SOUTH AFRICAN SUGARCANE PRODUCTION AND QUALITY IN THE 2007-2008 MILLING SEASON: AN UNFULFILLED PROMISE?

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Abstract

Sugarcane production and quality during the 2007-2008 season are discussed in relation to production conditions including weather, the pest and disease situation, and constraints to farming operations. The Canesim crop estimates at mill area level are used as the benchmark, and an attempt is made to explain differences between the model estimates and the (lower) actual mill records. These differences were particularly great (15% or more) for Zululand and the coastal areas. Further analysis confirmed that, whereas in most areas the 2007-2008 season was characterised by good growing conditions, frequent rains in the second half disrupted harvesting operations affecting the entire supply chain, resulting in poor cane quality and higher than normal unscheduled carry-overs. Most regions showed an improvement with respect to the incidence of the stalk borer *Eldana saccharina* and smut (*Ustilago scitaminea*); but the incidence of thrips (*Fulmekiola serrata*) showed a continued increase throughout the industry, with as yet unknown effects on yield and quality. Socio-economic conditions were not conducive to on-farm production capacity maintenance and new investments, but insufficient data precluded verification of an actual decline in investment, except in the small-scale grower sector, where sugarcane production has decreased by more than 7% per annum over the past decade. Overall, the analysis provides a plausible explanation for the gaps between actual production and Canesim estimates, but a firm conclusion, which could also support an analysis of future trends, would require supplementary data and a better understanding of the impacts of specific constraints (e.g. thrips) on sugarcane production and quality, and the interrelationships between these constraints.

Keywords: sugarcane production, agronomics, economics, model, yield forecast, pests, diseases

Introduction

Sugarcane deliveries in South Africa in the 2007-2008 season were considerably lower than generally expected, and similar to the disappointing 2006-2007 season. The quality of cane delivered was also mediocre. The objective of this paper is to provide an agronomic characterisation of the season, and to explain the discrepancy between expectations and realisations. The approach followed comprised a review and synthesis of information from databases, reports and questionnaires from regional specialists, complemented by personal engagements. Aspects looked into include, *inter alia*, weather conditions, the pest and disease situation, and farm economics. This is the first time that such a comprehensive analysis has been attempted. It is anticipated that, in addition to exploring the past, the study will provide some food for thought about the future, which might help the industry to prepare for challenges, identify priority issues for preventive or remedial action, and guide new research.

Methodology

Information sources

The principal information sources used in this study were:

- Industry records of sugarcane supplies and quality at mill area level.
- Canesim crop forecasts as compared to Mill Group Board (MGB) estimates and final actual supply records.
- Weather data.
- Database of Local Pest, Disease and Variety Control Committee (LPD&VCC) field survey results.
- South African Cane Growers' Association (CANEGROWERS) annual large-scale grower cost survey.
- Questionnaires to regional specialists, complemented by personal interviews.

Industry records of sugarcane supplies and quality at mill area level

Industry records of sugarcane supplies and quality at mill area level were extracted from the Oracle database of the industry's Cane Testing Service (CTS). Data were summarised according to the growers' 'home mill'; i.e. in cases where deliveries were diverted, the cane was assigned to the home mill supply area rather than to the mill area to which it was rerouted. ERC % cane was used as the indicator for cane quality. Information on small-scale grower sugarcane production was obtained from the annual Schedule of Deliveries published by the Sugar Industry Administration Board.

Canesim crop forecasts vs Mill Group Board estimates and final production data

Yield estimates from the Canesim crop forecasting system (Bezuidenhout and Singels, 2007) were analysed and compared to the final actual production data, as well as to MGB estimates that are based on field assessments by growers and millers during the harvest season. The crop forecasting system uses the Canesim model (water use efficiency based version), to quantify the effects of daily weather conditions on sugarcane growth and yield of crops of similar age harvested in each month of the milling season (April to December) for 48 homogeneous climate zones. Irrigation is simulated according to typical regional strategies, including water restrictions. Weather data from the South African Sugarcane Research Institute (SASRI) meteorological database (see below) are used, plus data from 10 historic seasons to substitute the (future) remainder of the season. The selection of the historic seasons is based on the climate outlook of the SA Weather Service. The simulation results are aggregated into mill and whole industry categories and published on the internet (http://sasri.sasa.org.za/cropest), expressed as a percentage of the previous season's yield for each category.

Weather data

In addition to the above, rainfall, radiation and temperature data from the SASRI meteorological database, recorded at numerous sites throughout the industry, were further inspected to gain a better understanding of climatic factors that might explain variations in production.

Pest and disease database

Pest and disease (P&D) data used in this study were derived from the database containing results of annual surveys by the LPD&VCCs across the South African sugar industry (SASRI, 2005). Current and long-term infestation and damage levels derived from data extracted from this database over the period June to May were compared for each region (Way, 2007; Way and Goebel, 2007). In this study, serious crop spoilers, *viz* the stalk borer *Eldana saccharina* Walker (Lepidoptera: Pyralidae) and the fungal disease smut (*Ustilago scitaminea*) were investigated, as were monitoring data regarding sugarcane thrips (*Fulmekiola serrata* (Kobus) (Thysanoptera: Thripidae)). Thrips is a recent pest incursion in South Africa first detected in 2004 (Way *et al*., 2006a), which is now present throughout the industry (Way *et al.*, 2006b), and, according to a recent grower survey, widely perceived as a constraint to production.

LPD&VCC surveys for *E. saccharina* are conducted across the industry in around 15 000 fields per year. The parameters measured include % fields infested by borer and % ‘hazard’ fields, and these were investigated in this study. Hazard fields are those where more than 10 larvae were recovered from a 100-stalk sample, and/or with stalk damage exceeding 5% of total stalk length in the sample. The latter parameter is locally referred to as ‘stalk length red’, as explained by Way and Goebel (2007). Fields in the hazard category should be harvested as soon as possible to reduce the chances of the pest spreading to adjacent fields.

With respect to sugarcane smut, an average of 2 300 fields covering 32 000 ha across the industry have been surveyed each year for the past 10 years, usually when the cane is 3-6 months old. This is done by inspecting a specified number of 50 m lengths of cane row in each field. The number of row segments thus inspected varies with field size. Disease incidence is expressed as % stools infected, assuming that there are two stools per metre of cane row (i.e. 100 stools/row segment) (SASRI, 2000). Mean % infection is calculated by dividing the total number of infected stools in each mill area by the total number of stools inspected. Smut threshold levels vary from one LPD&VCC area to another, but are set in most cases at 3 or 5% stools infected. Where smut cannot be maintained below these levels through regular roguing (plucking out infected stalks), a ploughout order for the entire field is issued by the relevant LPD&VCC (Anon, 2007).

The selection of fields for inspection varies with mill area but, in many cases, fields planted to varieties known to be susceptible to smut (and mosaic, for which the same fields are surveyed) are targeted. Generally, LPD&VCCs aim to visit each farm at least once per year, but this depends largely on the number of teams operating in the area and the size of the mill area to be covered. For these reasons, it is not possible to make comparisons between mill areas, but trends over the years within mill areas can be analysed.

Surveys for thrips were conducted on a monthly basis in all mill areas from October 2005 to March 2006. Each survey comprised 30 randomly distributed fields per mill area, with a maximum of three fields per farm, and only targeting 3-4 months old plant crops. Each field was surveyed only once. To sample a field, 20 leaf spindles were randomly removed to count thrips numbers in the laboratory. Field infestation was assessed as the number of *F. serrata* per spindle. Monthly average infestation per region was computed from the average of the 30 fields surveyed over six successive months, totalling 180 fields per region. In addition, to determine long-term trends since March 2006, thrips were sampled each month in 18 fields at Umfolozi. Way *et al.* (2006a) describe in detail the survey method and strategy adopted.

