FULL PAPER

BIOSECURITY: AN OVERVIEW OF THE 2023/2024 SEASON

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Abstract

This biosecurity review characterises the South African sugarcane industry from a pest and disease perspective for the 2023/2024 milling season, compared with the previous seasons. Eldana infestation levels across all regions for 2023/2024 were not significantly different from the 2022/2023 season. However, the mean percent stalk length red was generally higher across most regions, with the industry mean exceeding that of the previous two seasons. The incidence and severity of the yellow sugarcane aphid has remained a problem, with the Pongola, Midlands South, Zululand, North Coast, Umfolozi and uMzimkhulu regions reporting a higher-than-usual incidence over the past summer. The 2023 longhorn beetle surveys revealed that four fields in Entumeni and three fields in Melmoth all tested positive for larvae. These fields have been eradicated and are currently fallow. White grub surveys showed an increase in the grub numbers from 2023 to 2024, with *Schizonycha* spp. being most abundant. While the overall smut situation in the industry was similar to the 5-year mean, higher levels were recorded in commercial fields in the Zululand and Midlands regions. Ratoon Stunt (RSD) was diagnosed in 6% of the commercial fields and in 2% of the intended seed-cane sources that were tested, which exceeded the 5- and 10-year means for both categories. The mosaic levels remained extremely low in the industry. Symptoms of one or more of the three rusts infecting sugarcane in South Africa were reported in approximately 3% of the area that was inspected during routine pest and disease surveys. The factors that are likely to have influenced the occurrence of the major pests and diseases in the industry will be highlighted, along with the management strategies that have been adopted to address these issues.

Keywords: sugarcane, pests, diseases, biosecurity, monitoring, management

Introduction

The South African sugarcane industry covers approximately 350 000 hectares, from southern KwaZulu-Natal to the Mpumalanga Lowveld (Sithole *et al*. 2023), and it encompasses a wide range of environmental conditions that favour the development of different pests and diseases. The industry is subdivided into Control Areas, as defined by the Local Pest, Disease and Variety Control Committees of the South African Sugar Association (SASA) (Stranack, 2021). The Sugar Act (Act 9 of 1978) and the Sugar Industry Agreement (2000), which make provision for the establishment of these Committees, provide a means of protecting the industry against the effects of pests and diseases, through the routine monitoring of prospective seed-cane sources and commercial fields.

The last three seasons have placed the South African sugarcane industry under a great degree of pressure, mainly from the perspective of carry-over issues and climate-driven pest and disease outbreaks (Sithole *et al*., 2023). This paper will present the trends derived from the pest and disease surveys that were conducted during the 2023-2024 season.

Methodology

Pest Data

Eldana saccharina

The SASRI Biosecurity Inspectorate conducted industry-wide *Eldana saccharina* (Eldana) surveys during the 2023/2024 season (starting 01 June 2023 and ending 31 May 2024). Eldana infestations are quantified as the number of larvae and pupae per 100 stalks (e/100) and these were averaged for different Pest and Disease (P&D) areas over the 12-month period. The percent stalk length red (%SLR) due to Eldana infestation was also determined over the 12-month period. The seasonal average infestation levels plus %SLR for the different P&D areas and for the industry, were compared to those of the previous two seasons, plus the mean over the last five and ten seasons.

Other pests

Surveys for thrips, white grub and longhorn beetles were also conducted. The presence and severity of *Sipha flava* (Yellow Sugarcane Aphid, YSA) was continually monitored during the season.

Surveys for *Chilo sacchariphagus* remain ongoing. SASRI, in collaboration with Cropwatch Africa, monitors a total of thirty-six pheromone traps that have been placed in strategic positions in KwaZulu-Natal, Mpumalanga and the Limpopo Province. Surveillance reports are sent to SASRI monthly. Twenty-seven traps have been placed around the cane fields, seven at the border posts, and two around the natural vegetation in the Kruger National Park.

