

# DELIVERY EFFICIENCIES AND CANE QUALITY IN THE SOUTH AFRICAN SUGAR INDUSTRY: BENCHMARKING AND PENALTY ALLOCATIONS

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## Abstract

The Recoverable Value cane payment system and length of milling season controls were introduced in SIA 2000 as an incentive to growers to improve cane quality. In addition to these controls, the effects of seasonal cane quality, scheduling of non-rateable deliveries and cane quality differences between different homogenous regions within mill areas need to be considered to maximise mill area productivity (i.e. maximise cane quality) and mill capacity utilisation (i.e. minimise no cane stops) in terms of cane delivery timing. This paper examines incentives within the current institutional framework surrounding cane supply and attempts to identify and correct existing delivery inefficiencies. The solution comprises a penalty allocation mechanism, which can be fully automated and incorporated into the Laboratory Information Management System, both of which are flexible and can accommodate specific circumstances at the different mill centres. The mechanism comprises delivery window periods such that the timing of deliveries can be traded, which encourages selective harvesting of the best quality cane available. This should enhance the profitability of mill areas and the South African sugar industry as a whole. It also creates an incentive for growers to collectively reduce the impacts of accidental fires by informally exchanging delivery timings. The increased accountability for deliveries enables Local Area Agreement penalties to be apportioned amongst those individuals responsible. Penalties raised could also be used by the Local Grower Council to create an 'income stabilising fund' for its grower constituency. The penalty allocation mechanism creates the necessary incentives for growers and their agents to improve their estimating and delivery performance.

**Keywords:** delivery, efficiency, quality, estimates, penalty, incentives

## Introduction

The Recoverable Value (RV) cane payment system and length of milling season (LOMS) controls were introduced in SIA 2000 as an incentive to growers to improve cane quality. In addition to these controls, the effects of seasonal cane quality, scheduling of non-rateable deliveries ('Rau, personal communication) and cane quality differences between different homogenous regions within mill areas ('Thomson, personal communication) need to be considered to maximise mill area productivity (i.e. maximise cane quality) and mill capacity utilisation (i.e. minimise no-cane stops) in terms of cane delivery timing. Moreover, delivery timings and its effect on cane quality impacts sugar quality ('Lionnet, personal communication), which has international marketing and price implications, further increasing the need to better manage delivery timings. In achieving this objective, New

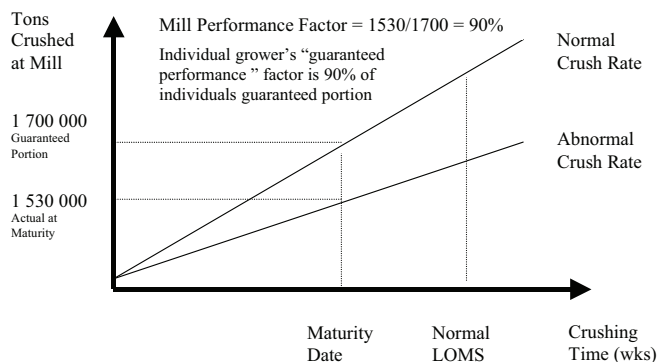
Growth Theory argues that if physical and human resources are to be fully utilised, incentives need to be created by prevailing institutions to achieve this objective (Olson, 1996). This paper examines incentives within the current institutional framework surrounding cane supply and attempts to identify and correct existing delivery inefficiencies.

## Accountability and delivery performance

Presently, the Mill Group Board (MGB) computes daily (or weekly) rateable deliveries (DRD) from each grower's estimate to provide that grower with a guideline to enhance effective deliveries. However, this system often causes delivery inconsistencies because many growers are unable to deliver rateably. It also restricts growers from 'over' delivering when no-cane stops arise. Growers that 'under' deliver are penalised according to current MGB rules by having their already unattained DRD restricted, which may further aggravate cane supply problems. Neither miller nor grower has an incentive to enforce these rules because the viability of both parties is dependent on the volume of cane crushed. An alternative institutional framework needs to be entertained that:

- provides equal opportunities to all growers to deliver their entire crop
- ensures consistent cane deliveries to the mill throughout the LOMS
- embraces the proposed benchmark mechanism; and
- is not in conflict with the relative cane payment system.

