REFEREED PAPER

SOUTH AFRICAN SUGARCANE PRODUCTION IN 2013/14: A RECORD BREAKING SEASON

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Abstract

The objective of this study was to analyse South African sugarcane production in the 2013/14 season and relate the key performance indicators of cane yield and cane quality to the main production factors. The information and lessons learnt from it can be used in future for more efficient production of high quality sugarcane in South Africa.

The industry produced 20.03 Mt of cane in the 2013/14 season, harvested from an estimated 263 465 ha. It was the third consecutive increase from the previous seasons after a steady decline since 2005, while the area under cane has increased from the previous season for the second consecutive season. The industry average cane yield is estimated at 76.0 t/ha, the highest yield achieved since 1987/88, when average age at harvest was substantially higher than at present.

The season was characterised by excellent growing conditions, especially in rainfed areas. Rainfall during the critical 2012/13 summer months was well distributed, keeping soil water status near optimal and enabling vigorous growth. The dry winter months promoted good cane quality, especially in late winter and spring. Excessive rainfall towards the end of milling season interfered with harvesting operations to some extent. Although this had a relatively small impact on seasonal average cane quality, some of crop scheduled for harvest in 2013 had to be carried over to 2014.

The good cane quality achieved in 2013/14 is ascribed to a combination of factors, namely, a large amount of mature cane carried over from 2012/13 in many areas, the increased and judicious use of chemical ripeners in irrigated and rainfed areas, and favourable climatic conditions.

Pests and diseases had relatively little impact on cane yield. Eldana damage declined steadily throughout the industry, and the sharp decline in 2013 on the South Coast of KwaZulu-Natal, in particular, was encouraging. Although problematic in some areas, overall, smut and mosaic disease levels were low. Brown and tawny rust were widespread in autumn and spring, and many growers applied a fungicide to infected fields to manage the disease. Of concern is the emergence of a new pest, yellow sugarcane aphid. This pest will be monitored carefully, and impacts on crop growth and yield and suitable control measures will be investigated.

The excellent growing conditions were offset by poor economic conditions. Sugarcane farming profitability has declined further to alarmingly low levels, due mainly to large production cost increases and a reduced product price. The latter was caused by massive

amounts of imported sugar that reduced local market demand, necessitating increased sugar exports at low world prices.

Keywords: cane quality, cane yield, diseases, modelling, profitability, pests, production

Introduction

The South African (SA) sugar industry produced 20.03 Mt of cane in the 2013/14 season, harvested from an estimated 263 465 ha. Corresponding amounts of cane for the 2011/12 and 2012/13 seasons were 16.80 and 17.28 Mt harvested from 253 102 and 257 095 ha, respectively. These data translate to a record breaking average cane yield (estimated) for the industry of 76.0 t/ha, compared to 66.3 and 68.1 t/ha for the 2011/12 and 2012/13 seasons, respectively. Sugar production increased to 2.35 Mt in 2013/14, up from values of 1.96 and 1.92 Mt for the 2011/12 and 2012/13 seasons, respectively. The cane to sugar ratio was an excellent 8.48 in 2013/14, compared to values of 9.17 for 2011/12 and 8.81 for 2012/13.

This season saw the third consecutive increase in production compared to previous seasons after a steady decline since 2005, while the area under cane has increased from the previous season for the second consecutive season (Figure 1). It thus seems that the declining trend in production in recent years has been changed for the better.

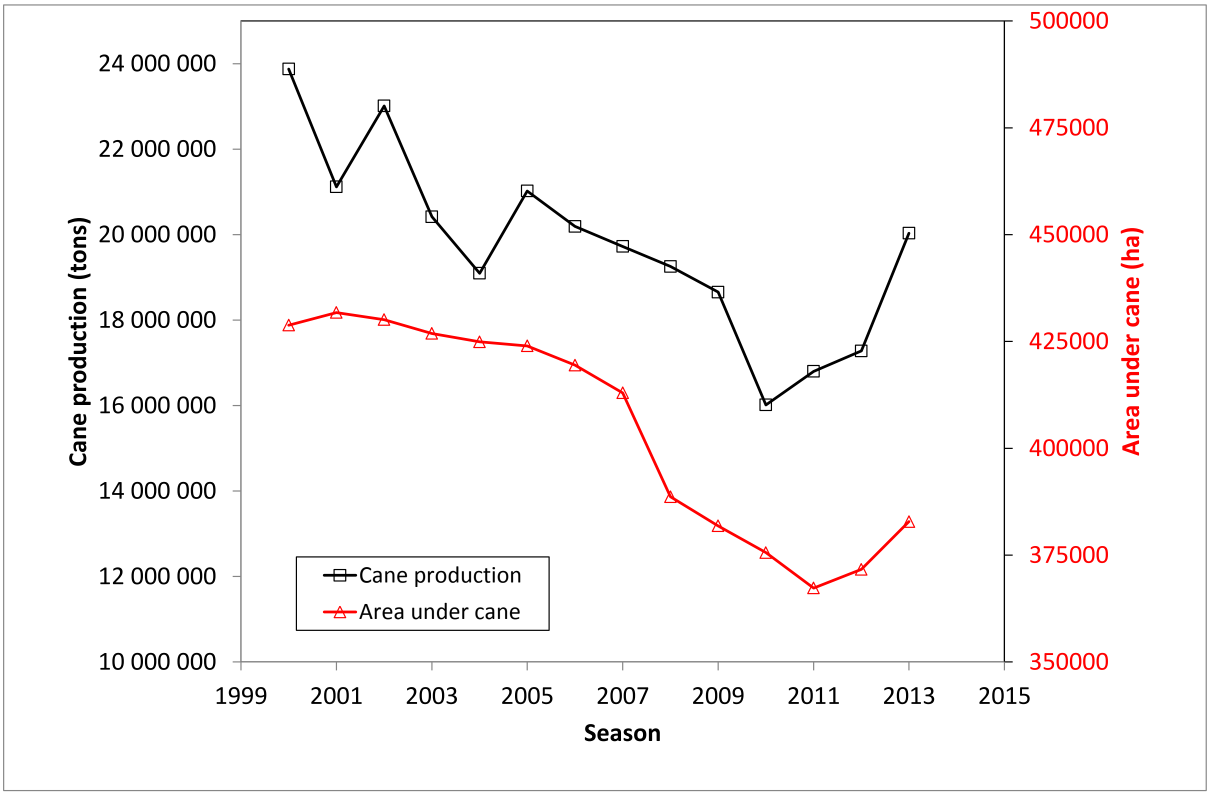

Figure 1. Cane production and area under cane in the South African sugar industry since 2000.

The objective of this study was to analyse the production of the 2013/14 season and relate the key performance indicators of cane yield and cane quality to the main production factors of climate, pests and diseases, agronomic and economic conditions. The information, and lessons learnt from it, should be used in future for more efficient production of high quality sugarcane in South Africa.

Methodology

A similar methodology was followed to that used in previous reviews (van den Berg *et al.*, 2008; Singels *et al.*, 2010). Production data were mostly analysed at the level of mill supply areas (MSAs), while in some cases pest and disease data were grouped or subdivided into areas as defined by Local Pest, Disease and Variety Control Committees (LPD&VCCs) of the South African Sugar Association (SASA). Some results are also discussed in the context of broad agroclimatic regions (Figure 2).

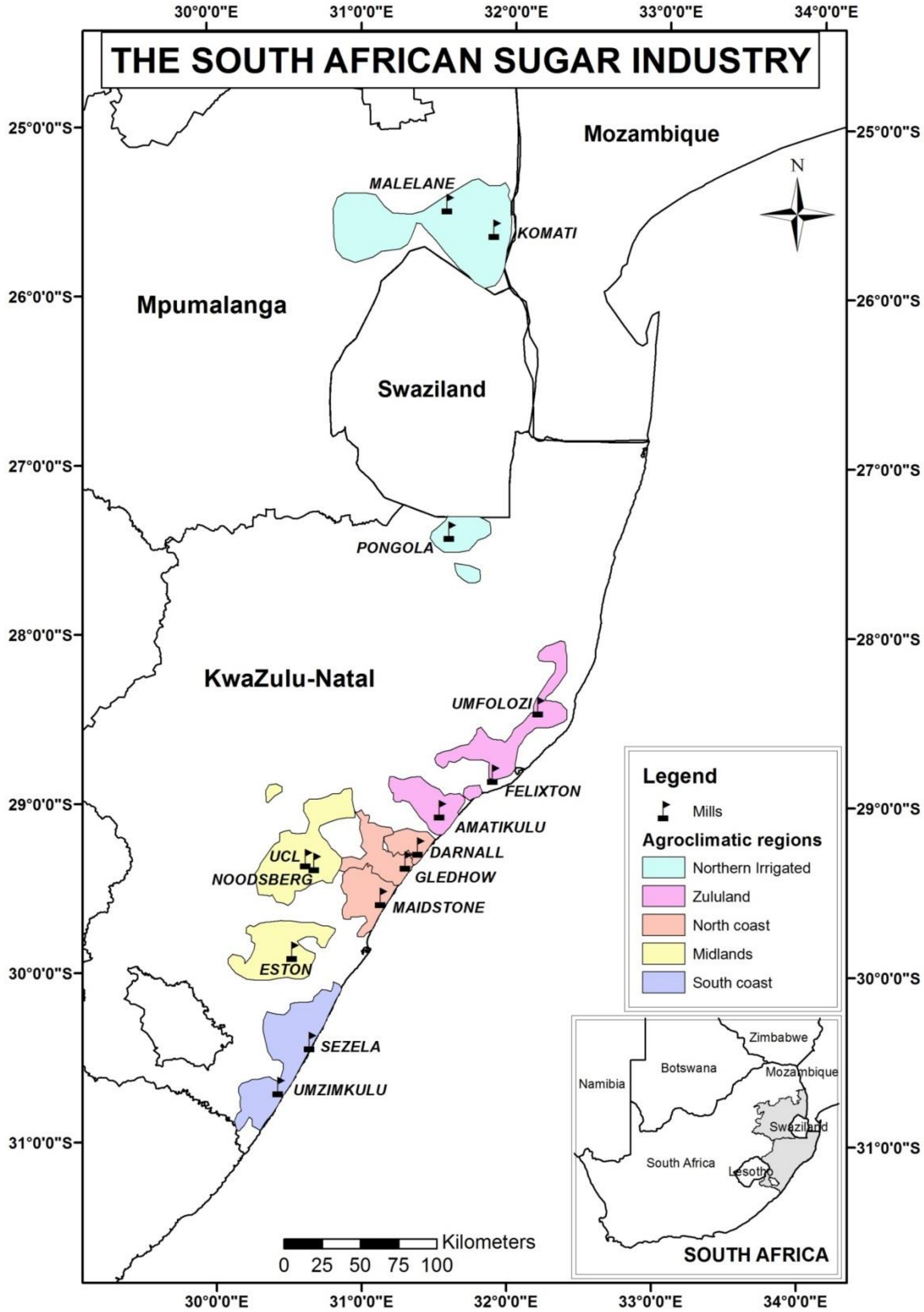

Figure 2. Map showing the 14 South African sugar mills and their location within broad agroclimatic production regions (source: SASRI GIS office).