Disease Data

Smut and mosaic

Smut (*Sporisorium scitamineum*) and mosaic (sugarcane mosaic virus) surveys are conducted by the SASRI Biosecurity Inspectorate annually, usually when the cane is three to six months old. This is done by inspecting a specified number of 50 m lengths of cane row in each field. The number of row sections inspected is dependent on the field size and it is assumed that there are 100 stools in each 50 m row length, i.e., two stools per metre. The number of off-types is also recorded. Disease prevalence is expressed as the proportion, or percent, of the fields inspected that were infected (Nutter *et al*., 1991). The disease incidence is expressed as the percent stools examined that were infected.

The selection of the fields for inspection varies between LPD&VCC areas. In some areas fields are randomly selected for the survey, while in others, fields planted to varieties known to be susceptible to smut or mosaic may also be targeted. Generally, the Biosecurity Inspectorate aims 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 area to be covered. Therefore, it is not possible to make comparisons between LPD&VCC areas, but the trends over the years within these areas can be analysed.

A total of 8 690 commercial fields, covering an area of approximately 41 500 ha, were inspected for smut, mosaic and off-types in the 2023-24 season. This represented approximately 12% of the area under cane. In addition, a total of 1 450 seed-cane fields representing over 2 200 ha were inspected, with these fields requiring one or two repeat surveys to comply with approved and certified seed-cane standards, respectively.

Ratoon stunt (RSD)

Since ratoon stunt (RSD, *Leifsonia xyli* subsp. *xyli*) does not have any obvious external symptoms, and the diagnosis is based on the serological analysis of expressed xylem sap from stalk samples (McFarlane *et al*., 1999). Routine surveys of commercial and seed-cane fields are conducted annually by the Biosecurity Inspectorate, in order to identify RSD-infected fields. The Biosecurity Inspectorate collects 20 stalks from obviously-stunted stools from commercial fields of 5 ha (or less), and additional samples are collected from larger fields. Forty stalks are collected from seed-cane fields of 1 ha or less.

A total of 7 322 commercial and seed-cane samples were processed in the RSD diagnostic laboratory at Mount Edgecombe during the period under review. These samples represented 4 591 commercial fields that covered approximately 22 000 ha, and 890 seed-cane nurseries.

Other diseases

Observational information for other diseases, such as rust, was also recorded.

Results and Discussion

Pests

Eldana

During the 2023/0024 season, approximately 89 308 ha under cane were surveyed for Eldana infestation. Eldana infestation levels (e/100) for the 2023/2024 season, across all regions, were not significantly different from those of the previous season (Figure 1). The 2023/2024 industry mean (e/100 = 1.33) was slightly above the 5-year mean (e/100 = 1.28), but this did not show any statistically-significant difference. The 2023/2024 industry mean was significantly lower than the 10-year mean (e/100 = 2.05). Pongola, Umfolozi, Felixton, Entumeni, North Coast and Sezela showed lower e/100 than the previous season; however, these differences were not statistically different from the year before. Although the Mpumalanga, Amatikulu, uMzimkhulu, Midlands North and Midlands South regions all showed a higher e/100 than the 2022/2023 season, these comparisons were again not statistically-different from each other. The %SLR was generally higher across most regions (Figure 2). Pongola, Felixton, Entumeni, Amatikulu, North Coast, uMzimkhulu, Midlands North and Midlands South showed a higher %SLR during 2023/2024 than during 2022/2023. The industry mean for 2023/2024 (%SLR = 0.63) was insignificantly lower than the 2022/2023 (%SLR = 0.64), but higher than the 2021/2022 (%SLR = 0.55) mean (these variances were not statistically different), but it was below the 10-year mean (%SLR = 0.83).

A concerning feature of the 2023/2024 season is that some regions of the industry experienced more severe Eldana infestations than previous years, with the surveys having reported e/100 ranging from 29-40. Other areas have reported an increase in the prevalence of the pest, but not in e/100, which might raise the possibility of more severe Eldana infestations in the 2024/2025 season. Both the spread and the severity of infestations could possibly be attributable to the high quantity of carry-over cane over the past three seasons, which has resulted in the excessive ageing of the crop in-field. This, coupled with a milder winter, was a likely contributing factor that has encouraged the persistence of Eldana in those carry-over fields. The carry-over issues experienced over the past three seasons could also have exacerbated the %SLR, as studies have shown that the damage assessed the previous October can increase between 2-4 times, if that field is carried over into April/May the following year (https://sasri.org.za/farming-manuals/#150-194-pests). The scouting and implementation of robust control measures need to remain a priority going forward, especially on ageing cane.