An alternative framework would be to monitor each grower's actual tons cane delivered against a benchmark of estimated tons cane to be delivered. In so doing, it is proposed that pre-season crop estimates be divided into horizontal and vertical components. Horizontal cane supply is a function of the area to be harvested. Vertical cane supply is a function of climatic conditions and its variable effect on yield. Obviously, growers cannot be held accountable for this variable and uncontrollable portion. Nevertheless, growers could be held accountable to deliver the horizontal component or 'guaranteed' portion before a specified date (the 'maturity date'). This 'guaranteed' portion is expected to constitute a higher percentage of the total crop estimate in irrigated areas because yield variations are smaller. However, all grower 'guaranteed' portions would need to be adjusted by a mill average performance factor to account for variations in milling performance (i.e. to accommodate the effects of rain, force majeure, mill breakdowns, etc.) Figure 1 presents this concept graphically.



**Figure 1. The effects of mill performance on the 'guaranteed' portion.**

To account for the remaining vertical component of the total crop growers could submit a second estimate or 'balance to deliver' portion just prior to the 'maturity date'. The effects of climate, eldana, flowering and other factors that impact on yields would be better known and the closing date of the mill established, enabling growers to determine which fields to carry-over.

Growers become accountable for their delivery performance when actual delivery performance is compared with their benchmark delivery performance, the latter being a composite of the "guaranteed" portion and the 'balance to deliver' portion. Consequently, an incentive can be created for growers to deliver effectively if 'over' and 'under' deliveries attract financial penalties (i.e. in the absence of physical delivery restrictions). However, penalties for 'over' deliveries should be less than 'under' deliveries to create the incentive for 'under' deliverers to reduce their penalty by paying other growers to 'over' deliver. Growers that 'over' deliver minimise no-cane stops and should be compensated accordingly.

#### Delivery window periods and trading rights

Under the relative payment system, growers have the incentive to deliver cane during periods when the difference between his individual weekly relative RV percentage and the mill weekly average RV percentage is greatest (compare scenarios

A and B in Table 1). This excludes any cash flow advantage and assumes that seasonal cane tonnage (or growth) is the same in all cases.

From a mill area perspective, selective harvesting of the best quality cane available at appropriate times of the year should flatten a mill's seasonal RV curve and enhance its profitability and that of the South African Sugar Industry as a whole. Geographical Information Systems (GIS) could play an important role. Conversely, a grower could be prejudiced if forced to deliver cane during periods when the difference between his individual weekly relative RV percentage and the mill weekly average RV percentage is not at its greatest (compare scenarios A and C in Table 1). This prejudice can be avoided if deliveries are assigned a delivery window period, which would constitute a period of time within which a 'collective' but pre-defined tonnage of cane is delivered. 'Collective' implies the tonnage can originate from any mix of growers. In this regard, three questions arise: (1) what time period constitutes a practical delivery window period? (2) how are grower consignments allocated to delivery window periods such that RV production is optimised? and, (3) how do growers secure a particular window period in consecutive seasons to protect their agronomic investment?

Firstly, the MGB through discussion should decide on the most appropriate number (or length) of delivery window periods for a particular mill area. As an example the 'guaranteed portion' of the crop could comprise three delivery window periods and the 'balance to deliver portion' two. This concept is illustrated in Figure 2 where the 'guaranteed portion' comprises of three growers (A, B, C), each sending three rateable consignments (1, 2, 3). A simplistic linear seasonal crush plan is assumed for clarity purposes.

Secondly, growers need to be given the right to freely trade the timing of their delivery consignments (Figure 3) so that agronomic cycles (e.g. harvesting, replant and growth), best harvesting practices and diversion scheduling can be optimised, and RV production maximised. This endogenous process allows growers to gradually adapt their operations over time, which avoids any equity problems associated with allocating delivery timings exogenously. However, trading would need to