CANEGROWERS’ large-scale grower cost survey results

Results from CANEGROWERS’ annual large-scale grower cane production cost surveys were used to provide an indicator of the attractiveness to invest in sugarcane production. The data are obtained from large-scale growers who (i) utilise the CaneFarms Bookkeeping Service offered by CANEGROWERS, (ii) complete the cost survey questionnaire that is distributed annually to all large-scale growers or (iii) submit their annual financial statements. Rigorous screening of responses is undertaken against 19 exclusion criteria, including incomplete information, small cane enterprises in relation to other farm activities, recently transferred properties, or submissions containing inaccurate costs.

The indices of primary farm input prices were calculated from the input prices detailed in the Crops and Markets quarterly reports issued by the Directorate of Agricultural Statistics, National Department of Agriculture. The sugar industry recoverable value (RV) price index was calculated using the final industry declared RV price since 2000-2001, while sucrose prices were converted to RV prices for the period from 1995-1996 to 1999-2000. All prices were indexed relative to 1995, which was taken as the base year (1995=100).

Real gross income per hectare and real total cost per hectare were derived from the cost survey results by removing inflationary influences from the data by applying the Consumer Price Index (2007 base year).

Questionnaires for regional specialists

To get an idea of other factors that may have influenced cane production and quality, questionnaires were sent to specialists in the regions, mostly Extension Officers. In the questionnaires, the respondents were asked to characterise the 2007-2008 harvest season as compared to a 'normal' season, in terms of carry-over cane, no-cane stops, harvest inefficiencies (e.g. in relation to application of ripeners), pest and disease incidence, and burning- and harvest-to-crush delays, by classifying each of these factors on a scale of –2 to +2, where –2 means considerably less than normal, 0 means normal and +2 means considerably more than normal. The respondents were also asked to indicate other relevant factors, and where appropriate to differentiate between early season (April-May), mid-season (June-September) and late season (October-December); and to provide comments.

Results

Amounts and quality of cane supplies

Figure 1 presents the amounts and quality of sugarcane supplied to the mills during the 2005-2006, 2006-2007 and 2007-2008 seasons. The total supply during the 2007-2008 season was 19.7 million tons, as compared to 20.3 million tons in 2006-2007 and 21.0 million tons in 2005-2006. The latter amount also corresponds roughly to the industry average from 1995-2006. It must be noted that a considerable part of the reduction in supplies from the Darnall area was ascribed to the reassignment of the Doornkop area from Darnall to Gledhow, involving *ca* 250 000 tons of sugarcane.

ERC levels at delivery were on average 11.6% in 2007-2008, well above the poor 11.0% of 2006-2007, but below the excellent 2005-2006 industry average, which was 11.8%. The only mill area where cane quality was poorer in 2007-2008 than in the two previous seasons was Umfolozi, while at Umzimkulu ERC levels were even higher than in 2005-2006. Eston reassumed its position as top performer in terms of ERC %, although less outstanding in 2007-2008 than in 2005-2006.

Figure 2 presents the quantities and ERC levels of monthly sugarcane supplies at the industry level for the 2005-2006, 2006-2007 and 2007-2008 seasons. The data presented suggest that the main problems in 2007 occurred after September, particularly regarding cane quality. This was common for most mill areas, the exceptions being the Mpumalanga mill areas, which presented slightly higher ERC levels towards the end of the season, and the Umfolozi mill area, where ERC levels were low throughout the season.

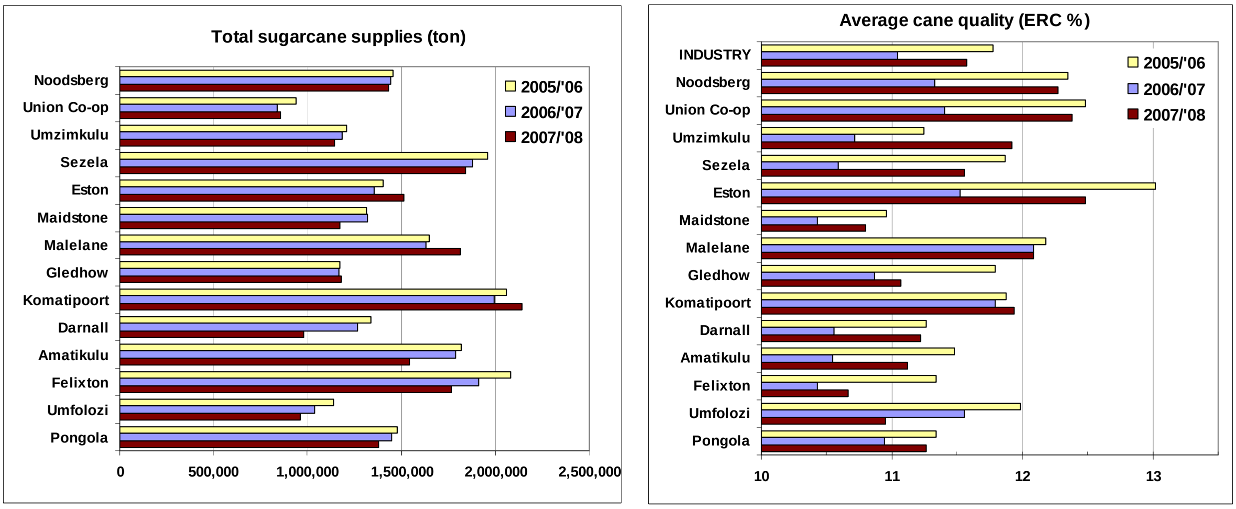

Figure 1. Total sugarcane (tons) supplied (left) and estimated recoverable crystal (ERC) % cane (right) per mill area for the 2005-2006, 2006-2007 and 2007-2008 seasons.

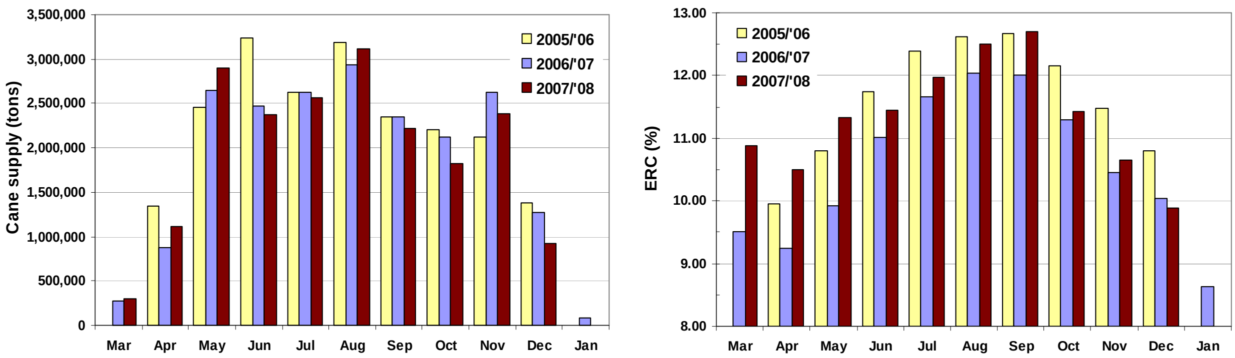

Figure 2. Monthly sugarcane (tons) supplied (left) and estimated recoverable crystal (ERC) % cane (right) for the 2005-2006, 2006-2007 and 2007-2008 milling seasons. Note that figures related to March and January refer to small supplies to a few mills only.