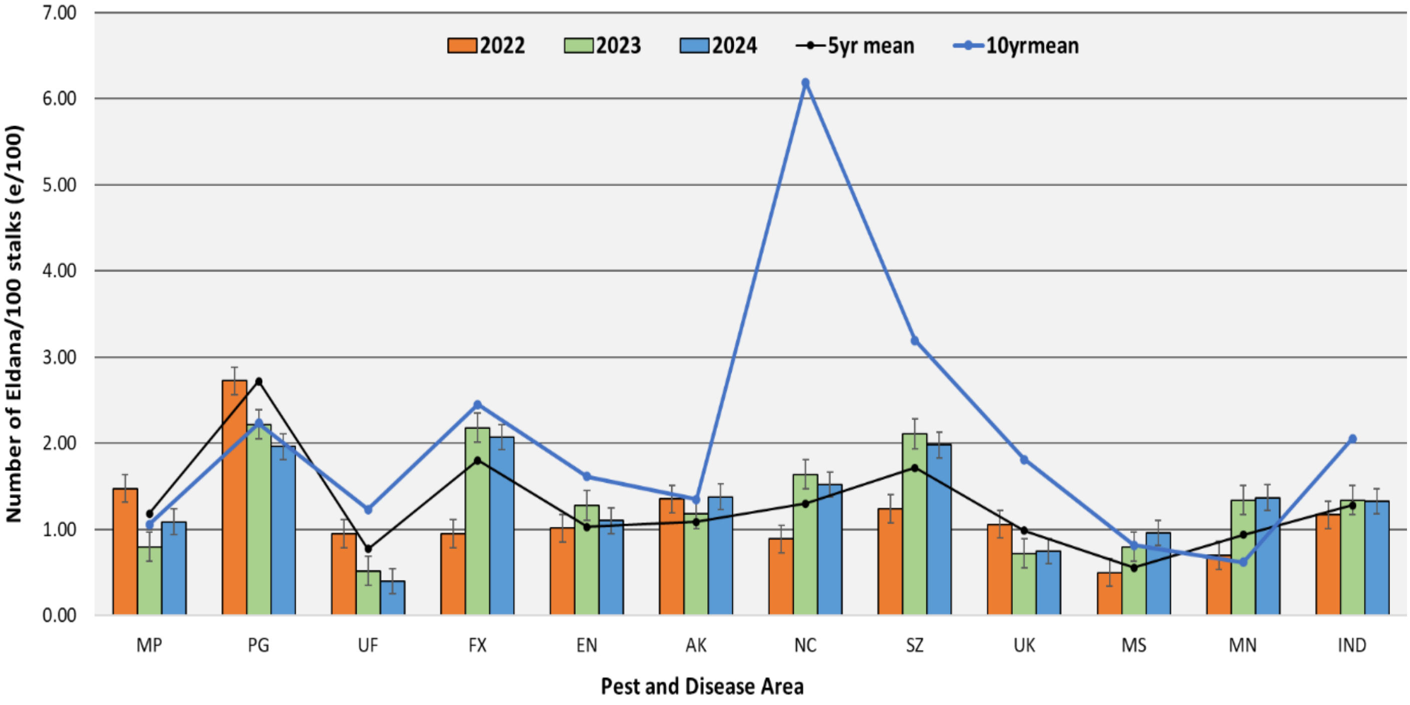

Figure 1. Eldana infestation for different pest and disease areas and for the industry as a whole for the 2023/2024 season, compared to the previous two seasons, and to the long-term mean over the past five seasons and 10 seasons. MP = Mpumalanga, PG = Pongola, UF = Umfolozi, FX = Felixton, EN = Entumeni, AK = Amatikulu, NC = North Coast; SZ = Sezela; UK = uMzimkhulu; MS = Midlands South; MN = Midlands North; IND = industry