**Table 1. Profitability of different delivery timings.**

Delivery Timing Scenarios	Period	Average Grower				Progressive Grower			
		Act RV%	Rel RV%	Tons Cane	Income	Act RV%	Rel RV%	Tons Cane	Income
<b>A) Rateable Deliveries</b> (Avg Income)	Beginning	8%	11%	3333	R 394,167	14%	17%	3333	R 609,167
	Middle	15%	11%	3333	R 394,167	16%	12%	3333	R 430,000
	End	10%	11%	3333	R 394,167	13%	14%	3333	R 501,667
	Season Total		11%	10000	R 1,182,500		14%	10000	R 1,540,833
<b>B) Tail Season Deliveries</b> (Max Income)	Beginning	8%	11%	4000	R 473,000	14%	17%	4000	R 731,000
	Middle	15%	11%	2000	R 236,500	16%	12%	2000	R 258,000
	End	10%	11%	4000	R 473,000	13%	14%	4000	R 602,000
	Season Total		11%	10000	R 1,182,500		15%	10000	R 1,591,000
<b>C) Mid Season Deliveries</b> (Min Income)	Beginning	8%	11%	1000	R 118,250	14%	17%	1000	R 182,750
	Middle	15%	11%	8000	R 946,000	16%	12%	8000	R 1,032,000
	End	10%	11%	1000	R 118,250	13%	14%	1000	R 150,500
	Season Total		11%	10000	R 1,182,500		13%	10000	R 1,365,250

Note: An RV price of R1075 per ton was used in the calculations

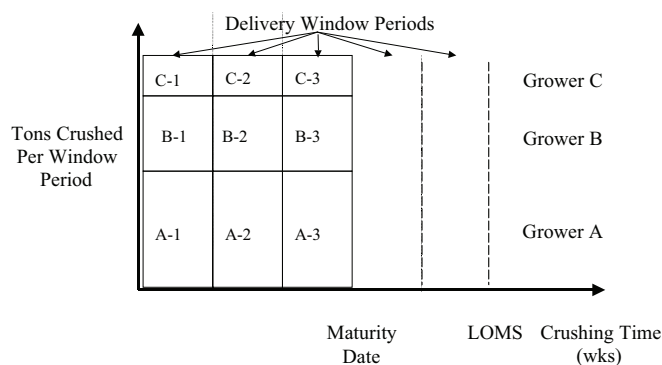


Figure 2. Delivery window periods for rateable deliveries.

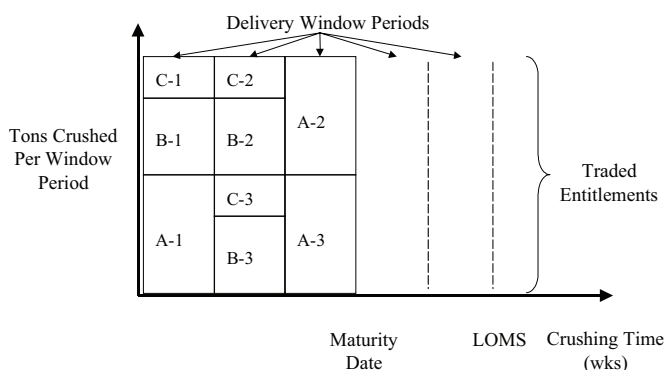


Figure 3. Delivery window periods after the timing of deliveries have been traded.

be terminated and delivery responsibilities formalised before the start of the crushing season so that grower penalties can be based on the difference between the estimate and actual deliveries per delivery window period.

Thirdly, to ensure that a grower's agronomic investment is protected, formal delivery timings need to be reallocated to the same individuals in the subsequent season before the next round of pre-season trading begins. This process would need to be administered by the MGB.

Two issues arise when a grower's cane is crushed at a time other than during its allocated delivery period: (1) that grower's cane quality will be affected because it will be crushed at a different point on the seasonal RV curve than was planned, and (2) the resulting 'knock-on' effect will impact on other growers' cane quality. Consequently, in the event of a large accidental fire Grower X can either over deliver in his own name and incur penalties, or informally deliver his surplus under the name of Grower Y who would exchange his current deliver right for a future deliver right. Grower Y has an incentive to participate if the 'good will' established to facilitate future 'emergency' exchanges of his own outweighs any foregone income due to cane quality and tonnage losses. However, Grower X and Grower Y remain accountable for any penalties levied against their original delivery obligations established at the start of the season. This mechanism creates the incentive for growers to co-operate in fire fighting operations and to maintain fire breaks.