About one third of the decrease in production from 2006-2007 to 2007-2008 can be attributed to small-scale growers (SSGs), who produced 1.83 million tons sugarcane in the 2007-2008 season, i.e. some 0.20 million tons less than in 2006-2007. This decline is much greater than the 10% contribution of SSGs to total sugarcane production, and is part of a trend of >7% decrease per annum in SSG cane production over the past decade (Figure 3). Only a minor part of the decline in SSG production (a net 0.017 million tons from 2006-2007 to 2007-2008) could be ascribed to reclassification from small-scale to large-scale grower status and to block farming projects on tribal land.

Canesim crop forecasts vs Mill Group Board estimates and final production data

Figure 4 shows MGB and Canesim (SASRI) estimates for the 2007-2008 season. The two types of estimates compared reasonably well from February 2007 to June 2007 at approximately 21.7 million tons of cane. Thereafter, the MGB estimates decreased rapidly, to the official 19.7 million tons in January 2008 - a drop of about 9% - whereas the SASRI estimates remained at around 21.7 million tons up to October 2007. Expressed as a percentage of the cane produced in the 2006-2007 season, the SASRI estimate in October equalled 107.4%, whereas the MGB estimate in January 2008 equalled 97.3%.

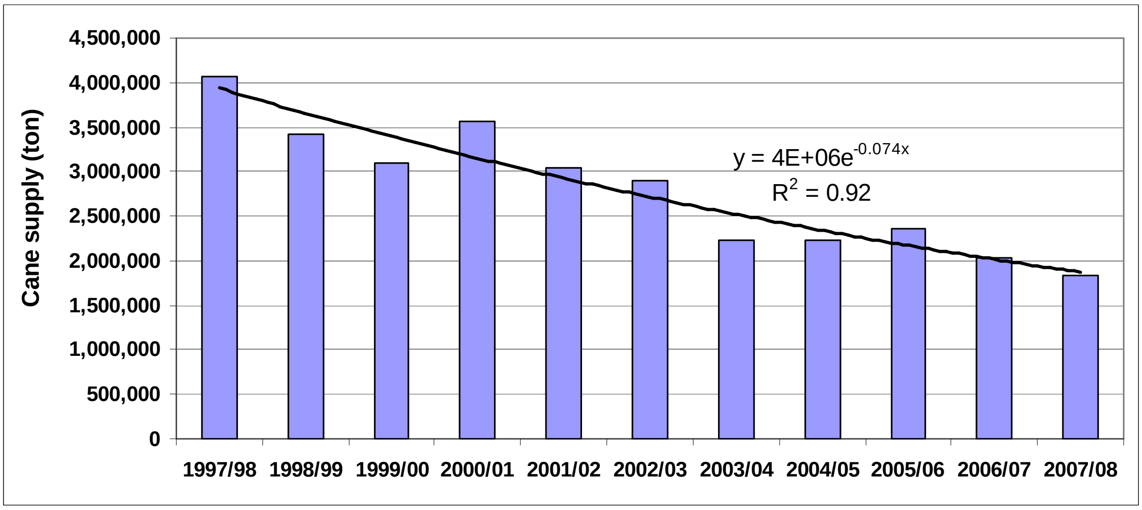

Figure 3. Small-scale grower cane deliveries (1997-1998 to 2007-2008).

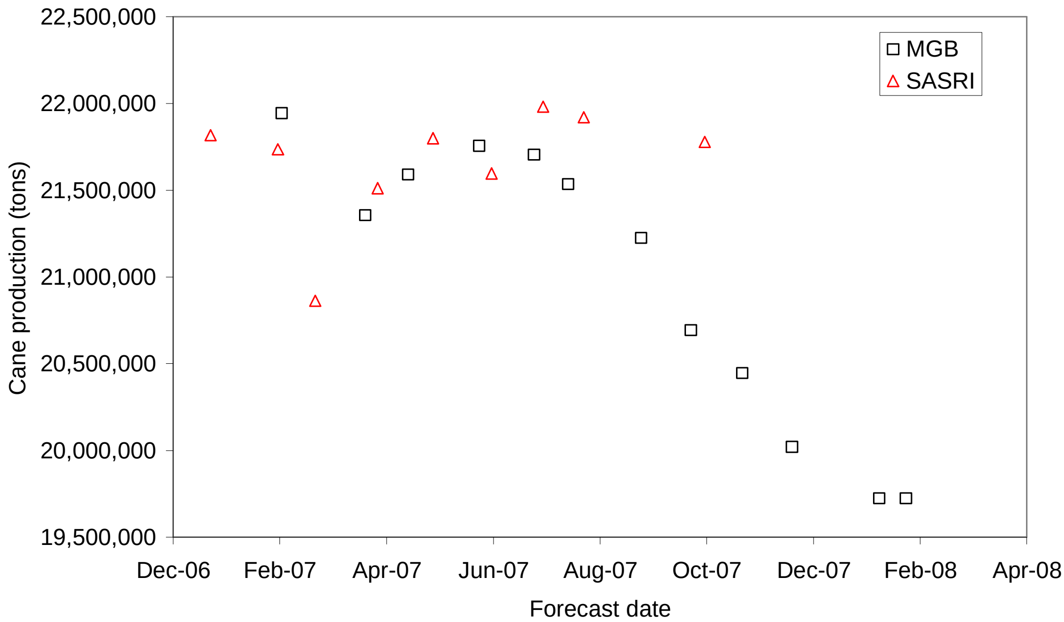

Figure 4. Mill Group Board (MGB) and Canesim (SASRI) estimates of industry cane production for the 2007-2008 season.

At a mill level, the difference between the SASRI forecasts and the actual production data were particularly large for the South and North Coast as well as for the Zululand mill areas (see Table 1). Note that the reassignment of Doornkop from Darnall to Gledhow (*ca* 250 000 tons) was not taken into account for the construction of Table 1.

A more detailed picture of the SASRI crop estimate made in October is presented in Figure 5, which shows the 2007-2008 yield estimates for cane harvested at different dates, in relation to the yield estimate for cane harvested at the same dates in 2006-2007, for a few selected mill areas. According to the model, the 2006-2007 season showed a trend of increasing yields of cane harvested towards the end of the season, and the reverse was true for 2007-2008. The combined effect of these trends is a strong decrease in the relative yields in most areas, as shown in Figure 5.

Table 1. Actual 2007-2008 sugarcane production (as determined in January 2008), compared to the SASRI crop estimate made in October 2007, both expressed as a percentage of the actual 2006-2007 crop.

Mill	Oct 2007 SASRI estimate (%)	Actual production (%)	Δ (SASRI estimate – actual) (%)
Malelane	116.1	111.1	5.0
Komatipoort	107.1	107.1	0.0
Pongola	100.9	95.1	5.8
Umfolozi	118.5	92.2	26.3
Felixton	104.3	92.5	11.8
Amatikulu	101.3	86.1	15.2
Darnall	108.2	77.3	30.9
Gledhow	108.3	101.2	7.1
Noodsberg	100.5	99.1	1.4
UnionCoop	103.3	102.5	0.8
Maidstone	105.8	88.7	17.1
Eston	115.1	111.8	3.3
Sezela	113.8	98.1	15.7
Umzimkulu	113.2	96.5	16.7
Industry average	**107.4**	**97.3**	**10.1**

