THE SELF REGULATING DELIVERY MECHANISM: OPTIMISNG LENGTH OF MILLING SEASON AND CANE SUPPLY

By

A.T. WYNNE

South African Cane Growers Association
PO Box 888 Mt Edgecombe, 4300, South Africa
E-mail: awynne@canegrowers.co.za

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Abstract
The miller and individual growers in a mill area have the incentive to deliver and crush more cane respectively in subsequent seasons to increase revenue. This expansion in cane deliveries firstly increases South Africa’s sugar exports, which reduces the average sugar price. Secondly, incremental cane delivery expansions increase the length of the milling season because this is more cost effective than increasing factory size. However, such season length extensions prejudice growers who are unable or unwilling to expand because (1) the South African recoverable value cane payment system is a function of cane quality, (2) cane quality is compromised due to a longer season length, and (3) the season mill average recoverable value % cane is reduced which, through the relative payment mechanism, reduces ALL growers’ average income per tonne of cane delivered. Under the Self Regulating Delivery mechanism, growers have the incentive to align their delivery rate with the mill crush rate, which is expected to reduce no-cane stops, improve cane transport logistics, optimise the transport fleet, reduce cane deterioration time delays between harvest and crushing, increase cane deliveries without compromising the agreed season length, improve cane quality, enhance mill performance and sugar quality, and ultimately enhance the profitability of the miller and growers. Growers may deliver cane after the agreed season length but, to ensure that growers who are unable or unwilling to deliver cane during the extension period are not prejudiced, all growers delivering cane in the extension period are paid on ‘actual’ recoverable value % cane and not ‘relative’ recoverable value % cane. This discourages excess cane area expansions and helps curb the erosion of the average sugar price in South Africa. The principles of the Self Regulating Delivery mechanism are easy to understand and inexpensive to implement; a spreadsheet analysis of delivery data is the minimum requirement.

Introduction
The miller and individual growers in a mill area have the incentive to deliver and crush more cane respectively in subsequent seasons to increase revenue. This expansion in cane deliveries firstly increases South Africa’s sugar exports, which reduces the average cane and sugar prices received by ALL millers and growers (including non-expanders). Secondly, incremental cane delivery expansions increase the length of the milling season because this is more cost effective than increasing factory size. However, such season length extensions prejudice growers who are unable or unwilling to expand because:

1. the South African recoverable value cane payment system is a function of cane quality;
2. cane quality is compromised due to a longer season length; and
3. the season mill average recoverable value % cane is reduced which, through the relative payment mechanism, reduces ALL growers’ average income per tonne of cane delivered.

To mitigate this conflict, Local Area Agreements have been negotiated between millers and growers in most mill areas, which define an appropriate season length for each mill area, a mechanism to apportion responsibility between the miller and the collective grower group for season length extensions,
and a means to financially compensate the affected party for revenue losses. This paper first explores the incentives for parties to match cane supply with factory size in an agreed season length using the current Local Area Agreement approach. It then investigates an alternative, the Self Regulating Delivery mechanism, which was developed through numerous industry forums and discussions in the Umfolozi mill area but has yet to be agreed and implemented locally.

This approach attempts to protect non-expanding growers and to create incentives that improve efficiencies within the cane supply logistics chain that are easy to understand, inexpensive to implement and benefit both the miller and growers.

Background

In South Africa, grower concerns over season length have been recorded during grower/miller negotiations dating back to the 1930s (SACGA, 1977). Until April 1998, season length concerns were partially addressed through the production quota system and differential pool pricing, thereby effectively capping season length. However, deregulation of the South African sugar industry in 1994 resulted in the phasing out of quotas between 1994 and 1998, which led to cane area expansions in many mill areas.

Given that previous attempts to legislate season length on an industry wide basis have proved cumbersome and difficult to enforce, a Local Area Agreement approach was adopted in 2000 prior to the implementation of the recoverable value cane quality payment system, using the season length model as a guide for season length negotiations (Moor and Wynne, 2001).

The model assumes the mill area to be a single business entity and hence, the economic optimal season length occurs where the losses associated with deteriorating cane quality offset the increasing benefits of factory utilisation. In essence, the generic Local Area Agreement incentive mechanism compares a ‘design’ milling season with the ‘actual’ milling season to determine which party, if any, is responsible for season length extensions. Exhibit 1 illustrates these concepts.