The sugarcane produced in the 2013/14 milling season grew mostly from between April 2011 (long cycle cane) and December 2012 (annual cane), to between April 2013 and December 2013, when it was harvested. For simplicity, both the growing and milling seasons were referred to as the 2013 season.

Production data

Production (cane deliveries and cane quality) data were obtained from the SASA Cane Testing Service (CTS) database, while the estimated area harvested was gleaned from survey data from SASA Industry Affairs or from data provided by Mill Group Boards (MGBs). It should be noted that area harvested for the 2012 and 2013 season were estimates.

Actual yield data (computed by dividing home mill production with estimated area harvested) were compared to yields estimated by the Canesim yield forecasting system (Bezuidenhout and Singels, 2007) using observed weather data. Model estimates provided a benchmark of the agroclimatic potential for sugarcane production, taking into account soil properties, radiation, temperature and effective rainfall as well as irrigation water supply. Large differences between trends in actual and estimated yields were investigated by considering pest, disease and agronomic information.

Climate

The impact of climate was assessed by assuming that climatic conditions over the 12-month period leading to harvest influenced the status of the crop for all MSAs. Although some of the cane harvested in 2013 was already growing prior to April 2012, it was decided to exclude this period from the climate analysis to allow meaningful comparisons between MSAs. Rainfall and temperature records from various weather stations, averaged per MSA, and solar radiation records from a representative station in each MSA, were obtained from the South African Sugarcane Research Institute (SASRI) weather database. Twelve-month totals or average values leading up to each month of the 2013 milling season (e.g. April 2012 to April 2013, May 2012 to May 2013, and so forth) were compared to the corresponding long term mean (LTM) values. The deviations from the LTM (anomalies) were in turn compared to the corresponding anomalies for the 2012 and 2011 seasons.

The number of harvestable days was calculated from weather data by maintaining a daily water balance of the top 30 cm of a hypothetical soil. A given day was deemed harvestable when the simulated volumetric water content of this 30 cm layer was less than 80% of field capacity. The algorithm was based on work by Bezuidenhout *et al*. (2008).

Pests

A number of insect pests impact production in the SA sugar industry. These include the stalk borer *Eldana saccharina* Walker (Lepidoptera: Pyralidae) (eldana), sugarcane thrips (*Fulmekiola serrata* Kobus (Thysanoptera: Thripidae)), white grubs (various species of Scarabaeidae) and grasshoppers (Acrididae). Of these, the eldana stalk borer and sugarcane thrips are the most widespread and serious threats to sugarcane production. LPD&VCC field survey results were used to provide information on the eldana infestation, which was expressed as the number of larvae per 100 stalks (e/100). Damage was quantified as the length of stalk tissue with a red colouration (caused by a fungal infection at the site of the borer damage) expressed as a percentage of total stalk length examined (% stalk length red). Both infestation and damage levels were determined through random sampling of stalks. Larval numbers and damage data were averaged over the 12-month period from June 2012 to

May 2013 and compared to the corresponding period in 2011/12, as well as to the average of the previous five seasons.

Information on the seasonal incidence of thrips was obtained from routine monitoring on the Umfolozi Flats in KwaZulu-Natal (Figure 2).

Diseases

Smut (*Sporisorium scitamineum*) and mosaic (*Sugarcane mosaic virus*) surveys are conducted by LPD&VCCs annually, usually when the cane is three to six months old. A total of 5825 commercial fields covering more than 28 000 ha (7% of the industry) were inspected for smut and mosaic between June 2012 and May 2013. This was done by inspecting a number of 50 m lengths of cane row in each field. The number of row sections inspected depended on field size. Disease prevalence was expressed as the percentage of fields inspected, that were infected (Nutter, 2001), while disease incidence was expressed as the percentage stools examined, that were infected. The average infection for each MSA was calculated by dividing the total number of infected stools by the total number of stools inspected in each MSA.

The selection of fields for inspection varied between MSAs. In some areas fields were randomly selected for survey, while in others, fields planted to varieties known to be susceptible to smut or mosaic were targeted. Generally, LPD&VCCs aim to visit each farm at least once a year, but this depends largely on the number of teams operating in the area and the size of the MSA to be covered. For these reasons, it was not possible to make comparisons between MSAs, but trends over the years within mill areas could be analysed. Since ratoon stunt (RSD) does not have any obvious external symptoms, diagnosis was based on the serological analysis or microscopic examination of xylem sap extracted from stalk samples (McFarlane *et al*., 1999). Routine surveys of commercial fields were conducted annually by the LPD&VCCs to identify RSD-infected fields.

Economic information

Farm economics were analysed using survey data from SA Cane Growers' Association (SACGA, 2013). Only actual data up to the 2011/12 financial year were available, and data for 2012/13 and 2013/14 were estimated using indices from reports released by the Department of Agriculture, Forestry and Fisheries (DAFF, 2014). The survey elicited cost and income data from a sample of large-scale growers from the 14 MSAs in SA. Average cost and income statistics reported in this study were determined by weighting MSA values by the deliveries of large scale growers in each MSA.

Results

Overview

Cane production, area harvested, cane yields and cane quality of the 2013 season were compared to previous seasons. A summary of production conditions during the growing season in the different MSAs is provided, focusing on climate, pests and diseases and economics. Cause and effect relationships were then discussed based on the separation of climatic impacts from non-climatic impacts that could possibly be managed.

Production information

Trends in cane production for individual MSAs are shown in Figure 3. Production has increased from 2012 and was higher than the five-season mean for all MSAs.

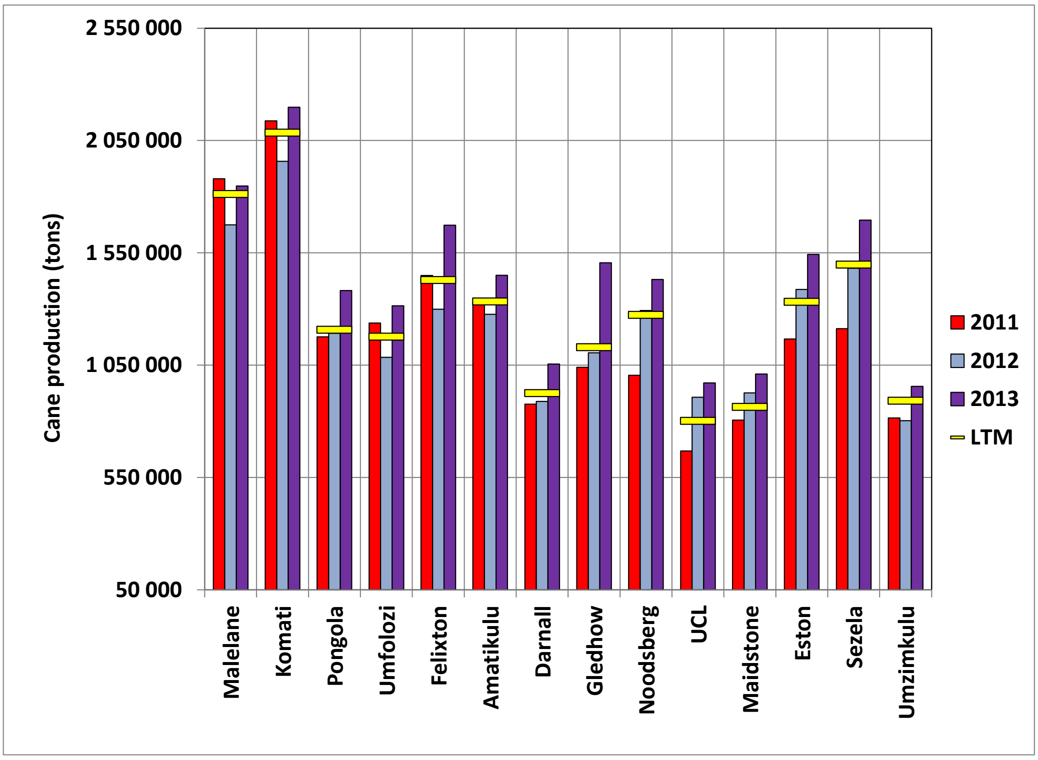

Figure 3. Cane production for different mill supply areas for the 2013 season compared to the 2011 and 2012 seasons and the five-season mean (LTM, shown as yellow horizontal bars).