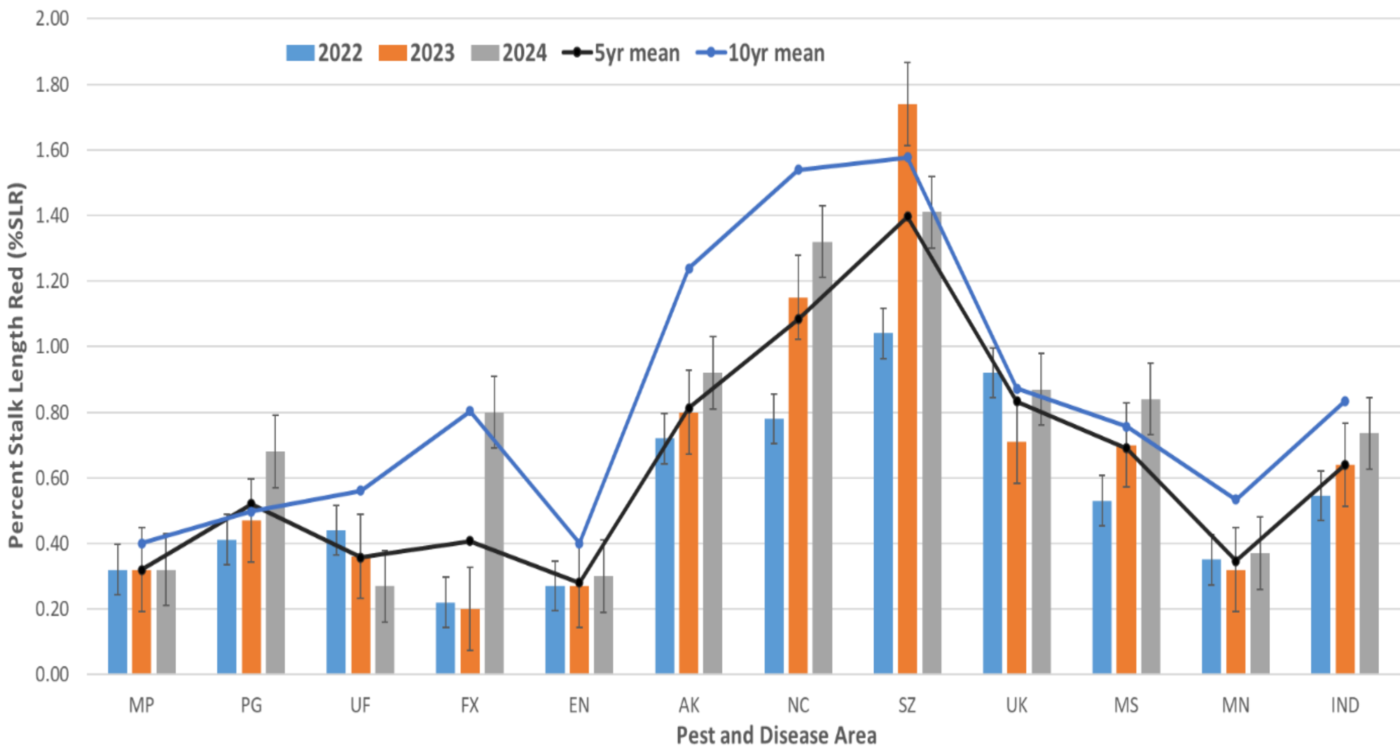

Figure 2. Percent stalk length red (%SLR) due to Eldana infestation for different pest and disease areas and for the industry as a whole for the 2023/2024 season, compared to the previous two seasons, and to the long-term mean over the past five seasons and 10 seasons. MP = Mpumalanga, PG = Pongola, UF = Umfolozi, FX = Felixton, EN = Entumeni, AK = Amatikulu, NC = North Coast; SZ = Sezela; UK = uMzimkhulu; MS = Midlands South; MN = Midlands North; IND = industry.