**Exhibit 1—Generic incentive mechanism used in the Local Area Agreements.**

<table>
<thead>
<tr>
<th>Concept</th>
<th>Calculation</th>
</tr>
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<tbody>
<tr>
<td>‘Design’ season</td>
<td>Mill supply area ( \times ) (Agreed yield) ( \times ) Agreed LOMS (wks) ( \times ) 168 hours ( \times ) (OTE %) ( \times ) (TCH)</td>
</tr>
<tr>
<td>‘Actual’ season</td>
<td>Mill supply area ( \times ) (Agreed yield) ( \times ) Actual LOMS (wks) ( \times ) 168 hours ( \times ) (OTE %) ( \times ) (TCH)</td>
</tr>
</tbody>
</table>

Where: (OTE %)\( \text{des} \) and (OTE %)\( \text{act} \) are the design and actual overall time efficiencies.

(TCH)\( \text{des} \) and (TCH)\( \text{act} \) are the design and actual season average tonnes cane processed per hour.

LOMS is the length of milling season.

The practical difficulties associated with this approach include:

- The grower, miller and neutral impacts that make up the (OTE %)\( \text{act} \) requires an objective and robust ‘time account’ mechanism to record the causes of various mill stops. This is not always easy because there may be more than one impact contributing to a stop.

- Determining a season average (TCH)\( \text{des} \) is difficult, because mill capacity is constrained by different factors at different times of the year; e.g. fibre % cane at the beginning of the season, sucrose % cane in the middle and non-sucrose % cane at the end. Furthermore, if this parameter is set too high (or low), the prevalence of slow (fast) crushing will increase (Wynne, 2003), and it can be more difficult to apportion responsibility than for mill stops.

- An accurate and current mapping program is required which can be undermined if a miller and growers who wilfully want to expand only passively participate. Under these circumstances, maintaining an accurate mapping program becomes costly especially in mill areas with large numbers of transient small-scale growers.

- Determining the (Agreed Yield)\( \text{des} \) is contentious because a 10 year mean implies the actual season length will only be within the agreed season length half of the time and yield variations can be significant in dryland areas. The current principle agreement is that the actual season length should not exceed the agreed season length more than three years out of ten, all else being equal.
As a consequence of these difficulties, the Umfolozi mill area (growers and miller) requested that an alternative approach to the current Local Area Agreement be investigated with the purpose of meeting the following primary objectives:

1. To match factory size to cane supply in an agreed length of season.
2. To ensure the proposed mechanism is cost effective, simple and easy to implement.
3. To provide growers with season length controls so that growers unwilling or unable to expand are not prejudiced by a reduced ‘relative’ recoverable value % cane.

Secondary objectives included the following:

1. To provide an incentive for the miller to set realistic crushing targets.
2. To provide an incentive for growers to align their delivery rate with the mill crush rate.
3. To provide an incentive for smaller delivery allocations to consolidate and capture size economies.

The Self Regulating Delivery mechanism attempts to achieve these by simply monitoring cane tonnages at the mill weigh bridge in conjunction with clearly defined rules and incentives, which are described in the subsequent sections. Further detail concerning the mathematical formulae associated with the concepts described can be obtained from the author.

**Determining principle parameters**

From the Local Area Agreement experience, the length of the milling season is the most contentious parameter to agree between miller and growers and this may require revision given the new paradigm approach adopted by the Self Regulating Delivery mechanism. The responsibility for revising the agreed season length rests with the Mill Group Board (an organisation with equal mill and grower representation). Similarly, the Mill Group Board must agree on a budgeted grower no-cane stoppage allowance inclusive of no-cane stops caused by rain for the purpose of calculating penalties in the event of a season length extension.

**Determining delivery allocations**

At the start of each season, the miller should notify the Mill Group Board of its ‘factory size’, which shall remain fixed for the forthcoming season. Equally, growers wishing to deliver cane to the mill must apply to the Mill Group Board for a Grower Code. The Board shall then determine a ‘fixed allocation’ for each Grower Code based on that Grower Code’s historical rolling average ‘actual deliveries’ within the agreed season length, which shall remain fixed for the entire season (this creates a disincentive for growers to frequently change Grower Codes to avoid debt repayments).