The estimated area harvested (Figure 4) in 2013 increased compared with the 2012 season for all MSAs except Umfolozi and Felixton, with the industry total increasing by 7.6%. This is mostly ascribed to large areas of cane carried over from 2012, when the industry experienced industrial action and wet weather in the second half of the season. Area harvested increased for two consecutive seasons for Amatikulu, North Coast and Midlands MSAs.

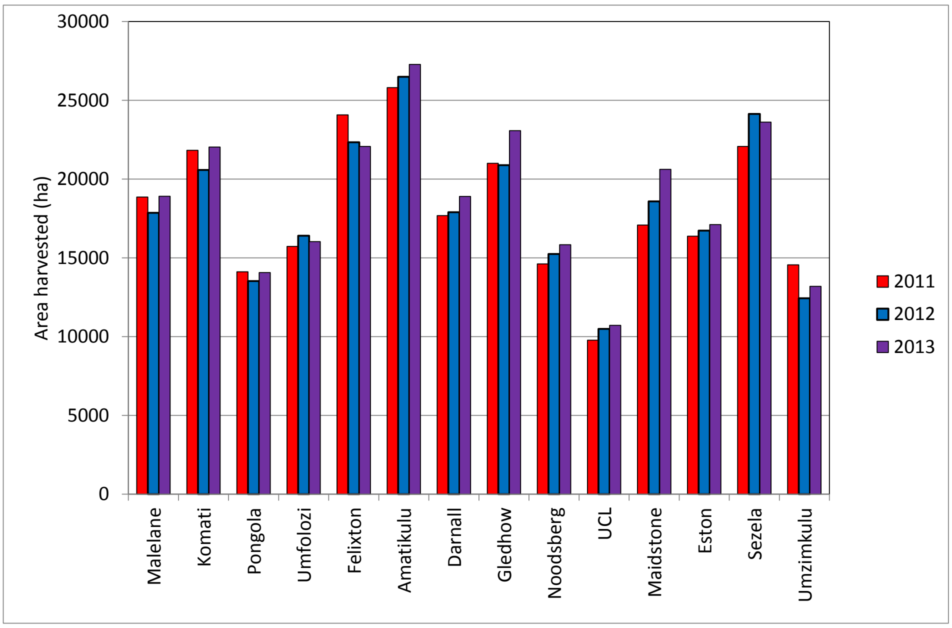

Figure 4. Estimated area harvested in the 2013 season for different mill supply areas, compared to the 2011 and 2012 seasons.

Estimated MSA average cane yields have increased from 2012 to 2013 and were above the five-season mean for all MSAs, with the industry average yield increasing by 11.6% (Figure 5). The industry average of 76.0 t/ha was the highest since the 1987/88 season, when age of harvest was much more than at present. Average yields for most MSAs also ranked amongst the highest in recent times.

Cane quality, as quantified by estimated recoverable crystal (ERC) content of cane (fresh mass basis), improved from 2012 to 2013 for all MSAs except those in the Midlands. Seasonal average ERC contents exceeded, or were close to the five-season mean for all MSAs and the industry as a whole (Figure 6).

Production conditions

In this section, the status of main factors that determine production conditions and drive cane growth and productivity, namely climate (primarily rainfall, but also temperature and solar radiation), plant health (pests and diseases) and economics, are described for different MSAs for the 2013 growing season. Soil health and nutrition were excluded from the analysis due to lack of reliable information.

Climate

Average growing season rainfall totals for 2013 were higher than for 2012, and above the LTM for all MSAs. Rainfall totals exceeded the LTM by more than 20% for all coastal MSAs as well as the two Mpumalanga MSAs (Figure 7).

Monthly distribution of rainfall for KwaZulu-Natal (with a large proportion of rainfed sugarcane production) is shown in Figure 8. Although rainfall was below average during the dormant winter months of 2012, good rains fell during the active growing months of the 2012/13 summer, with most months having above-normal rainfall except November 2012 and February 2013. The second half of 2013 was drier with only October receiving above normal rainfall. The impact of this on the 2013 crop would have been small, compared to the expected impact on the 2014 crop. The favourable rainfall distribution led to exceptionally favourable soil water conditions through most rainfed areas, with a brief dry spell in March and a dry period in the winter and spring of 2013, which promoted cane maturation.

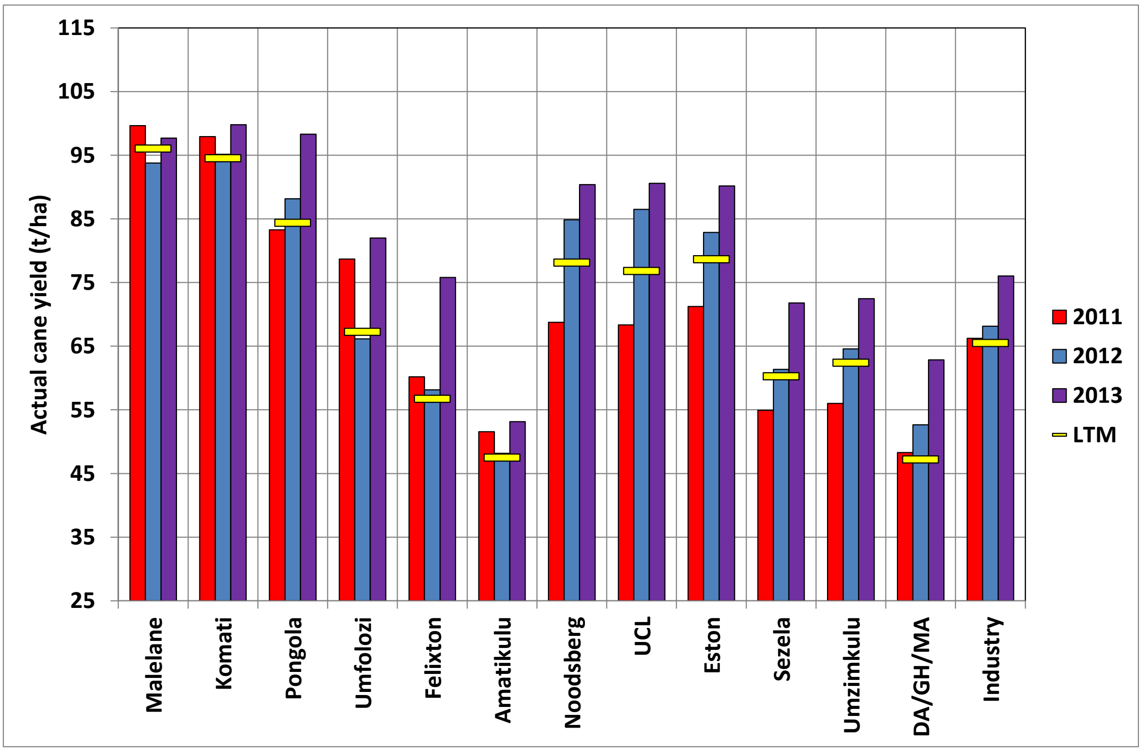

Figure 5. Average cane yields in the 2013 season for different mill supply areas and the industry compared to the 2011 and 2012 seasons and the five-season mean yield (LTM, shown as yellow horizontal bars).

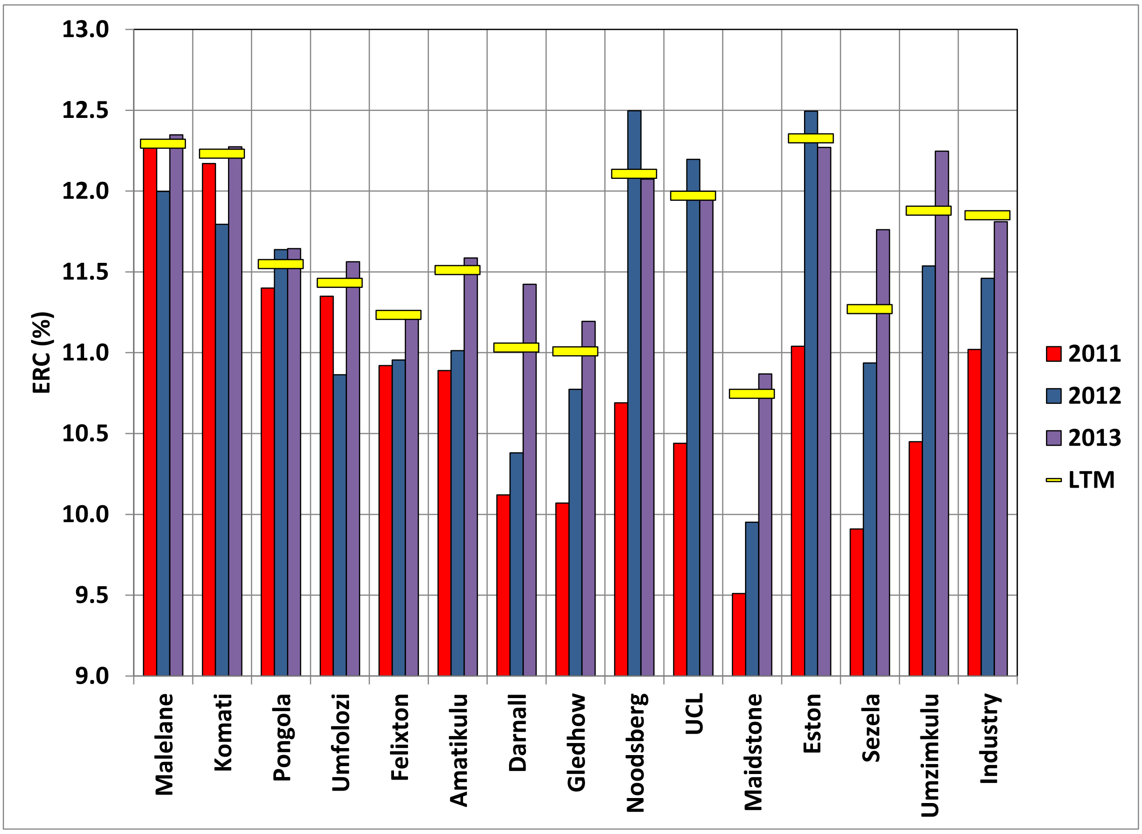

Figure 6. Estimated recoverable crystal content of cane (ERC%) on a fresh mass basis for different mill supply areas and for the whole industry for the 2013 season, compared to the 2011 and 2012 seasons and the five-season mean (LTM, shown as yellow horizontal bars).