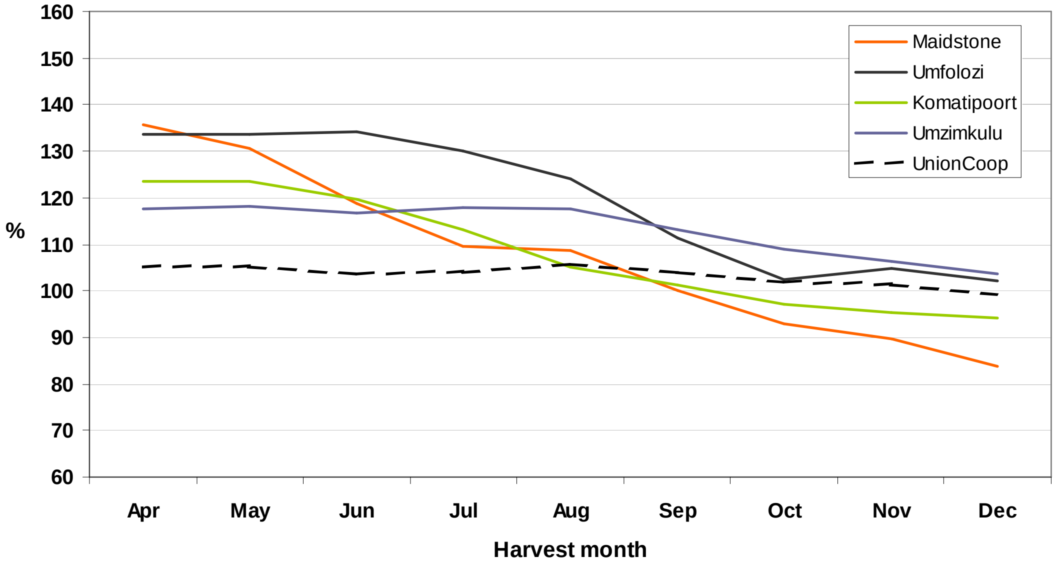

Figure 5. Canesim estimates (October 2007 run) of 2007-2008 yields at different harvest dates, expressed in relation to 2006-2007 yield estimates harvested at the same dates (source: http://sasri.sasa.org.za/cropest/Main.asp).

Weather

For the purposes of this investigation, it was assumed that weather conditions from April 2006 to December 2007 determined the yield potential of crops harvested in the 2007-2008 milling season. Rainfall in the second half of 2006 was generally favourable (compared to the poor rains received in the first half) with above normal rainfall occurring in most months and regions (with the exception of Mpumalanga). This was followed by below normal rainfall in January and February 2007 for the whole industry and in some areas also in March. This was due to the impact of a weak El Nino, which was anticipated and therefore taken into account in the SASRI crop forecasts (as shown by the declining yields as the season progresses; Figure 5). April and June had good rainfall, and above normal rainfall also occurred in October and November. Thus, although there were several months of low rainfall in the growing season of the 2007-2008 crop, these were interspersed with months of above normal rainfall.

As a consequence of the above, 12-month running rainfall totals in 2007 were above normal from April to November for the South and North Coast regions and near normal for the Midlands and Zululand (see Figure 6). For the industry as a whole, the 12-month totals were above normal from April to November. In terms of growing conditions, this is better than in 2006, when 12-month rainfall totals were below average from April to August before increasing to exceed the long-term mean for the rest of 2006.

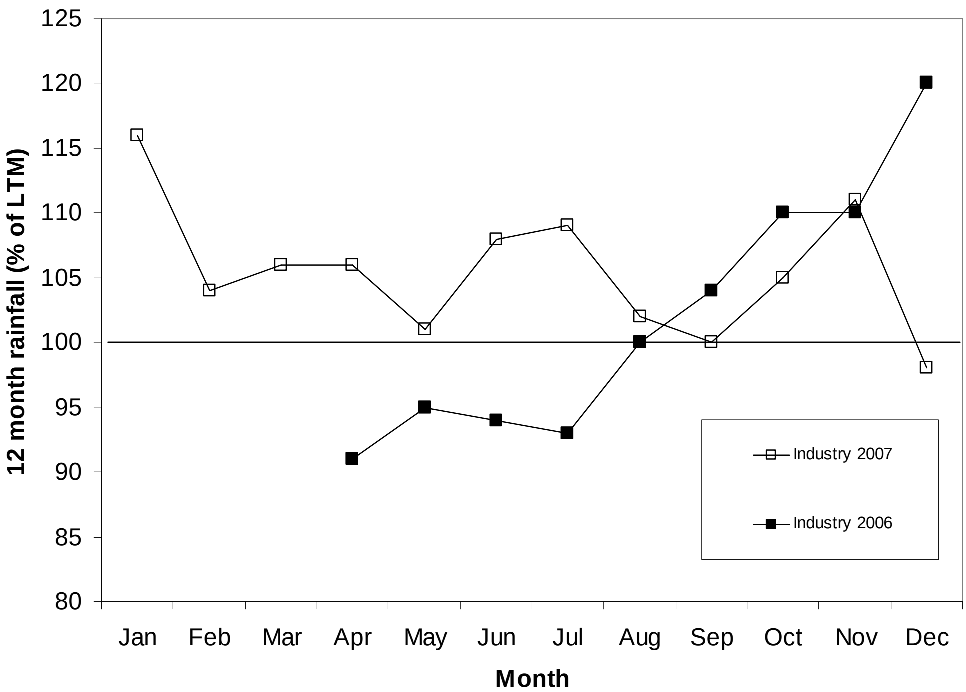

Figure 6. Rainfall totals for consecutive 12-month periods ending on indicated month, expressed as a percentage of the long-term mean, for different regions in the industry.

In most regions, solar radiation was generally below average in 2006, especially in the first four and last three months of the year. In 2007, radiation was well above average in the dry months of January and February and again in December, and below average in the wet months of September, October and November.

Mean temperature was below average (0.5 to 1°C) for most of 2006 for most regions, resulting in below average heat units that may have limited canopy development and stalk growth. In 2007, temperatures were closer to the long-term mean in many parts of the industry, but below average in Zululand in some winter months, which could have enhanced cane quality. In the last three months of the 2007-2008 season, temperatures dropped well below average.

Taken together, this interpretation of weather data supports the Canesim results, that conditions for sugarcane growth towards and during the respective harvest seasons have in general been more favourable for the 2007-2008 crop than for the 2006-2007 crop.

Eldana saccharina

Figure 7 shows annual trends, derived from the LPD&VCC survey database, of industry-wide incidence of *E. saccharina*. Regional infestation levels in 2006-2007 (i.e. June 2006 to May 2007) compared with the long-term average, are given in Figure 8.

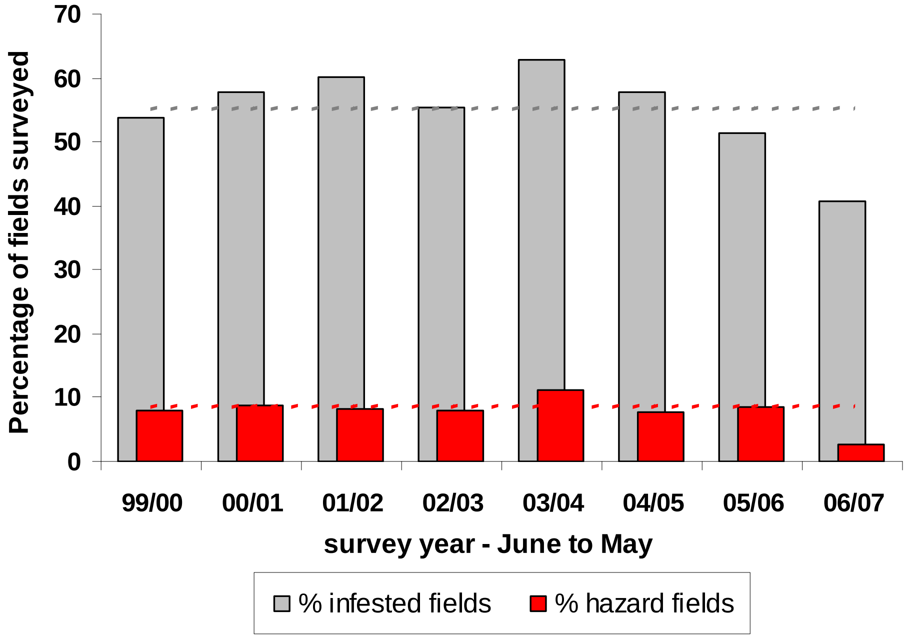

Figure 7. Trends in *E. saccharina* infested fields and hazard fields, expressed as a percentage of the total number of fields surveyed across the industry. Horizontal hashed lines indicate industry averages from the 1999-2000 season to the 2006-2007 season.