If the sum of all ‘fixed allocations’ is in excess of ‘factory size’, each Grower Code’s allocation shall be reduced _pro rata_, such that the sum of all the Grower Codes’ ‘fixed allocations’ equals ‘factory size’. ‘Extra allocation’ is the unallocated portion of ‘factory size’ plus ‘undelivered allocations’ during the season. Hence, a Grower Code’s ‘total allocation’ is the sum of its ‘fixed’ and ‘extra allocation’.

**Management of deliveries within the agreed season length**

The Mill Group Board will calculate a ‘weekly delivery allocation’ from each Grower Code’s total allocation but inclusive of a ‘variance factor’ (e.g. 0.95) to account for cane supply difficulties and variable crush rates during the season; i.e. the ‘weekly delivery allocation’ is the minimum weekly delivery tonnage each Grower Code must deliver; otherwise, the ‘undelivered allocation’ portion is forfeited.

Grower Codes can catch up ‘undelivered allocations’ by successfully applying to the Mill Group Board for ‘extra allocation’ during the season. Available ‘extra allocation’ will be distributed by the Mill Group Board but, if agreement cannot be reached, the miller’s view shall take precedence, subject to an appeals procedure that is based on distributing the ‘extra allocation’ in the following order to:

- a. ‘Fixed allocation’ Grower Codes with an accepted motivation for ‘undelivered allocation’;
- b. ‘Fixed allocation’ Grower Codes that can substantiate significant vertical growth;
- c. Inward diversion cane; and lastly,
- d. Grower Codes with or without ‘fixed allocation’ who have new cane areas.

‘Fixed allocation’ and ‘extra allocation’ will be exclusively linked to individual Grower Codes but they may be ‘traded’, and ‘fixed allocations’ may be ‘transferred’ between Grower Codes.
• ‘Trading’ fixed and/or extra allocation between Grower Codes does not require Mill Group Board notification because the Grower Codes concerned take full responsibility for redistributing cane proceeds for the current season among themselves.

• ‘Transferring’ fixed allocation requires Mill Group Board notification prior to the start of the season to ensure cane payments accrue to the correct Grower Code. ‘Fixed allocation’ can be exchanged independently of, or together with, land transfers. If land transfers take place during the milling season, parties will be required to enter into a fixed allocation ‘trading’ arrangement for the remainder of the season.

**Extension of the milling season beyond the agreed season length**

ALL cane delivered within the agreed season length will be paid according to the ‘relative’ recoverable value % cane payment mechanism and ALL cane delivered after the agreed season length will be paid on ‘actual’ recoverable value % cane (a more detailed account of ‘relative’ versus ‘actual’ payments can be obtained from the author). The amount of cane crushed after the agreed season length will be determined by the Mill Group Board as follows:

a. By consent between miller and grower representatives.

b. By the calculated tonnage the miller failed to crush during the agreed season length as requested by growers.

c. By the calculated tonnage the growers failed to deliver during the agreed season length as requested by the miller.

**Penalties**

Any delivery made at any time within the agreed season length that is without or in excess of its ‘weekly delivery allocation’ shall be deemed ‘unauthorised cane’, such that all proceeds from ‘unauthorised cane’ will be automatically placed into a ‘holding account’. If the actual season length is less than or equal to the agreed length, ‘unauthorised cane’ proceeds will be paid retrospectively from the ‘holding account’ with interest. If the actual season length is greater than the agreed length for whatever reason, the proceeds from ‘unauthorised cane’ will be forfeited; i.e. the miller will pay 100% of the Grower Code’s ‘unauthorised cane’ proceeds from the ‘holding account’ directly to the Mill Group Board, which will be used to reduce the Board’s expenses. The calculated tonnages that the miller and collective grower group failed to crush during the agreed season length will also attract a per tonne cane penalty as agreed by the Mill Group Board at the start of the season.

**Incentives for contractors**

Providing a contractor is responsible for both harvesting and transport operations, a Grower Code can justifiably transfer the entire per tonne cane penalty for failure to deliver (i.e. to compensate the miller) onto this contractor. An additional claim can be submitted for poor contractor performance (i.e. to compensate the Grower Code).