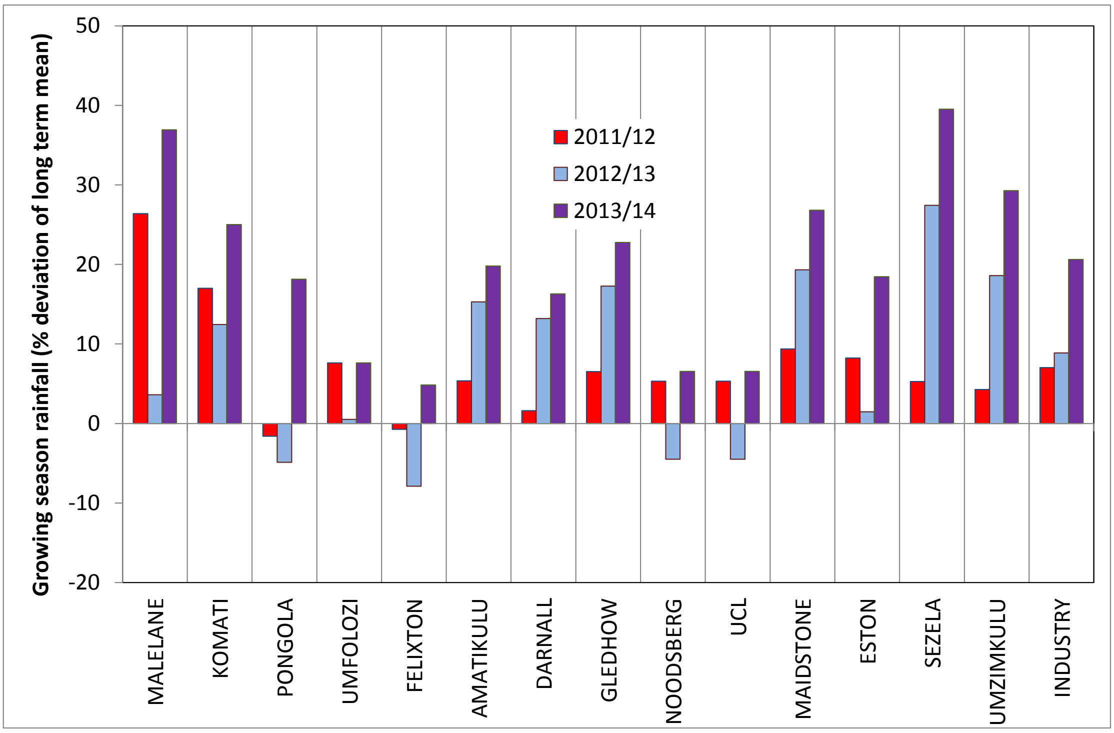

Figure 7. Total 12-month rainfall expressed as a percentage deviation from the long term mean, averaged over each month of the harvest season for different mill supply areas and the industry as a whole.

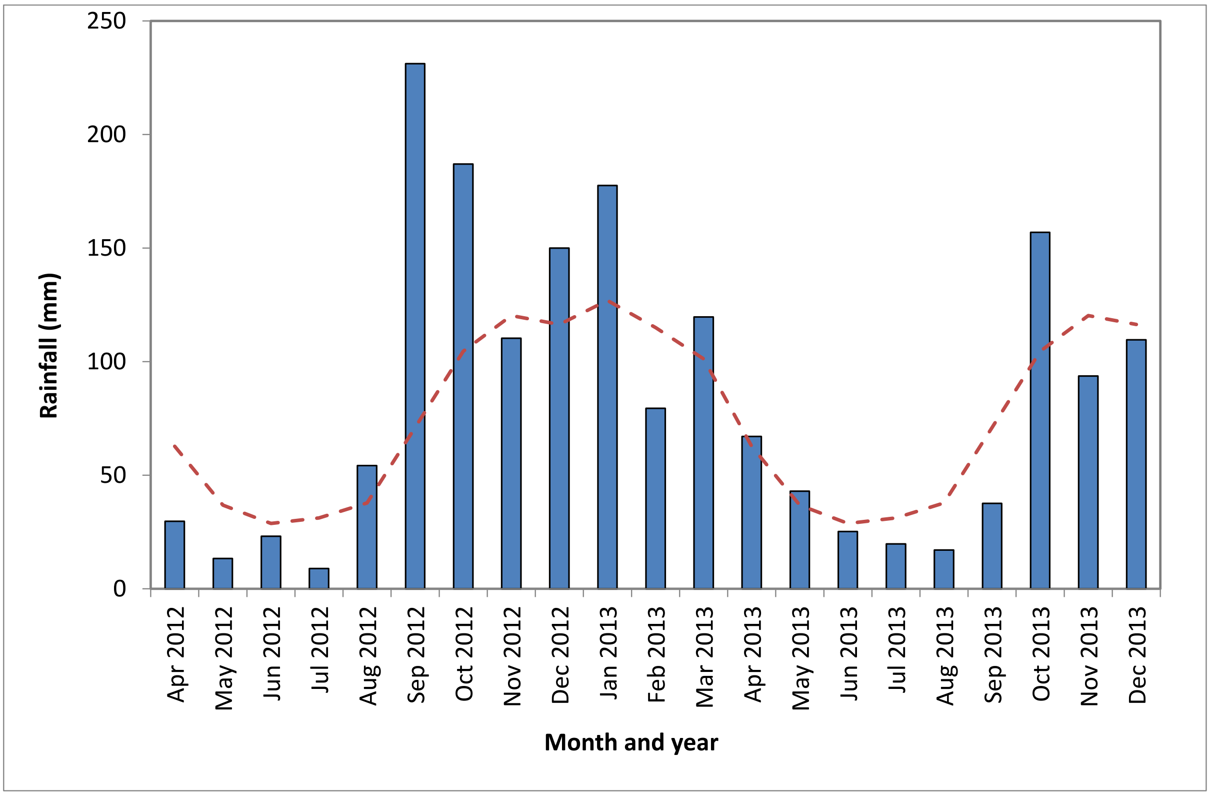

Figure 8. Monthly rainfall averaged for Kwazulu-Natal from April 2012 to December 2013 (bars) compared to the long term mean monthly values (line).

The industry average temperature for the 2013 growing season was 0.55°C below the LTM (data not shown). All MSAs experienced below normal temperatures during the 2013 growing season due to cloud cover. This was particularly notable in Mpumalanga (about 1°C below the LTM) and Zululand (about 0.8°C below the LTM). Average solar radiation for the growing season was also below the LTM for most MSAs (exceptions were Pongola and Umzimkulu). This is likely to have had a negative impact on cane growth in fully irrigated MSAs in Mpumalanga. Lower temperatures and radiation would have reduced evaporative demand, but also yield potential in areas where adequate water was present.

Overall, the industry experienced good harvesting conditions for most of the season. For most MSAs the number of harvestable days in 2013 was higher than in 2012, when wet weather interfered with harvesting and transport operations (Figure 9). Harvestable days exceeded the long term mean, except for Mpumalanga and North Coast MSAs. Heavy rainfalls over the period October to December interfered with harvesting operations in most MSAs, some more than others.

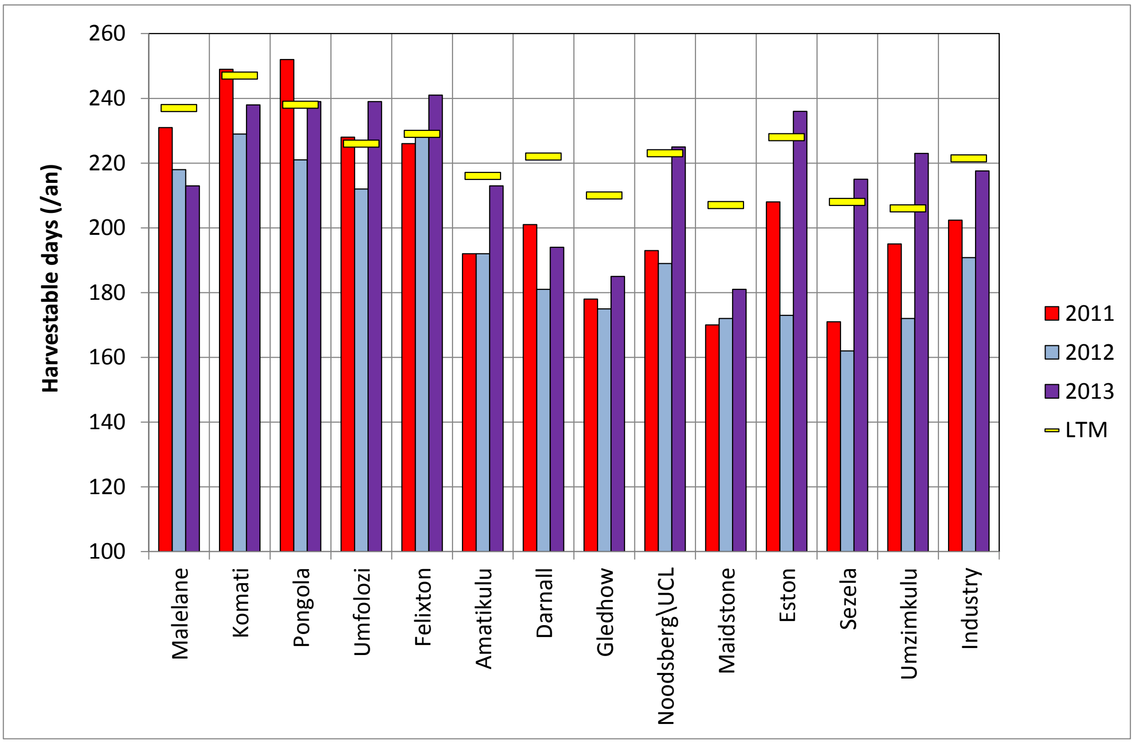

Figure 9. Number of harvestable days from April to December for the 2011, 2012 and 2013 seasons, for the different mill supply areas and for the whole industry. The five-season mean (LTM) is shown as yellow horizontal bars.