These data indicate that in the 2006-2007 survey year, on average, the number of infested and hazard fields decreased as compared to the previous year, whereas both indicators presented lower levels than the long-term average in all areas except ML (Figure 8), which includes both the Malelane and Komatipoort mill areas. However, the apparently serious increase in infestations at ML might have been an exaggeration of the actual situation, as only 53 fields were inspected during 2006-2007.

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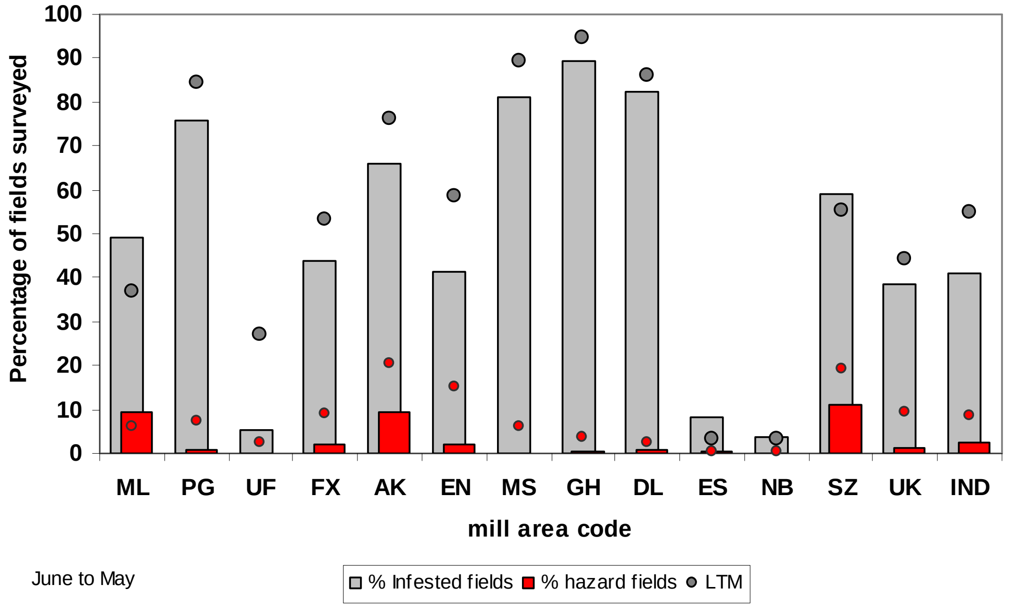

Figure 8. *E. saccharina* infested fields and hazard fields, expressed as a percentage of the total number of fields surveyed in each mill area. Bars refer to the June 2006- May 2007 survey year; bullets indicate the long-term (1999-2000 to 2006-2007) average. ML combines data from surveys conducted in the Malelane and the Komatipoort mill areas.

Thrips

The industry-wide 2005-2006 survey results showed that the entire industry is affected to some extent by sugarcane thrips: 96.2% fields and 67.2% spindles were infested by *F. serrata* (Way *et al*., 2006a). Average infestation levels measured over six months and by region appeared moderate, ranging between 0.4 and 9.8 *F. serrata*/spindle. Subsequent monitoring at Umfolozi showed increased numbers in 2006-2007 and 2007-2008 summer months (Figure 9), and in December 2007 an average 41.6 *F. serrata*/spindle was measured. Note that the latter values refer to sugarcane which will be harvested in the 2008-2009 season.

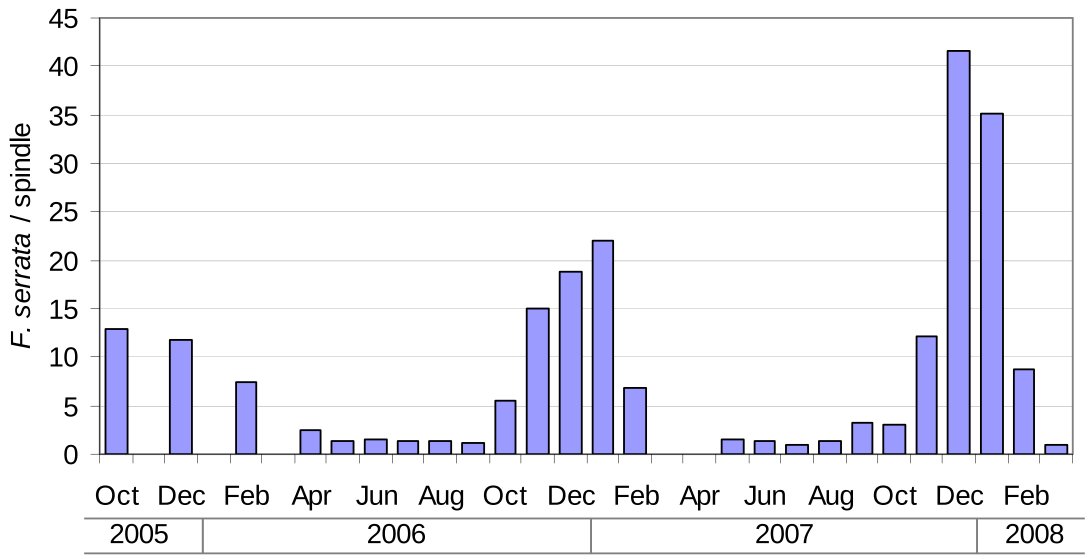

Figure 9. *Fulmekiola serrata* infestations in sugarcane at Umfolozi, monitored from October 2005 until March 2008.

Smut

Figure 10 gives an overview of the variation in smut infection rates per mill area from 1996-1997 to 2006-2007.

Survey results from June 2006 to May 2007 show that smut infection rates were lower in most areas than in the corresponding period in 2005-2006. As expected, smut incidence was higher in the northern irrigated areas. The apparent increase in smut incidence in Sezela, Maidstone and Midlands North, after several years of being at negligible levels, is also of concern. According to Rutherford *et al*. (2003), rainfall and temperatures from May through August have a direct effect on smut incidence, with drier, warmer winters favouring smut development. Below average rainfall was recorded from April through September in 2005 and may explain the increased smut incidence observed in the smut-prone northern parts of the industry. Although smut levels in Malelane increased in the 2006-2007 season, good rainfall in 2006 may have caused the apparent decrease in levels observed in the rest of the northern region. However, below average rainfall in Mpumalanga in the second half of 2007 would have favoured further increases in smut. During the past summer period (October 2007 through March 2008), smut was recorded in 83% of the fields inspected in Mpumalanga; 70 of these fields (more than 700 ha) were above the ploughout threshold of 10%. The disease has had serious economic implications for many growers in the area, and it is estimated that up to 1.3% of the crop could have been lost in the past season due to smut. Substantial costs associated with eradicating and re-establishing fields affected by compulsory ploughout orders were also incurred.