With these efficiency incentives in place, all Grower Codes within a mill area should have the confidence to mandate the Mill Group Board through a competitive tender system to appoint a maximum number of registered contractors. This would have the effect of reducing the number of contractors, increasing capital, utilisation and improving synchronisation between cane supply and crush rates given a finite transport fleet with various cutting fronts at different distances from the mill. Synchronisation can be further enhanced by communicating cane supply information from the mill to contractors using regular automated text messages via cell phones.

**Delivery groups**

Consolidating numerous smaller-scale Grower Codes into delivery groups can also capture size economy efficiencies. To achieve this, the Mill Group Board must agree on an acceptable minimum ‘total allocation’ tonnage, such that Grower Codes with a ‘total allocation’ below this threshold can either proactively create a delivery group or be allocated to a collective default delivery group. Grower codes with a ‘total allocation’ in excess of the minimum are not precluded from participating in a delivery group. For each delivery group, the Mill Group Board will calculate the number of weekly delivery time slots per Grower Code pro rata to total allocation tonnages, the timing of which can be adjusted by ‘trading’ to optimise cane quality at a farm and field level. The risk of one delivery group member being forced to deliver in the extension period when payment is made on ‘actual’ recoverable value % cane can be mitigated using an interim payment and retention interest approach similar to that of relative payment.
Conclusion

Under the Self Regulating Delivery Mechanism growers have the incentive to align their delivery rate with the mill crush rate to ensure:

(1) none of their allocation is forfeited in the current and subsequent seasons due to actual under-deliveries; and

(2) none of their proceeds are forfeited from actual over-deliveries.

Furthermore, growers that do not meet their allocation in the absence of substitute cane supplies will financially compensate the miller and, similarly, the miller will compensate performing growers for poor mill performance (i.e. the miller has an incentive to set realistic crushing targets). This improved alignment between cane supply and mill crush rates is expected to reduce no-cane stops, improve cane transport logistics, optimise the transport fleet, reduce cane deterioration time delays between harvest and crushing, increase cane deliveries without compromising the length of milling season, improve cane quality, enhance mill performance and sugar quality, and ultimately enhance the profitability of the miller and growers.

A degree of flexibility is necessary to be practical, which is achieved through the redistribution of ‘extra allocation’, allocation ‘trading’ and the adjustment of allocations using the ‘variance factor’. Growers may also deliver cane after the agreed season length but, to ensure that growers who are unable or unwilling to deliver cane during the extension period are not prejudiced, all growers delivering cane in the extension period are paid on ‘actual’ recoverable value % cane and not ‘relative’ recoverable value % cane. Hence, growers directly bear the financial consequences of delivering poorer quality cane at the end of the season, which discourages excess cane area expansions and helps curb the erosion of the average sugar price in South Africa. The principles of the Self Regulating Delivery mechanism are easy to understand and inexpensive to implement; a spreadsheet analysis of delivery data is the minimum requirement. However, this approach is untested and may require refinement.

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REFERENCES


L'AUTORÉGULATION DU MÉCANISME DE LIVRAISON : OPTIMISATION DE LA DURÉE DE LA SAISON DE BROYAGE ET DE LA LIVRAISON DE LA CANNE

A.T. WYNNE

South African Cane Growers Association, PO Box 888 Mt Edgecombe, 4300, South Africa

E-mail: awynne@canegrowers.co.za

MOTS CLÉS: Durée de la Saison, Livraison de la Canne, Performance des Moulins, Encouragement, Optimisation, Relation Planteur/Usinier