Pests

Eldana

Trends in eldana larval numbers for the various LPD&VCC areas are summarised in Figure 10a, and show that numbers have declined this season in nine of the 13 areas. Where numbers have increased (Mpumalanga, Felixton, Umfolozi and Entumeni) it was from a low base, except for Felixton. The dramatic decline in eldana numbers for the South Coast areas over the past two years was encouraging (52% and 64% respectively), with levels below their respective five-season means. While in some areas levels remained above their respective five-season means (Felixton, Amatikulu, Entumeni and Maidstone) the overall trend in the industry remained for numbers to continue to decline.

Similarly, eldana damage has declined throughout the industry over the past two seasons (Figure 10b). The most dramatic decline has been in the South Coast areas where damage has fallen by 45% and 51% respectively, to below the respective five-year means. While levels of damage have risen sharply in Eston, they remained below the LTM. In the vulnerable North Coast region, damage at Darnall was lower in the 2013 season than in 2012. However, at Amatikulu and to a lesser extent Gledhow and Maidstone areas, damage increased in 2013 compared to 2012. This may be attributable to excessive rainfall causing waterlogging stress. In the northern irrigated areas, damage remained low at or below the five-season mean. At the industry level, eldana damage levels in 2013 were marginally lower than the levels of 2012.

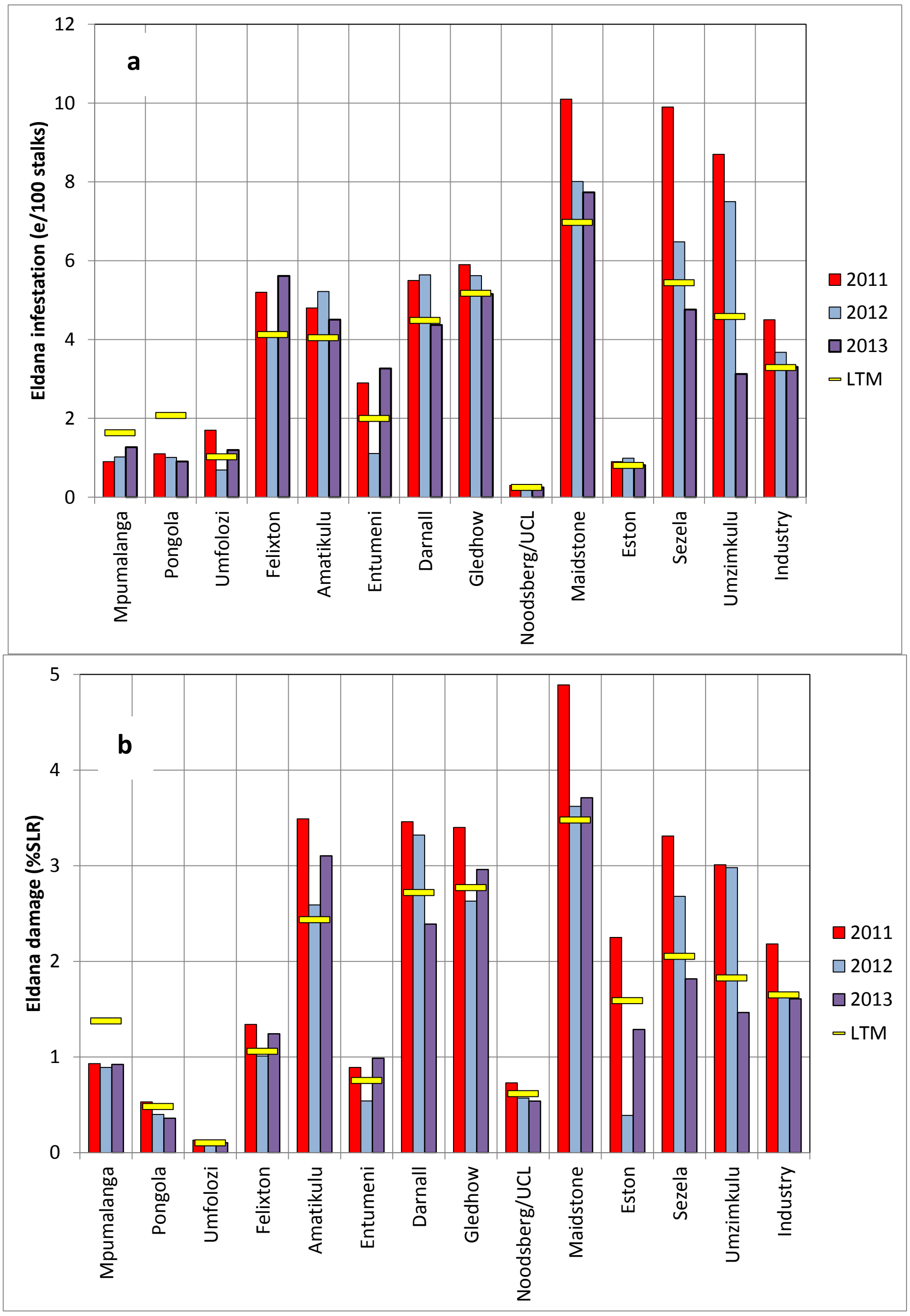

Figure 10. ***Eldana saccharina*** **larval numbers (a) and damage as % stalk length red (%SLR) (b) for different pest and disease areas for the 2013 growing season, compared to the 2012 and 2011 seasons and to the five-season mean (LTM, shown as yellow horizontal bars).**

Thrips

Over eight years of sampling has confirmed that peak numbers of thrips occur over the November to January period (Figure 11). In 2012/13, numbers of thrips were higher than the previous three seasons. Reasons for this are uncertain but may be related to climatic factors, changes in patterns of insecticide use or possibly long term population cycles.

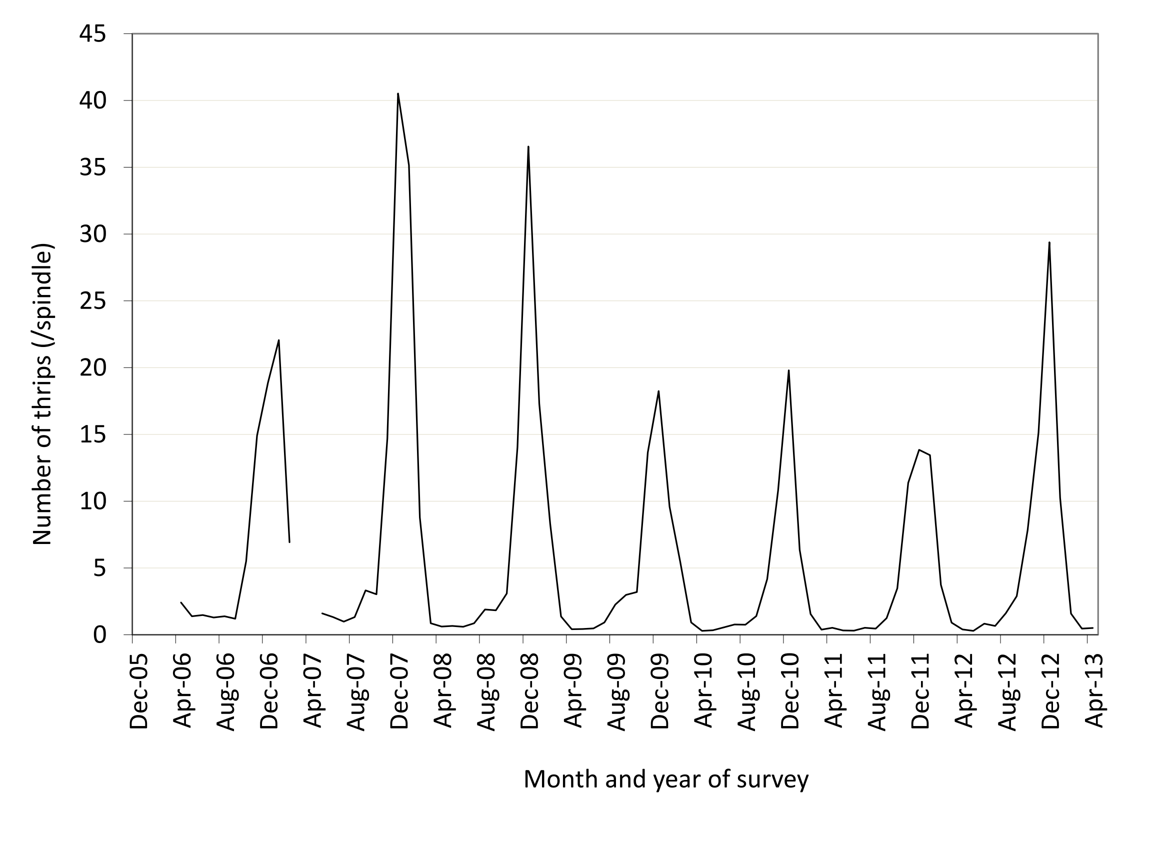

Figure 11. Long term seasonal trends in thrips populations in the Umfolozi area.

Grasshoppers

Grasshoppers continued to be a serious pest in the Empangeni district (Felixton area). Studies have confirmed that of the five species present, two are more common, *Nomadacris septemfasciata* and *Petamella prosternalis* (Bam, 2013). These studies have also shown that they have differing life cycles. Hoppers (which are the prime target for insecticides) of *Nomadacris* tend to occur over January to March, while *Petamella* hoppers tend to occur over the November to January period. Insecticide control options targeting these hoppers with synthetic pyrethroids continue to be investigated and efforts to control them have shown promise.