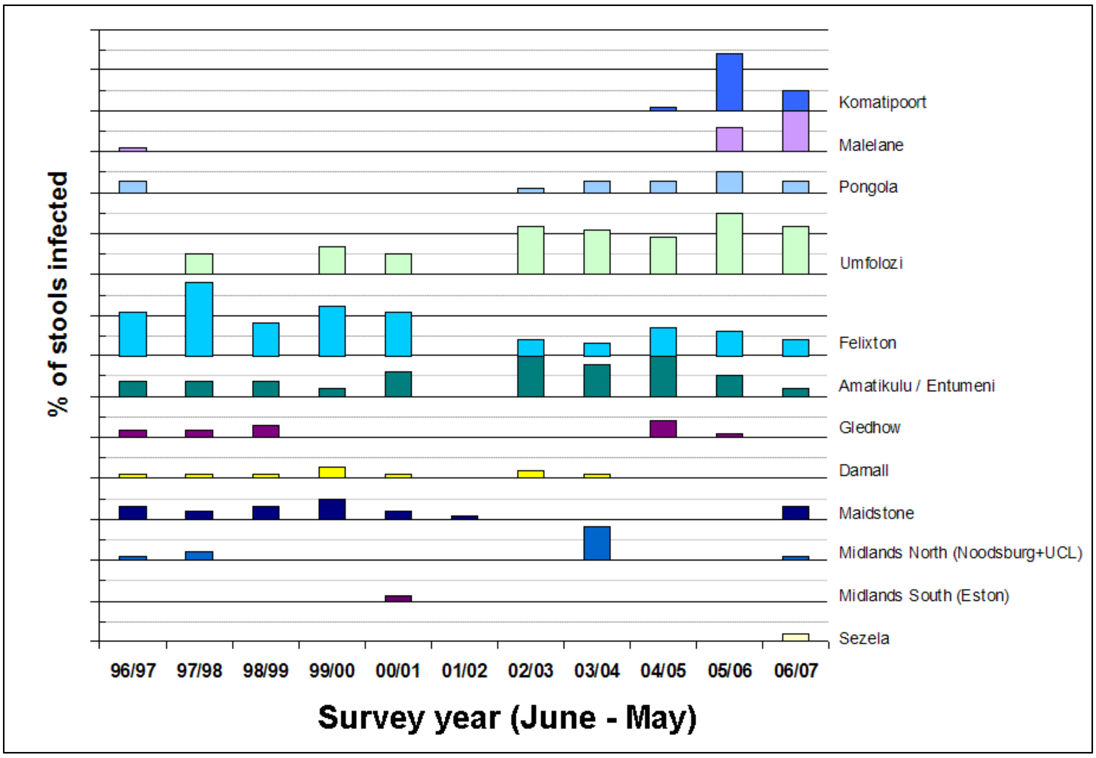

Figure 10. Variation in smut infection rates per mill area from 1996-1997 to 2006-2007 (0.5% between grid lines). No smut was detected in the Umzimkulu area (not shown).

Yield losses due to smut are dependent on variety, crop stage and growing conditions. They can vary from 0.26 to 1.9 tons cane/1 000 whips/ha (corresponding to approximately 1% stalks or 10% stools infected). Yield loss per 1 000 whips/ha is generally greater under low yielding conditions (Rutherford *et al*., 2003). Actual smut incidence is often exaggerated by the survey data because susceptible varieties tend to be targeted each year. Therefore, with the exception of Mpumalanga, yield losses due to smut were likely to be low at an industry level.

Farm economics

Figure 11 shows that between 1995 and 2007 the rate of change in the RV price has been considerably lower than the rate of change in the prices of primary production inputs, such as fertilisers, herbicides, wages and diesel fuel.

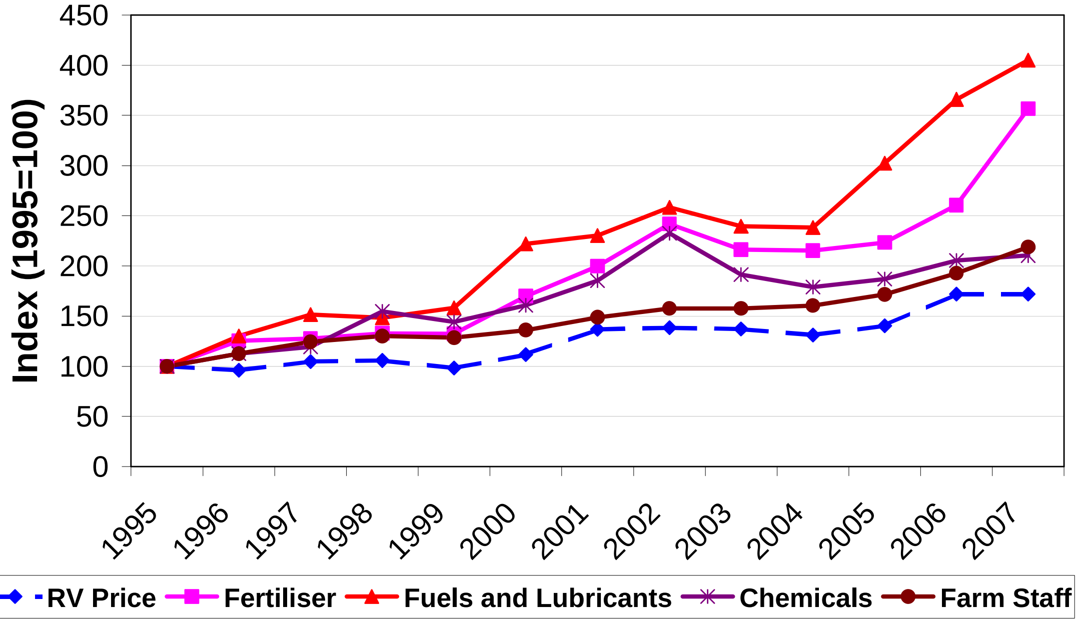

Figure 11. Indices of primary farm input prices and the RV price (basis year 1995=100).

This has placed great pressure on returns to cane production, as shown in Figure 12, which presents the development from 1991-1992 to 2007-2008, in growers' real gross income and costs per hectare under cane. The shaded area represents the shortfall between Gross Income and Total Costs including Return on Capital (ROC). A recurring shortfall implies an unsustainable cane growing environment, which has been the case since the 2002-2003 season. Note that in 2007-2008, Gross Income was even less than Total Costs excluding ROC, a situation which represents a threat of bankruptcy.