Résumé

Les planteurs individuels et l’usinier d’une région sucrière sont encouragés respectivement à délivrer et broyer plus de cannes durant les saisons consécutives afin d’augmenter le revenu. Cette expansion de livraison de canne a pour effet d’augmenter l’exportation du sucre de l’Afrique du Sud, réduisant ainsi le prix moyen du sucre. D’autre part, ces expansions progressives permettent d’étendre la durée de la saison de broyage, vu que c’est plus rentable que d’augmenter la capacité de l’usine. Cependant, cette extension
de la durée de la saison est préjudiciable aux planteurs qui ne peuvent ou ne veulent pas étendre leur saison puisque (1) la valeur de recouvrement du système de paiement de canne de l’Afrique du Sud est fonction de la qualité de la canne, (2) la qualité de la canne est compromise due à une extension de la saison et (3) la valeur moyenne saisonnière recouvrable de la sucrerie % canne est réduite ce qui, à travers un mécanisme de paiement relatif, réduit le revenu moyen par tonne de canne livrée de TOUS les planteurs. Avec l’autorégulation du mécanisme de livraison, les planteurs sont encouragés à aligner leur taux de livraison à celui du broyage et l’on peut s’attendre à une réduction des arrêts dus à un manque de canne, à une amélioration de la logistique pour le transport de la canne, à une optimisation de la flotte des véhicules de transport. L’autorégulation amènerait aussi une réduction de la détérioration de la canne due au délai entre la coupe et le broyage, une augmentation de la livraison de la canne, sans compromettre la durée agréée de la saison, une amélioration de la qualité de la canne, de la performance de la sucrerie et de la qualité du sucre et finalement une rentabilité accrue pour l’usinier et les planteurs. Les planteurs peuvent livrer leur canne après la durée agréée de la saison; toutefois, afin de s’assurer qu’aucun préjudice n’est causé aux planteurs qui ne peuvent ou ne veulent pas livrer leur canne pendant la période étendue, tous les planteurs qui livrent leur canne pendant cette période sont payés sur la valeur recouvrable ‘réelle’ % canne et non sur la valeur recouvrable ‘relative’ % canne. Cette mesure décourage l’expansion excessive de la région sous canne et aide à contenir l’éroision du prix moyen du sucre en Afrique du Sud. Les principes de l’autorégulation du mécanisme de livraison sont faciles à comprendre et peu coûteux à mettre en œuvre; une analyse sur tableurs des données sur la livraison est le minimum requis.

EL MECANISMO AUTO REGULADO DE ENVÍOS: OPTIMIZANDO LA DURACIÓN DE LA TEMPORADA DE ZAFRA Y EL ABASTECIMIENTO DE CAÑA

A.T. WYNNE
South African Cane Growers Association, PO Box 888 Mt Edgecombe, 4300, South Africa
E-mail: awynne@canegrowers.co.za

PALABRAS CLAVE: Temporada de Zafra, Abastecimiento de Caña, Rendimiento de Ingenio, Incentivos, Optimizar, Relación Productor/Ingenio

Resumen

Los ingenios y los productores individuales tienen el incentivo de enviar y vender más caña respectivamente en zonas sucesivas para aumentar sus ingresos. Este aumento en envíos de caña primeramente aumenta las exportaciones de azúcar de Sudáfrica, lo cual reduce el precio promedio del azúcar. Segundo, aumentos en los envíos de caña alarga la temporada de zafra ya que es más eficiente en costos que aumentar el tamaño de la fábrica. Sin embargo, esas prolongaciones de la zafra perjudican a los productores que no pueden o no desean hacerlo ya que (1) el sistema Sudáfricano de pago de caña recuperada es en función de la calidad de la caña, (2) se compromete la calidad de la caña debido a una temporada de zafra más larga, y (3) el valor promedio recuperable % de caña de zafra en los ingenios se reduce, por medio del mecanismo de pago relativo, reduciendo el ingreso promedio por tonelada de caña enviada de TODOS los productores. Bajo el Mecanismo Auto Regulado de Envíos, los productores tienen el incentivo de ajustar sus frecuencias de envío con la capacidad de molinera de los ingenios, lo que se espera reduzca las paradas por falta de caña, mejore la logística del transporte de caña, optimice las flotas de transporte, reduzca el tiempo de deterioro de la caña entre cosecha y molinera, aumente los envíos de caña sin comprometer la duración acordada de la temporada de zafra, mejore la calidad de la caña, aumente la eficiencia de los ingenios y la calidad de la caña y por último aumente la rentabilidad de los ingenios y de los productores. Los productores podrán enviar caña después de la duración acordada de la zafra, pero para asegurarse que no se perjudique a productores que no puedan o no desean enviar caña durante el período de extensión, a todos aquellos productores que envíen caña en el período de extensión se les pagará con valor ‘actual’ recuperable % de caña y no con valor ‘relativo’ recuperable % de caña. Esto desanima las expansiones excesivas de áreas de caña y ayuda a controlar la reducción de los recios del azúcar en Sudáfrica. Los principios del Mecanismo Auto Regulado de Envíos son fáciles de entender y baratos de implementar. Un análisis en hoja electrónica de la información de envíos es el requerimiento mínimo.