### The proposed penalty mechanism

In terms of the proposed benchmarking system, growers are liable for penalties for under/over delivery against a pre-determined benchmark. Table 2 illustrates the proposed penalty mechanism in the form of a simple worked example using two benchmarking delivery window periods. The season is broken up into four management periods: (1) submission of the pre-season estimate, (2) submission of the balance to deliver estimate at the maturity date, (3) calculation of penalties at end of season, and (4) payment of penalties in March. The extent of the penalty would be determined by the Local Grower Council (LGC) who could agree that defaulting growers EITHER pay a fixed penalty per ton OR contribute towards a predetermined penalty amount. The latter lump sum penalty would be apportioned amongst responsible growers by multiplying each growers percentage share of the penalty tons by the lump sum penalty, where 'over' deliveries attract a smaller penalty than 'under' deliveries (as determined by the LGC; e.g. 50% in Table 1). This methodology provides an appropriate vehicle to collect penalty payments from responsible growers if the LGC incurs Local Area Agreement penalties for season length extensions due to excessive no-cane stops, which are payable to the miller. Table 2 illustrates how R10 000 is recovered from growers who did not perform relative to their predetermined benchmark.

Before the season starts, growers would submit initial crop estimates. The MGB would then agree on a maturity date before which a percentage (e.g. 85%) of the crop estimate can be guaranteed. For example, in Table 2 Grower B secures 8500 tons to be delivered in the first delivery window period. At the maturity date this benchmark is adjusted by the mill performance factor (90% or total tons delivered to the mill divided by the mill's total guaranteed portion) to determine Grower B's guaranteed performance benchmark (7650 tons). Actual tons cane delivered by Grower B (5700 tons) is also recorded up until the maturity date. However, prior to the maturity date Grower B would submit to the MGB the balance to deliver portion of his crop (4300 tons) and the above process would be repeated for the last delivery window period.

Penalty tons for individual growers are calculated by adding the difference between the 'guaranteed performance' and actual tons cane delivered for all delivery window periods, which for Grower B is 2233 tons. The penalty payable for poor performance at the end of the season is then apportioned pro rata amongst all defaulting growers (R4159 for Grower B). This mechanism can be automatically linked to the cane payment system through the Laboratory Information Management System (LIMS), which accurately records the timing and quantity of cane delivered for every grower consignment during any specified period (Bekker, personal communication).

In time, the LGC is expected to accumulate a pool of monies by recovering penalties from its defaulting growers in seasons where no compensation payment is due to the miller. If this pool of monies becomes significant it could be used as an income stabilisation fund to pay excessive compensation payments in subsequent years, provide drought relief, facilitate

**Table 2. The proposed penalty mechanism: a worked example.**

Description		Pre-Season April		At Maturity Date November			At End of Season December			Penalty Payment February		Overall Perform
		Initial Est/Allo	Guarantee Portion	Actual @ Maturity	Guarantee Perform	Bal to Del Est/Allo	Actual @ LOMS	Bal to Del Perform	Season Total	Penalty Tons	Penalty	
Mill	Mill Total	2,000,000	1,700,000	1,530,000	90%	470,000	430,000	91%	1,960,000	5,369	R 10,000	98%
	Guarant %	85%								Dis=50%		
Large-scale	Grower A	10,000	8,500	7,650	7,650	2,350	2,150	2,150	9,800	0	R 0	98%
	Grower B	10,000	8,500	5,700	7,650	4,300	4,500	3,934	10,200	2,233	R 4,159	102%
	Grower C	10,000	8,500	5,700	7,650	4,300	3,000	3,934	8,700	2,884	R 5,372	87%
	Grower D	10,000	8,500	7,650	7,650	1,000	915	915	8,565	0	R 0	86%
Small-Scale	Grower E	1,000				1,000	915	915	915	0	R 0	92%
	Grower F	1,000				1,000	800	915	800	115	R 214	80%
	Grower G	1,000				800	1005	732	1005	137	R 254	101%

Note: 'Over' deliverers receive 50% of the penalty imposed on 'under' deliverers.

road maintenance or simply be used as a bonus payment when the RV price is low. However, the continued threat of penalties is necessary to maintain the incentive to deliver effectively.