Yellow sugarcane aphid

The incidence of the yellow sugarcane aphid and the severity of infestation remains an ongoing problem throughout the South African sugar industry. This pest also occurs in eSwatini, Mozambique, Zimbabwe and Zambia. A notable observation from the Midlands North region over the 2023/2024 summer saw the most significant outbreak of YSA in the last ten years. However, there was a relative abundance of predatory insects where the infestations were prevalent. Most growers in the area opted not to apply insecticides to manage the infestations, and within three weeks the cane had begun to recover well. Other regions that reported a higher-than-normal incidence of infestation this past summer included Pongola, Midlands South, Zululand (North, Central, South), North Coast, Umfolozi and uMzimkhulu. It is likely that the hot, dry weather experienced during the summer of 2023/2024 could have exacerbated the level of infestation experienced across the industry. SASRI continues to engage with growers and to undertake research to promote the long-term practical in-field management of the pest. This information is disseminated to growers as it becomes available, in the form of newsletters, ad-hoc publications or grower events.

Longhorn beetle

Survey data of the Longhorn Beetle (LHB), *Cacosceles newmanii*, from the 2023/2024 season yielded results that have raised some concern. During the surveys that are conducted every two months (or ad-hoc), four fields tested positive for LHB grubs in August 2023 in the Entumeni area. All four fields have been eradicated and are currently lying fallow. In November/December 2023, a further two fields tested positive for grubs in Melmoth. One field has been eradicated, and the second field is in the process of eradication. A further field tested positive in Melmoth in April/May 2024. These fields have been harvested and eradicated. These results show that LHB is not just found within the Entumeni region. It therefore remains paramount to continue with the surveys, in order to adequately inform the industry on the way forward and to map their movement from the point of first discovery in Entumeni in 2015.

White grub

White grub surveys showed an increase in the grub numbers from the 2022/2023 season (with 249 grubs captured) to 2023/2024 season (with 282 grubs captured). The *Schizonycha* spp. were most abundant, with minimal captures of *Hypopholis* spp. (7 grubs) and *Pegylis* spp. (3 grubs and 1 adult). The age and variety of the cane appeared to have no effect on the number of grubs that were captured during each survey. However, the captures were higher in number where the cane was grown in proximity to either maize or timber plantations (mainly wattle), as these crops also serve as a food source for many beetle species. No insecticides are currently registered for use against the white grub on cane in South Africa. Therefore, where infestations have been severe, growers were advised to rotovate those fields and to expose the grubs to sunlight (grubs are photosensitive) and natural predators, such as birds and small rodents.

Chilo sacchariphagus

Chilo sacchariphagus, the Chilo stem borer, remains a potential threat to the South African sugarcane industry and its monitoring remains ongoing, in collaboration with Cropwatch Africa. No suspect specimens were received for identification over the past 12 months, and communication channels remain open between SASRI and Cropwatch Africa. Furthermore, a revised Bio-incursion Plan has been developed for the management of a potential *C. sacchariphagus* incursion into South Africa.

Thrips (Fulmekiola serrata)

The long-term sampling programme that is in place for thrips has confirmed consistent seasonal trends of a general peak in activity from November to January, with a drop in the population numbers from March until October/November. The populations appeared to be consistent with the seasonal changes, with no notable deviations to report. Thrips remain a serious pest throughout the cane industry. However, with the arsenal of registered insecticides that are at the disposal of the grower, its management has been undertaken in a relatively efficient manner.

Other pests

With regard to other matters, the Lowveld region reported a severe leafhopper infestation in the Kaalrug area during the 2023/24 season. This highly-sporadic infestation was followed by the development of sooty mould on the affected cane. The infestation could not be chemically managed, as there are no insecticide registrations for leafhoppers on South African cane. The infestation did not persist, and the cane was able to recover. The uMzimkhulu region reported a spike in trash caterpillar infestation after the 2023 harvest. This infestation was also sporadic, it did not persist, and the cane was able to recover.

Diseases

Smut

For the period under review, 19% of the commercial fields inspected in the industry (Figure 3a), which covered 21% of the inspected area, were infected with smut. This was similar to the 5- and 10-year means. Smut was identified in 0.15% of the stools that were inspected, which is lower than the previous season and the 5- and 10-year means (Figure 3b).