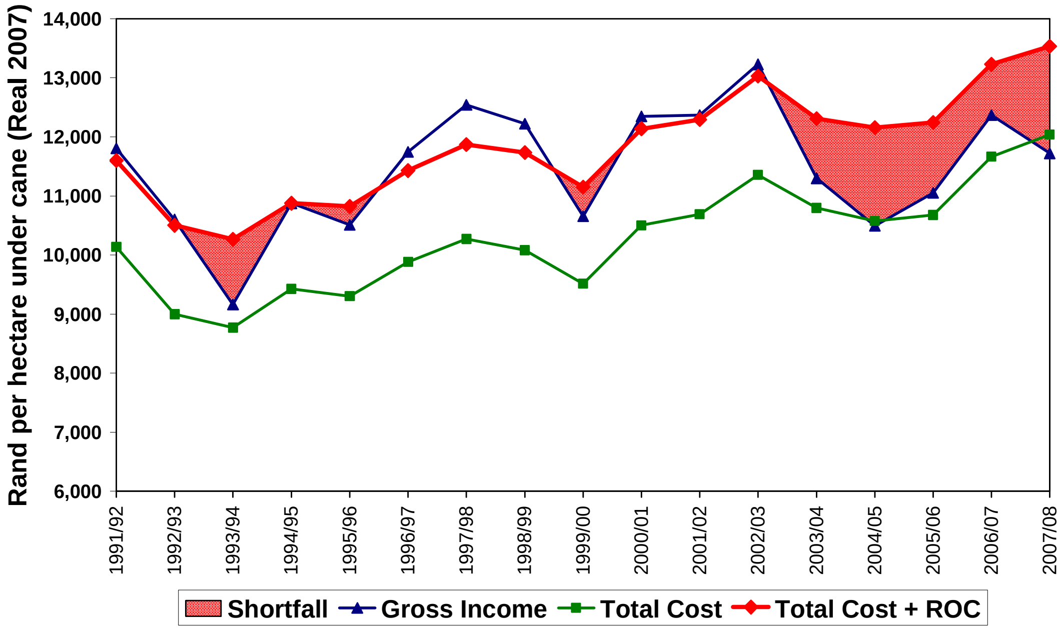

Figure 12. Real gross income and costs per hectare under cane of large-scale growers (1991-1992 to 2007-2008), derived from CANEGROWERS' Large-Scale Grower Cost Survey results. The values for Total Costs exclude interest, rent and leases. Return on capital (ROC) represents an allowance of 7% on the determined capital value per hectare. The shaded area represents the shortfall between Gross Income and Total Costs + ROC.

Other factors

Twelve regional specialists responded to the questionnaires aimed at characterising the 2007-2008 harvest season as compared to a 'normal' season. Results are summarised in Figure 13.

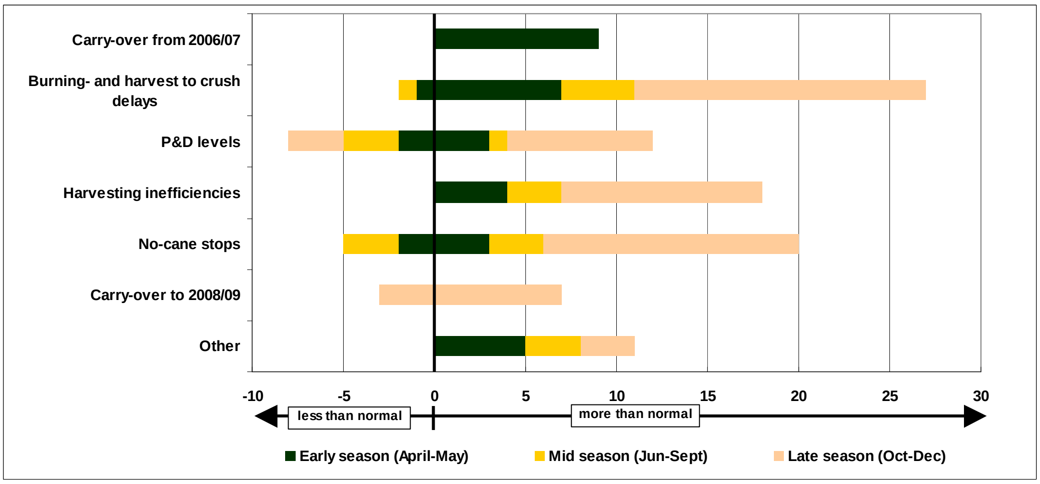

Figure 13. Characterisation of the 2007-2008 harvest season as compared to a 'normal' season, according to 12 regional specialists. The frequency with which a certain feature was indicated as more or less than normal is given on the horizontal axis. A weighting factor of 2 was attributed to features that were perceived as 'considerably' more, or less, than normal.

In general, these results suggest that the late season, i.e. from October to December, was the most problematic. In this period, burn- and harvest-to-crush delays (BHTCD) were perceived by all specialists to be longer or considerably longer than normal. The main reason given was wet, rainy conditions, aggravated in several cases by labour constraints/disputes and/or problems at the mills. These same factors would have resulted in other inefficiencies (e.g. execution and effectiveness of ripener programmes) and no-cane stops, all of which would have affected cane quality. Lower pre-harvest sucrose contents, post-harvest deterioration, and extraneous matter entering the mill eventually resulted in a large number of fields being carried over to the 2008-2009 season (e.g. 154 000 tons in the Amatikulu supply area alone).

Additional factors identified by the specialists as affecting cane quality and supply included:

- Thrips, which, with the exception of the Midlands areas, was almost invariably identified as being on the increase, and was perceived as having a significant effect on yields.
- High rust levels affecting the crop late in 2006 (Amatikulu).
- Arson fires during dry months (Sezela).
- Localised severe early frosts in the Midlands, which were exacerbated in fields that had been trashed, but which did not considerably affect production at the mill area level.
- Poor performance of SSGs (contractor inefficiencies and disputes) and new freehold growers, affecting total cane supply and quality not only as a direct consequence, but also by putting pressure on large-scale growers to harvest younger cane (North Coast and Zululand).
- Considerable damage caused by a flood in late December 2006 (Umfolozi).

The Umfolozi area seems to have been the hardest hit by most of these factors. There were nevertheless also some positive notes, such as good yields of high quality cane at the beginning of the season, and the reduction in no-cane stops in Mpumalanga, thanks to huge efforts by Cane supply and the introduction of FREDD, a system that pools vehicles between big transporters.

Results from the Sugar Logistics Improvement Programme (SLIP) confirmed an increase in BHTCD, with a record average of 71 hours for the six South African mills participating in the programme, against 68 hours in 2006-2007 and 66 hours in 2005-2006.

Discussion

The results of this investigation clearly indicate that weather conditions leading up to and during the 2007-2008 growing season have in general been favourable for sugarcane growth, whereas the main environmental factors that would have limited and/or reduced production at the industry level appear to be (i) the rains towards the end of the season with which the different role players in the supply chain had not been able to cope, and (ii) the increased levels of thrips infestation. The results also suggest that problems at a local level occurred in greater proportions in those regions with the largest gaps between estimated and actual production.

P&D survey data indicate that in 2007, in most regions, neither *E. saccharina* nor smut had a greater negative impact on industry performance than in previous years. This finding is corroborated by the perceptions of the regional specialists. The situation in Mpumalanga is, however, of particular concern. Although *E. saccharina* survey data may have been biased, irrigated areas such as these pose a greater risk from this borer because the cane varieties cultivated are more susceptible to attack. Normally, *E. saccharina* proliferates in stressed crops during periods of below average rainfall and in older crops such as carry-over cane fields. Moreover, the premature eradication of fields infected with smut, along with the direct effects of this disease on the crop, will continue to have a serious impact during the 2008-

2009 season. The rate at which smut levels decrease in the northern irrigated areas will depend largely on the ability of growers to apply the recommended management practices, and the rate at which smut-prone varieties are replaced with more resistant varieties. This in itself poses a unique problem, as varieties that are more resistant to smut tend to be more susceptible to *E. saccharina*.

The yield loss due to sugarcane thrips is unknown. However, regional specialists surmise that injuries retard crop growth and ultimately adversely affect final yields. In general, regions where thrips populations appear to have increased markedly (i.e. most of the coastal and Zululand areas), also present the greatest gaps between expected and actual production levels. Regional specialists in the Midlands regions did not mention thrips as being a major concern, though it was mentioned as being on the rise in Mpumalanga. Thrips numbers can increase markedly over a short period of time, therefore this situation requires ongoing monitoring.