Aphids

During 2013, severe yellowing of sugarcane leaves was observed in the irrigated North. Investigations revealed the presence of a yellow-coloured aphid, now identified as *Sipha flava* (Forbes) (Homoptera: Aphididae), the yellow sugarcane aphid. Native to North America, it was first recorded from sugarcane in Morocco in 2006 (Abdelmajid, 2008), from where it has become widespread. It causes a general yellowing and death of leaves, but in some varieties, for example N57, this manifests as red stippling of the leaves. *S. flava* has been implicated as a vector of sugarcane mosaic virus (Blackman and Eastop, 2000), but this remains to be confirmed locally. This new pest is potentially a serious threat to the industry, particularly should it be proven that it is a vector of sugarcane mosaic virus. However, based on approaches to control developed in Florida, SASRI is developing a strategy against this aphid.

Diseases

Smut

Smut incidence has remained fairly static in recent years with an industry mean of 0.25% stools infected in the 2012-13 season compared to the five-year mean of 0.27% (Figure 12a). Smut prevalence was below the five-year mean in most MSAs, as was the industry mean, with 20% of the fields inspected being infected to some degree (Figure 12b). Smut was less prevalent in the Malelane and Komati MSAs in 2012/13, but continued to be problematic, with the disease being present in more than 50% of the fields inspected. Incidence within some of the infected fields exceeded the thresholds set by the Lowveld LPD&VCC and 25 immediate crop eradication orders, covering an area of approximately 315 ha, were issued during the period under review. In Pongola, fewer fields were infected when compared to the five-year mean but incidence within the infected fields was higher. More growers in the smut-prone irrigated north are inspecting and roguing their fields routinely to reduce the risk of high levels of smut developing in their fields. There continues to be an improvement in the Amatikulu area as fields of smut-susceptible NCo376 are replaced with more resistant varieties.

Mosaic

Mosaic incidence (Figure 13a) and prevalence (Figure 13b) were lower in most areas and were generally below the five-year mean. Mosaic was found in 3% of the fields inspected in the industry and 0.02% of the stools were infected. Although mosaic incidence declined and was well below the five-year mean in the Noodsberg/UCL MSA, an increase in prevalence has been observed over the past three years. More than 50% of the fields inspected in the area were infected in the 2012/13 season. A marked increase in mosaic incidence in the Gledhow MSA was noted; this may be a sampling anomaly, but mosaic levels will be monitored in the area. There is a strong focus on improving seedcane health in most MSAs which is likely to result in a decrease in mosaic levels over time.

Ratoon stunt (RSD)

A total of 5701 samples were received from commercial fields for RSD diagnosis in the 2012-13 season, with 11.8% testing positive. This is 1.2% higher than the five-year mean. The disease was most prevalent in the Komati/Malelane, Pongola and Entumeni MSAs, with more than 15% of the samples testing positive in each area. RSD levels were lowest in the Felixton MSA where a mandatory seedcane scheme has been in operation since 1986 (Mathew *et al*., 1990).

Rust

Brown rust (*Puccinia melanocephala*) was prevalent on N37, N39 and N42 in autumn and spring. Tawny rust (previously known as African sugarcane rust; *Puccinia fulvous* sp. nov.) was widespread in the industry but was particularly severe in the Midlands and the Pongola and Entumeni MSAs. Varieties most commonly and severely infected were N16, N25, N46 and N49. Varieties are assessed for their reaction to both brown and tawny rust during the course of the plant breeding selection programme, and many that are resistant to one rust are susceptible to the other. The number of high yielding varieties with adequate resistance to the major pests and diseases that occur in the industry, including both rusts is likely to be limited and the application of fungicides remains an important management tool for growers.

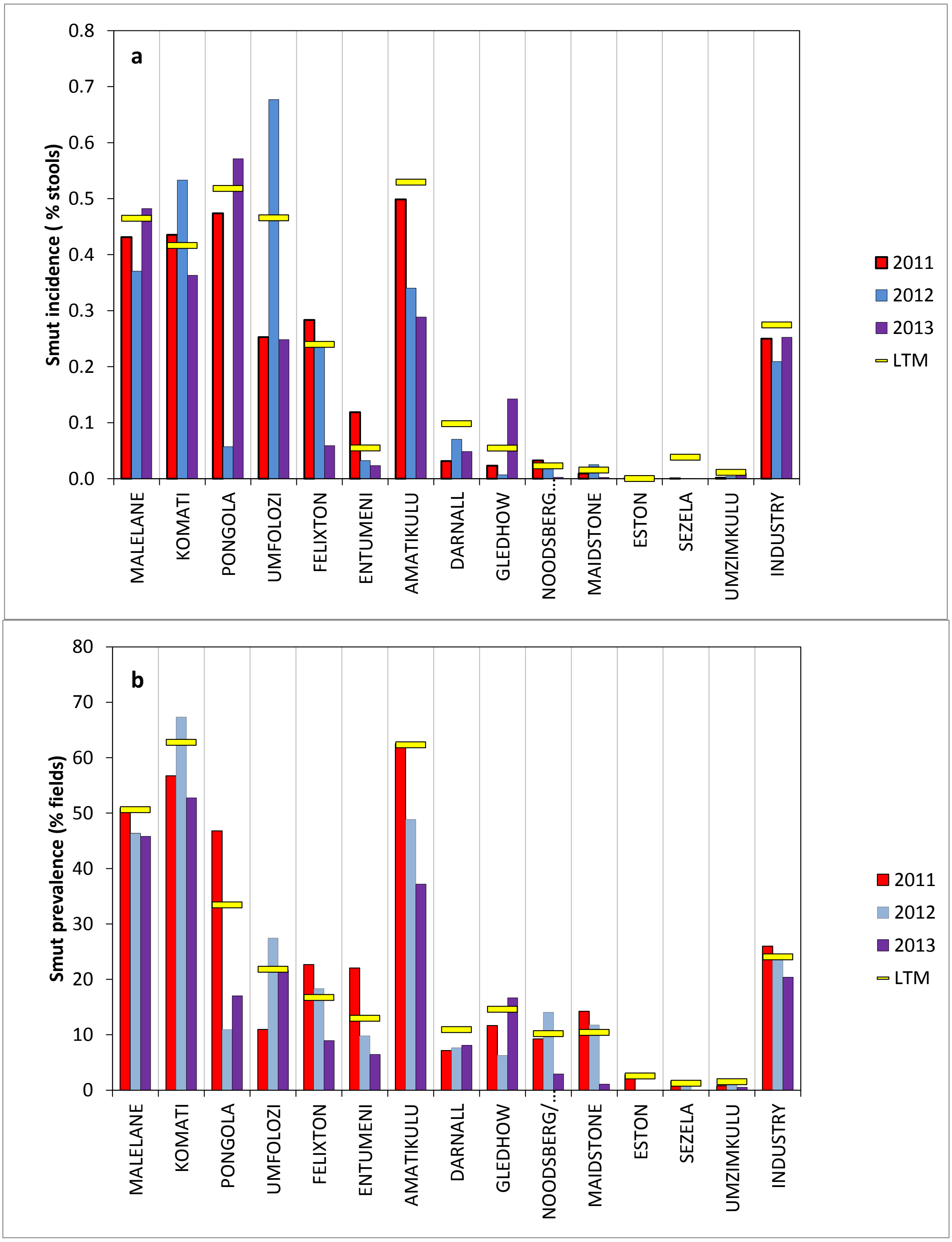

Figure 12. Smut incidence (a) and prevalence (b) for the 2013 season compared to that of the 2011 and 2010 seasons and to the five-season mean (LTM, shown as yellow horizontal bars).