#### Estimating and penalties

In addition to poor delivery performance against estimate, the existing system provides the incentive for growers to inflate their estimates to ensure their entire crop is delivered before the crushing season ends. These practices have the following implications:

- Forward selling of sugar becomes difficult, lowering the RV price
- A lower RV price at the beginning of the season reduces the cash flow of all growers
- No-cane stops might increase, increasing potential compensation payments to the miller
- Establishing diversion programmes becomes difficult, increasing LOMS
- Increasing LOMS lowers the season average RV %
- Disrupts agronomic cycles, lowering growth rates, cane quality and potential earnings.

Although growers have a strong incentive to estimate accurately under the proposed penalty mechanism they can still inflate their estimates and avoid delivery penalties (e.g. Grower D in Table 2). Note that Grower E in Table 2 did not submit an inflated estimate as he only delivered in the 'balance to deliver' window where the mill performance factor was 91%. To discourage inflationary estimates the LGC has three options at its disposal, using the MGB as its agent (Table 3):

1. If just reason is found the LGC can simply issue the grower with a warning.

2. If no just reason is found, the LGC could reduce the grower's subsequent allocation by the difference between that grower's performance and mill performance (e.g. 11% for Grower D, which is 98% less 87%). In order to deliver the same tonnage as that of the previous year, Grower D would incur transport fleet problems delivering his 'balance to deliver' portion.

3. If estimates are inflated in consecutive seasons, the LGC could penalise such growers by reducing that grower's allocation as in Option 2 but basing penalty payments on the difference between the grower's estimate and actual deliveries (rather than the difference between allocation and actual deliveries as in Option 2). All available cane would be crushed, no-cane stops minimised and sugar production maximised.

#### Conclusion

The proposed penalty allocation mechanism is detailed but the underlying principles are easy to understand and the mechanics of the system can be fully automated and incorporated into the LIMS system, making it grower and MGB 'friendly'. It is also flexible and can accommodate specific circumstances at the different mill centres; but further research is required to clarify its impact on contract harvesters and hauliers. The mechanism comprises of delivery window periods within which delivery consignments are traded, which should encourage selective harvesting of the best quality cane available and enhance the profitability of mill areas and the South African sugar industry as a whole. It also provides an appropriate vehicle to collect penalty payments from responsible growers if the LGC incurs Local Area Agreement penalties for season length extensions

**Table 3. Inflationary estimates and penalty payments: a worked example.**

Description	Pre-Season April		At Maturity Date November			At End of Season December			Penalty Payment February		Overall Perform
	Initial Est/Allo	Guarantee Portion	Actual (@ Maturity	Guarantee Perform	Bal to Del Est/Allo	Actual (@ LOMS	Bal to Del Perform	Season Total	Penalty Tons	Penalty	
<b>Option 1: Norm</b>											
Grower D: Est	10000				1000						
Grower D: Allo	10000	8500	7650	7650	1000	915	915	8565	0	R 0	86%
<b>Option 2: Slight</b>											
Grower D: Est	10000				2486						
Grower D: Allo	8565	7280	6617	6552	2129	1948	1948	8565	0	R 0	100%
<b>Option 3: Severe</b>											
Grower D: Est	10000	8500	7650		2486	2274					
Grower D: Allo	8565	7280	6617	6552	2129	1948	1948	8565	1359	R 2746	100%

due to excessive no-cane stops. More importantly, the mechanism creates the necessary incentives for growers and their agents to improve their estimating and delivery performance.

#### REFERENCES

- Olson, M (1996). Big bills left on the sidewalk: why some nations are rich and others poor. *Journal of Economic Perspectives*, Vol. 10, No. 2, pp 3-24.
- <sup>1</sup> Rau, S. (2001). Personal communication. Illovo Sugar. General Manager; Gledhow Mill.
- <sup>2</sup> Thomson, R. (2001). Personal communication. SA Canegrowers Association. Regional Manager (South Coast); Umzimkulu Mill.
- <sup>3</sup> Lionnet, R. (2001). Personal communication. Sugar Milling Research Institute. Assistant Director.
- <sup>4</sup> Clause 149 of the Sugar Industry Agreement, 2000: Department of Trade and Industry.
- <sup>5</sup> Bekker, W. (2001). Personal Communication. South African Sugar Association: Autolab. LIMS Project Manager.