It is often speculated that socio-economic factors could have contributed to production decline by creating disincentives for on-farm production capacity maintenance and new investments. In agricultural economics literature (Barlowe, 1958) it is clear that incentives to invest in farmland are directly related to expected returns. Lower expected returns to farmland act as a disincentive to future investment in farmland improvements, because the grower's disposable income and ability to reinvest are reduced. The data presented in Figure 12 clearly illustrate that, on average, cane production has been economically unsustainable in South Africa since the 2002-2003 season. Of even greater concern is the threat of bankruptcy where total costs excluding return on capital are greater than gross income, which was the case in the 2007-2008 season estimate (see Figure 12). Continuation of this scenario in 2008-2009 could compromise the industry cane area in subsequent seasons. It is expected that, in an environment of rapidly changing input-output relationships, negligible returns to cane production and tightening cash-flow constraints, growers will focus on altering production functions to contain costs for farm business survival. Cost saving measures would include delaying expenditure on replant programmes or, as a last resort, reducing expenditure on crop nutrition and protection. No documented evidence could be found of symptoms of such problems already occurring in the large-scale grower sector, although it would appear that these processes are already taking place in the SSG sector, as evidenced by the strong and consistent decline in production over the past 10 years (Figure 3), and described in a case study in Zululand by Mahlangu and Lewis (2008).

Land claims pending for years with uncertain outcomes are another disincentive to investments. According to information obtained by CANEGROWERS from the Office of the Regional Land Claims Commission (RLCC) in November 2007, approximately 51% of the freehold cane area in KwaZulu-Natal and 78% of the freehold cane area in Mpumalanga was under gazetted claim or in the advanced stages of pre-gazetting during the 2007-2008 season. At that stage only 4% of land claims in KwaZulu-Natal had been settled and 34% in Mpumalanga, leaving approximately 1 463 unresolved claims in KwaZulu-Natal and 1 326 in Mpumalanga.

In almost all settled claims to date, the beneficiaries have struggled to maintain production efficiency due to a number of contributing factors (personal communication[1]). Some of these include lack of business and technical skills, poor co-ordination of post-transfer support between the Dept of Land Affairs and the Dept of Agriculture, delays in the disbursement of restitution and operating expenditure grants, lack of collateral value of restituted land and lack of machinery to perform primary agricultural operations (Cousins, 2007; CDE, 2008).

[1]Kathy Hurley, South African Cane Growers' Association, Mount Edgecombe, South Africa (2008).

Overall, this study provides a plausible explanation for the gaps between actual production and the Canesim estimates. However, it is not possible to provide a more definitive 'verdict' on the specific factors that had the highest impacts on 2007-2008 sugarcane production in the different mill areas. This would require more information regarding some features, notably the impact of thrips on yields, areas harvested and on-farm production capacity maintenance and new investments. Furthermore, some of the factors at play are interrelated. For example, it is well known that supply chain problems can have cascading effects (e.g. Le Gal *et al*., 2007) as well as knock-on effects from one season to another. Other interrelations tend to be more subtle; for example, where harvesting of sugarcane affected by thrips is delayed because early growth and canopy development has been retarded or, as described above, where smut susceptible varieties are replaced by smut resistant varieties that are more susceptible to *E. saccharina*.

Conclusions

- Climatic conditions favoured the growth of the 2007-2008 crop more than the 2006-2007 crop. In most areas, the 2007-2008 crop received more rain, which was also more evenly distributed than rains that fell during the 2006-2007 season. The high radiation levels and low water status in the first few months of 2007 led to better quality (higher sucrose content and juice purity) cane at the start of the 2007-2008 milling season, compared to the low radiation levels at the start and end of the 2006-2007 season. Higher cane (confirmed by Canesim estimates) and sucrose yields were therefore expected for 2007-2008, compared to 2006-2007. The small crop that was actually realised in 2007-2008, particularly in Zululand and the coastal areas, cannot be ascribed to low climatic potential.
- Rainy weather and wet conditions, in particular towards the end of the season, posed numerous problems to the different role players in the supply chain, resulting in inefficient harvest operations that affected sugarcane quality and supply.
- Levels of *E. saccharina* and smut were generally lower in the survey leading up to the 2007-2008 season than in previous years. These factors were therefore not invoked to explain the yield decline.
- The numbers of the sugarcane thrips pest increased last year. It is highly likely that this pest impacted negatively on yields in 2007-2008. The highest populations were recorded in the coastal regions and Zululand, areas where the greatest yield decline took place. However, at this stage, ascribing a particular amount of damage to thrips would be conjecture, since yield loss from this pest in the industry remains to be quantified.
- Poor financial returns to primary cane production and lingering land claims with uncertain outcomes have acted as a disincentive to investment to maintain or increase sugarcane production. The data available at present are insufficient to verify whether such investments have declined in real terms in the large-scale sector of the industry. In the small-scale sector, however, it is clear that declining returns have had an impact on maintenance of the crop, and sugarcane production decreased by more than 7% per annum over the past decade.
- Several of the problems identified here are likely to continue challenging the industry for several years to come, notably thrips and socio-economic constraints. Smut and *E. saccharina* will require continued vigilance, particularly in Mpumalanga.

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REFERENCES

Anon (2007). Minutes of the Annual LPD&VCC Chairmen's Meeting. South African Sugar Association Pest and Disease Control Steering Committee. pp 79-84.

Barlowe R (1958). *Land Resource Economics.* Prentice-Hall, New Jersey, USA. 150 pp.

Bezuidenhout CN and Singels A (2007). Operational forecasting of South African sugarcane production. Part 1: System description. *Agric Systems* 92: 23-38.

CDE (2008). *Land reform in South Africa: Getting back on track.* Research Report No. 16, Centre for Development and Enterprise, Johannesburg, South Africa. 61 pp.

Cousins B (2007). Agrarian reform and the two economies: Transforming South Africa's countryside. pp 220-245 In: Hall R and Ntsebeza L (Eds.), *The Land Question in South Africa: The Challenge of Transformation and Redistribution.* HSRC Press, Cape Town, South Africa.

Le Gal PY, Bezuidenhout CN, Lyne PWL (2007). Mill-scale supply chain and logistics model integration for improved decision support. *Proc Int Soc Sugar Cane Technol* 26: 121-130.

Mahlangu IM and Lewis F (2008). Social and institutional constraints to the production of sugarcane by small-scale growers in the Amatikulu catchment. *Proc S Afr Sug Technol Ass* 81 (in press).

Rutherford RS, McFarlane SA, van Antwerpen T and McFarlane K (2003). Use of varieties to minimise losses from sugarcane diseases in South Africa. *Proc S Afr Sug Technol Ass* 77: 180-188.

SASRI (2000). Information Sheet 2.8: Inspecting for Disease and Off-types. Published by the South African Sugarcane Research Institute, Mount Edgecombe, South Africa

SASRI (2005). Guidelines and recommendations for Eldana control in the South African sugar industry. Published by the South African Sugarcane Research Institute, Mount Edgecombe, South Africa. pp 79-82.

Way MJ (2007). Annual Local Pest and Disease Report. Published by the South African Sugarcane Research Institute, Mount Edgecombe, South Africa.

Way MJ and Goebel FR (2007). Monitoring *Eldana saccharina* and other arthropod pests in South African sugarcane. *Proc Int Soc Sug Cane Technol* 26: 780-786.

Way MJ, Leslie GW, Keeping MG and Govender A (2006a). Incidence of *Fulmekiola serrata* (Kobus) (Thysanoptera: Thripidae) in South African sugarcane. *Proc S Afr Sug Technol Ass* 80: 199.

Way MJ, Stiller M, Leslie GW, Conlong DE, Keeping MG and Rutherford RS (2006b). *Fulmekiola serrata* (Kobus) (Thysanoptera: Thripidae), a new pest in southern African sugarcane. *African Entomology* 14(2): 410-403.