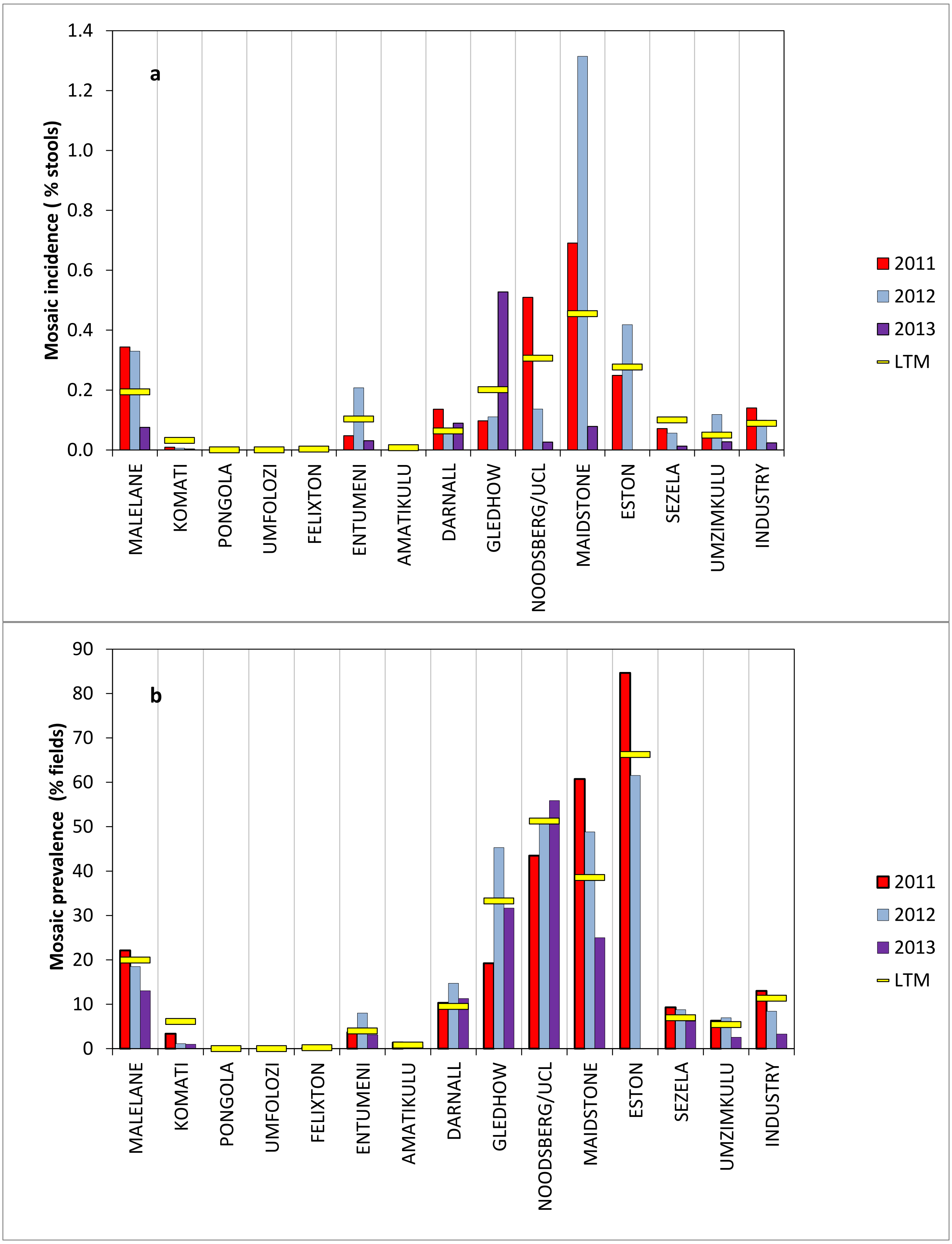

Figure 13. Mosaic incidence (a) and prevalence (b) for different areas for the 2013 season compared to that of the 2011 and 2010 seasons and to the five-season mean (LTM, shown as yellow horizontal bars)

Farm economics

Table 1 is a summary of profitability trends for a typical large-scale rainfed and irrigated sugarcane farm in SA. Higher input prices, especially the increase in wage rates, and a lower income per unit cane produced were the main factors that reduced profitability even further in 2013. The profitability of small-scale farming is also under severe pressure. A study by Hurly and Sibiya (2014) shows that a small-scale grower can earn 2.7 times more income by working for a minimum wage, compared to the income derived from a typical small-scale farm delivering on average 115 tons cane per season (based on 2012/13 data).

Farm income in 2013 was reduced because of a 2.5 % decrease in the price of relative value (RV, a measure of sugarcane productivity for which growers are paid for South Africa – see Groom, 1999) to R 3116.66/t in 2013 (Table 2). Local market demand decreased because of the supply of massive amounts of cheap imported sugar. On the other hand, sugar production rose by 20% from 2012, creating a very large surplus that had to be exported at low world prices (Table 2).

The recent trend in duty-paid sugar imports into SA is shown in Figure 14. A step change occurred in 2007, followed by a decline after 2008 due to a high world price. The pronounced increase since 2010 and the further step-change in 2013 is confirmation that sugar pricing has favoured sugar imports and this source of supply presents an on-going threat to the industry. The industry has applied to the SA Department of Trade and Industry for a review of the sugar import tariff to counter this threat.

Economic conditions are threatening the sustainability of SA sugarcane production. Many growers may go out of business or seek alternative opportunities if the current low profitability levels continue. Additional revenue streams are searched for and farms are becoming bigger and more diversified. Adapting farming practices to reduce operational costs (e.g. introducing mechanisation to reduce labour costs) may not always be practical (e.g due to unsuitable terrain) or beneficial (e.g. reducing fertiliser or replanting).

Table 1. Gross income, operational costs and net farm income (defined as the difference between gross income and total operational cost, and excluding managerial costs, interest, rent and leases, depreciation, and tax) per ton of cane harvested (derived from SACGA, 2013).

	Rainfed			Irrigated		
Season:	**2011**	**2012***	**2013****	**2011**	**2012***	**2013****
Gross income (R/ton)	339.70	390.50	380.65	393.35	408.94	398.62
Expense items (R/ton)						
Farm staff	82.60	87.78	108.96	59.16	65.54	83.22
Chemicals	15.14	20.02	21.58	9.71	13.54	15.17
Fertiliser	49.63	54.97	59.69	40.99	47.42	53.12
Fuels and lubricants	23.10	26.15	29.32	19.28	22.63	26.03
Mechanical maintenance	25.06	26.95	27.84	30.23	33.69	35.68
Fixture maintenance	7.49	7.95	8.20	6.50	7.16	7.59
Services	8.13	9.10	9.47	43.29	50.88	54.85
Administration	16.58	18.56	19.22	12.33	14.26	15.10
Insurance	6.27	6.98	7.19	6.08	7.06	7.48
Licenses	0.74	0.82	0.84	0.33	0.39	0.41
Irrigation costs	0.14	0.15	0.15	1.16	1.30	1.38
Sundry	21.88	24.32	27.41	16.42	18.90	20.52
Cane transport	30.47	31.14	34.25	40.65	41.55	45.69
Total operational costs (R/ton)	287.22	314.89	354.11	286.14	324.32	366.24
Net farm income (R/ton)	52.48	75.61	26.54	107.20	84.62	32.38

*Projected, **Estimated

Table 2. Key economic indicators for the South African sugar industry (SACGA, 2014b).

Season:	**2012**	**2013***
Gross sugar production (tons)	1 961 031	2 352 878
Local market demand (tons)	1 701 731	1 508 185
Sugar imports (tons)	204 121	433 150
Sugar exports (tons)	249 785	834 836
#11 World price (wt avg USc/lb)	25.62	18.22
R/US$ exchange rate (wt avg)	8.32	9.94
World price (wt avg R/ton)	4 699.34	3 992.73
RV price (R/ton)	3 197.32	3 116.66

*Projected

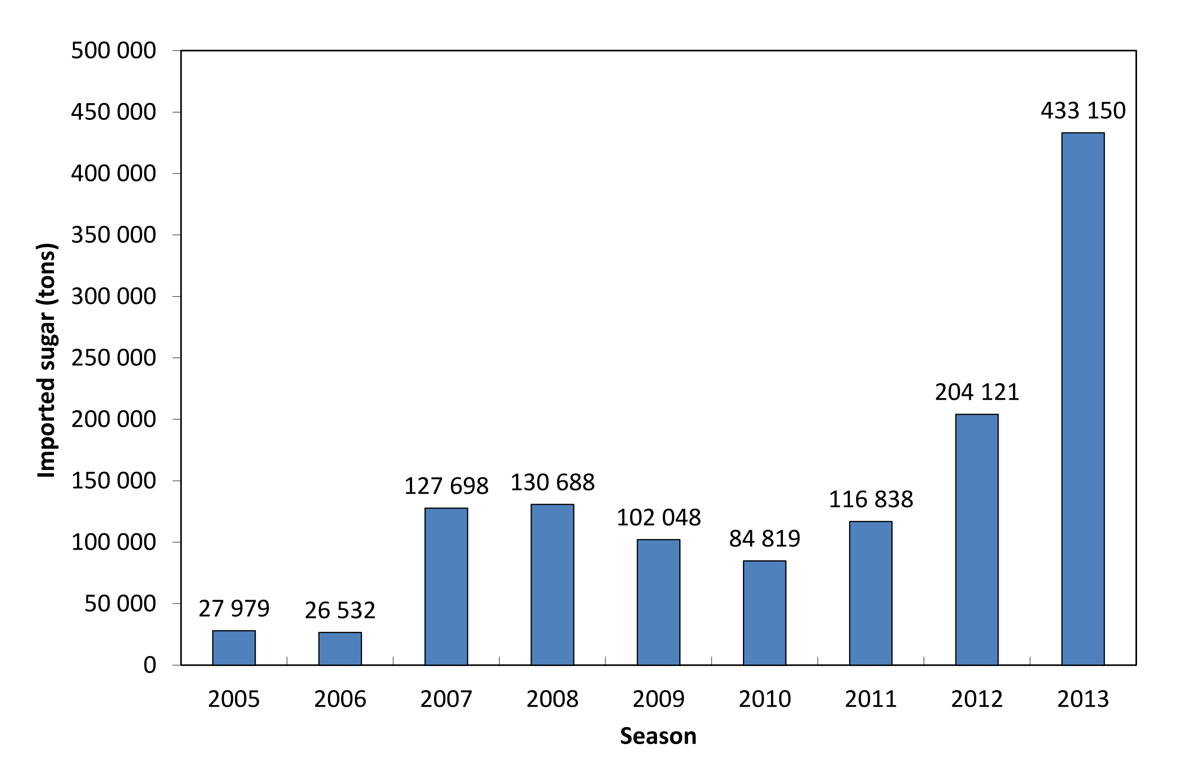

Figure 14. Amount of duty-paid sugar imports into South Africa over the last eight seasons (s**ource: SACGA, 2014a).**

Discussion

Yields in Mpumalanga and Pongola improved from 2012 to 2013, to a larger extent than the simulated change in climatic potential (Figure 15). Apart from favourable climatic conditions, high yields are ascribed to a very large proportion of older cane carried over from 2012, as well as improved agronomic practices and the use of varieties best suited to the different growing cycles (personal communication[1,2]).

Umfolozi and Felixton yields also increased substantially in 2013, more than the simulated change in climatic potential (Figure 15). For Umfolozi, this is ascribed to unusual amounts of older carry-over cane and improved ripener practices (personal communication[3]).

Sezela average yield also improved substantially. This could be the result of a very large amount older cane carried over from 2012 (personal communication[4]), as well as improved pest and disease control (Figures 10 and 12).

