests that Brix is not very useful as a result of excessive BHTCDs.

Mature or ripened cane that is clean and has been correctly topped and delivered to the mill within a reasonable time, will exhibit favourable characteristics such as high DM% cane, a high Bx%DM and a high purity. This analysis was performed on selected growers in homogenous regions at Maidstone.

[1] Mr EO Hulbert, Extension Officer, SASEX

Results and discussion

Tables 2 and 3 summarise the results for the five mills, and show the RV price established at each mill, the average Rand per ton variance within each homogenous region, and the variance between each region. The industrial RV price has also been included to demonstrate how certain groups would have been better or worse off under an industrial RV scheme.

Table 2. The RV "Gainers" and "Losers" on a Rand per ton cane basis.

Area/ region	Top grower	Bottom grower	Range	Average R/t gain/loss	Average R/t Ind gain/loss
FELIXTON					
1	3.98	0.62	3.36	2.20	0.90
2	2.29	-2.86	5.05	0.62	-0.56
3	2.09	-2.19	4.21	0.48	-0.64
4	0.87	-1.08	1.91	-0.15	-1.30
5	2.08	-2.70	4.68	0.05	-1.04
6	1.43	-3.18	4.52	0.04	-1.11
7	1.48	-1.74	3.16	-0.20	-1.34
8	0.93	-3.13	3.99	-0.42	-1.50
9	-	-	0.00	-0.51	-1.66
10	2.53	-4.06	6.46	-0.89	-2.04
11	-0.57	-3.13	2.51	-1.47	-2.55
Total	**3.98**	**-4.06**	**8.04**	**0.00**	**-1.14**
AMATIKULU					
1	1.12	-0.32	1.44	0.57	1.43
2	1.34	-1.84	3.18	0.05	0.88
3	1.07	-1.28	2.35	0.04	0.86
4	1.23	-1.92	3.15	-0.11	0.71
5	2.01	-3.15	5.16	-0.29	0.52
6	1.53	-3.80	5.33	-0.25	0.55
7	3.56	-1.86	5.42	1.91	2.82
8	-0.25	-1.41	1.16	-1.08	-0.28
Total	**3.56**	**-3.15**	**6.71**	**0.00**	**0.83**
ENTUMENI					
1	0.84	-0.08	0.92	0.35	2.50
2	1.18	-0.48	1.66	0.52	2.73
3	-0.52	-1.14	0.62	-0.82	1.28
4	0.59	-0.96	1.55	-0.23	1.96
5	-	-	-	0.13	2.32
Total	**1.18**	**-1.14**	**2.32**	**0.00**	**2.17**
DARNALL					
1	1.49	-2.60	4.09	0.03	0.45
2	0.67	-1.86	2.53	-0.33	0.08
3	0.79	-1.22	2.01	-0.59	-0.19
4	2.11	-1.14	3.25	0.31	0.73
5	2.67	-1.10	3.77	0.56	1.00
6	1.66	-1.64	3.30	0.12	0.54
7	0.92	-0.44	1.36	0.33	0.75
Total	**2.67**	**-2.60**	**5.27**	**0.00**	**0.42**
MAIDSTONE					
1	0.49	-4.88	5.37	-0.66	-1.15
2	1.58	-2.65	4.23	-0.13	-0.64
3	2.13	-2.92	5.05	0.03	-0.49
4	2.93	-2.01	4.94	0.77	0.25
5	2.06	-0.98	3.04	0.63	0.10
6	-0.87	-3.47	2.60	-1.42	-1.91
Total	**2.93**	**-4.88**	**7.81**	**0.00**	**-0.52**

Note: Based on a final sucrose price for the 1998/99 season of R938 per ton.

result of low moisture levels and increased sucrose conversion. Lionnet (1993) showed the effect of drought on pol and purity. In such cases it is generally accepted that very little improvement in quality can be achieved through improved management.

Conclusion

It is evident from the results that, under an RV scheme, coastal growers are on average worse off than inland growers, and that dryland growers are worse off than those able to irrigate their cane, particularly in a dry season. Growing conditions, irrigation practices and in particular age of cane, play a significant role in determining the financial impact on growers of an RV scheme. The considerable reduction in age of cane over the past decade, largely to control the cane borer *Eldana saccharina* Walker (Lepidoptera: Pyralidae) (Inman-Bamber, 1991), has had a significant effect on cane quality.

In conclusion, the results would indicate that growing conditions play a major role in determining cane quality when comparing coastal with inland, or dryland with irrigated, regions. It is therefore accepted that, with identical management practices, cane quality will always differ from region to region. However, within each homogenous region there was a difference between the best and worst grower, suggesting that management plays a very important role even in areas that are prejudiced as a result of their growing conditions. Good management practices can therefore significantly improve cane quality and in this way reduce any financial losses brought about by an RV scheme, be it introduced locally or industrially.

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REFERENCES

Bond, RS and de Haas, AO (1990). Comparison of a series of varieties at two harvest ages. *Proc S Afr Sug Technol Ass* 64: 26-29.

Cox, MGS and Sahadeo, P (1992). Post harvest deterioration of burnt cane in bundles. *Proc S Afr Sug Technol Ass* 66: 220-223.

Inman-Bamber, NG (1991). Some physiological factors affecting the optimum age and season for harvesting sugarcane. *Proc S Afr Sug Technol Ass* 65: 103-108.

Lionnet, GRE (1993). Some effects of the drought during the 1992-93 season. *Proc S Afr Sug Technol Ass* 67: 209-216.

Stevenson, DWA, van der Merwe, A, Benninga, W, and Allison, JCS (1992). Response of different sugarcane varieties to greater than normal applications of nitrogen. *Proc S Afr Sug Technol Ass* 66: 50-53.