Yield increases in all other MSAs are of similar magnitude to the simulated change in climatic potential and are therefore ascribed to favourable climate.

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[1] M. Adendorff, SASRI, Pongola
[2] P. Cronjé, TSB, Malelane
[3] A. Searle, SASRI, Mtubatuba
[4] D. McElligot, SASRI, Sezela

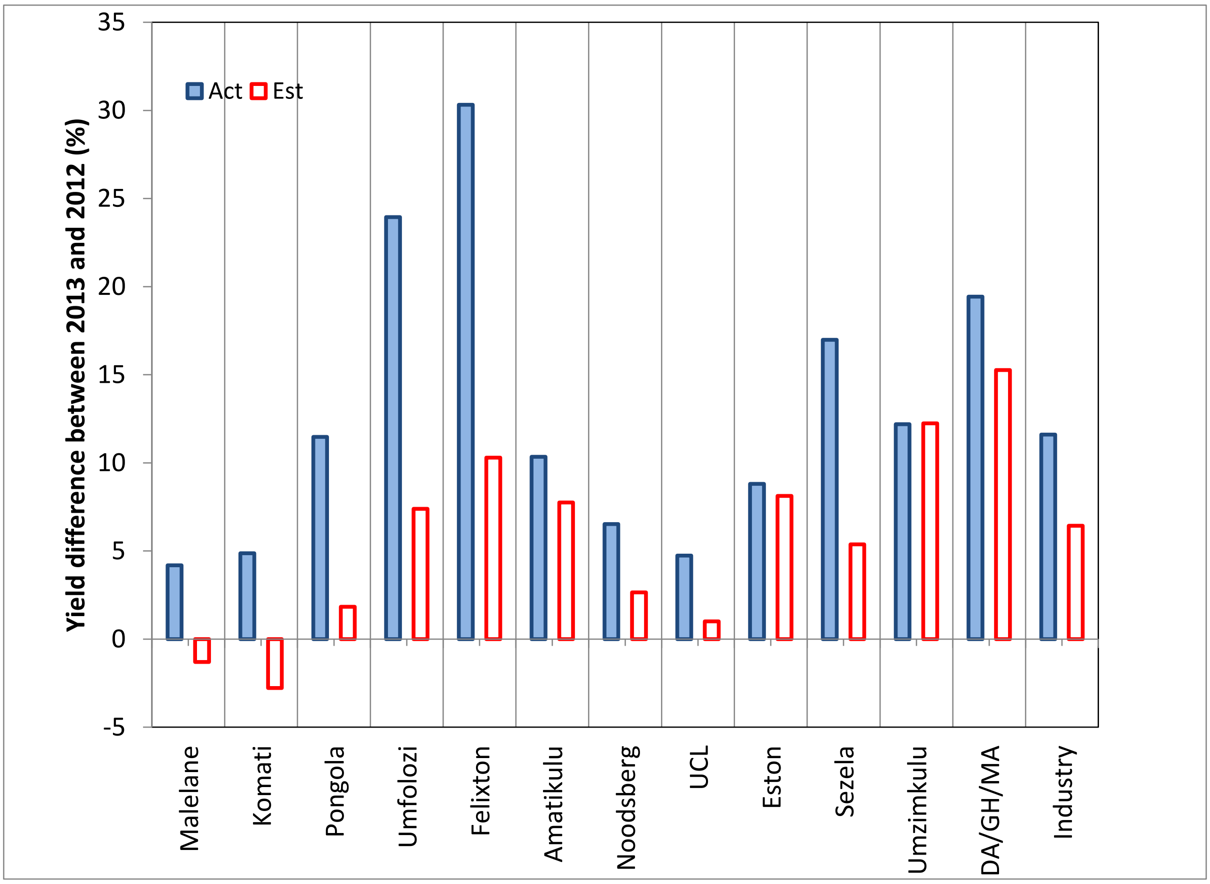

Figure 15. Yield difference between the 2013 and 2012 seasons for the different mills and for the industry, expressed as a percentage of the 2011 yield. DA/GH/MA refers to a combination of the Darnall, Gledhow and Maidstone MSAs. Differences in actual yields (Act) and in the Canesim model simulated yields (Est) are shown.

The good cane quality achieved in 2013 was due to a combination of factors: large amounts of mature carry-over cane in many areas, the increased and judicious use of chemical ripeners in irrigated and rainfed areas (van Heerden *et al.*, 2014; personal communication[5,6]), and favourable climatic conditions. Cane was growing vigorously in the first three months of the year and therefore responded well to early season chemical ripening. The dry winter and spring promoted sucrose accumulation in the second part of the season and very high sucrose levels were achieved during this time in many cases (see example in Figure 16). Quality deteriorated rapidly thereafter due to several heavy rainfalls that interrupted harvest and transport operations. In some cases fields scheduled for harvest in 2013 could not be harvested and had to be carried over to 2014, but the impact on 2013 cane quality was mimimal.

[5] G. Lagerwell, SASRI, Gingindlovu; A Searle, SASRI, Mtubatuba
[6] P. Cronjé, TSB, Malelane

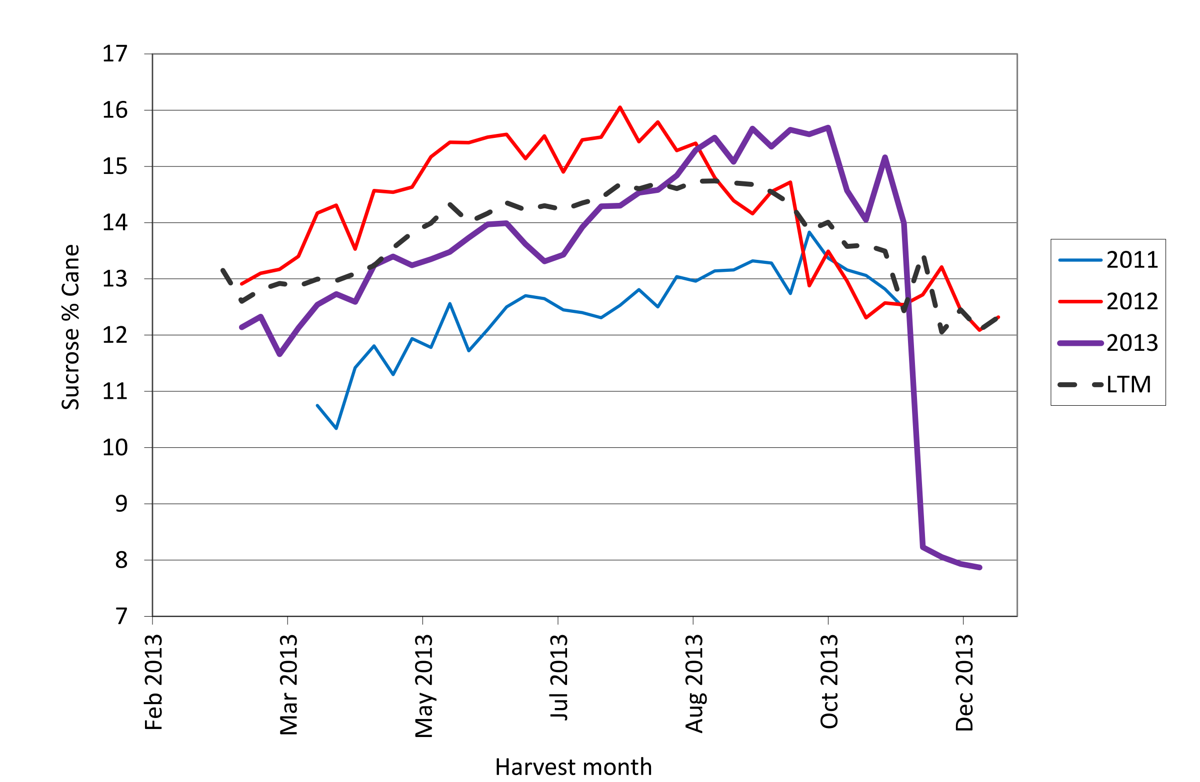

Figure 16. Weekly sucrose content of cane stalks (fresh mass basis) for 2013 compared to that of 2012 and 2011 and the five-year mean (LTM) for the Noodsberg mill.

Conclusions

The 2013 season was characterised by excellent growing conditions, especially in rainfed areas. Rainfall was exceptionally well distributed, enabling vigorous growth in summer and effective harvesting in winter. This led to record cane yields in many areas (an all-time high for the industry of 76.0 t/ha), and good cane quality, especially in late winter and spring.

Record yields were also achieved at mill level. Exceptionally good yields were achieved in Mpumalanga, Pongola, Zululand and Sezela, and these can be ascribed to large amounts of carry-over cane, and better agronomic practices and pest and disease management. The good cane quality is ascribed to large amounts of mature carry-over cane in many areas, judicious use of chemical ripeners, and favourable climatic conditions.

Pests and diseases had relatively little impact. Eldana damage declined steadily throughout the industry, and the sharp decline in 2013 on the South Coast in particular, is encouraging. Although problematic in some areas, overall smut and mosaic levels in the industry were low. Brown and tawny rust were widespread in autumn and spring, and many growers applied a fungicide to infected fields to manage the disease. Of concern is the emergence of a new pest, the yellow sugarcane aphid. This pest should be monitored carefully, and impacts on crop growth and yield and suitable control measures researched.

Sugarcane farming profitability has declined further to alarmingly low levels, due mainly to a reduced RV price caused by massive amounts of imported sugar that reduced local market demand, necessitating increased sugar exports at low world prices. This was the only negative factor in an otherwise remarkable season for the SA sugar industry.

Finally, the 2013 season will be remembered for excellent yields and good cane quality through most of the industry. Although large amounts of cane carried over from 2012 contributed to this, the industry has succeeded through good agronomic and biosecurity practices to exploit the very favourable growing conditions. This, however, was not fully converted to profits due to economic forces.

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