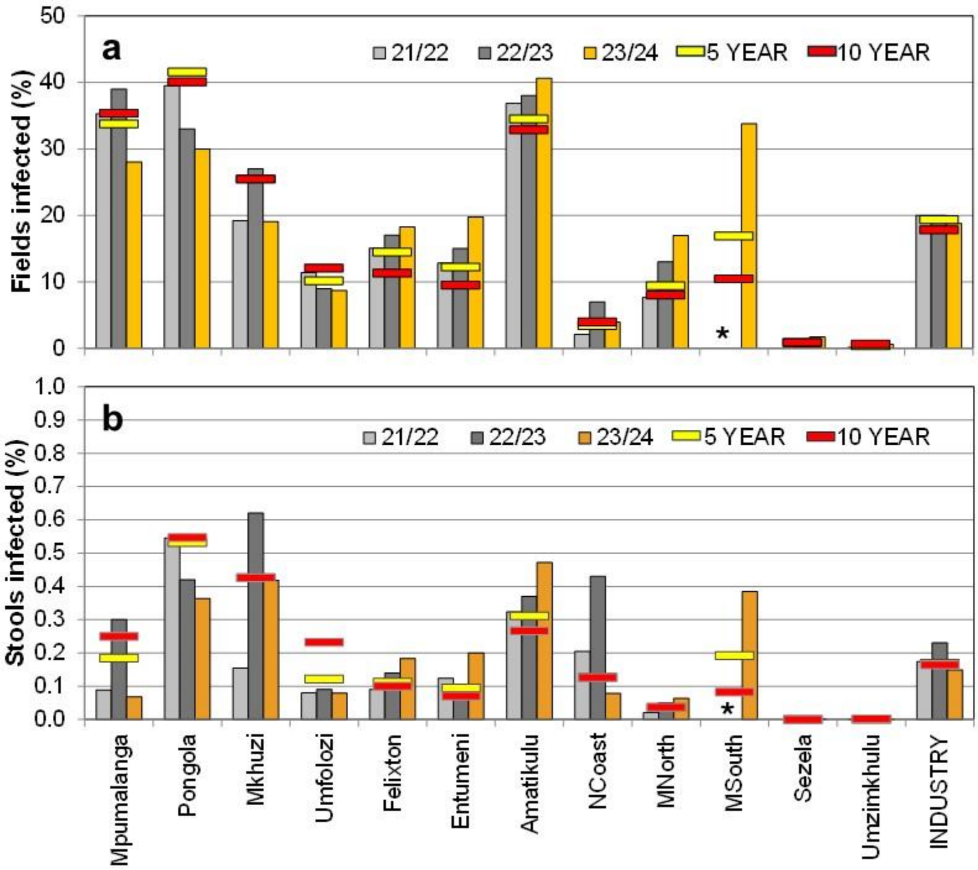

Figure 3. Smut (a) prevalence and (b) incidence in the South African sugarcane industry, June 2023 to May 2024 (commercial fields only), compared with the previous two seasons; * indicates small sample size

Both the smut incidence and prevalence have decreased in Pongola in recent years, and they are currently well below the 5- and 10-year means after the adoption of an integrated management strategy stipulated by the Pongola LPD&VCC, which was supported by the majority of growers. In addition, reduced crop stress as a result of improvements in some irrigation systems and an adequate water supply (Sithole *et al*., 2023) are likely to have had an impact on the smut levels in the area. The incidence of smut is known to increase with moisture stress and drier, warmer winters (James, 1972; Rutherford *et al.* 2003). However, while good progress has been made, smut remains prevalent in Pongola, with 30% of the approximately 5 200 ha inspected being infected to some degree, and the incidence of smut remains high in some fields, particularly in N41 (Figure 4). As part of the integrated management strategy for Pongola, no further planting of this variety is permitted, and any fields above the permissible limit are flagged for eradication.

Smut levels exceeded the 5- and 10- year means in Felixton, Entumeni and Amatikulu (Figures 3a and b). Several varieties grown in the region have shown some susceptibility, with smut being particularly common and severe in the popular varieties of N54 and N59 (Figure 4). Similarly, smut was highest in these varieties, along with NCo376, in the North Coast area, although its incidence and prevalence were lower than in previous seasons. Poorly-distributed rainfall, which resulted in extended periods of dry weather in recent years, along with mild winters (Sithole *et al*., 2023), would have contributed to increases in some areas.

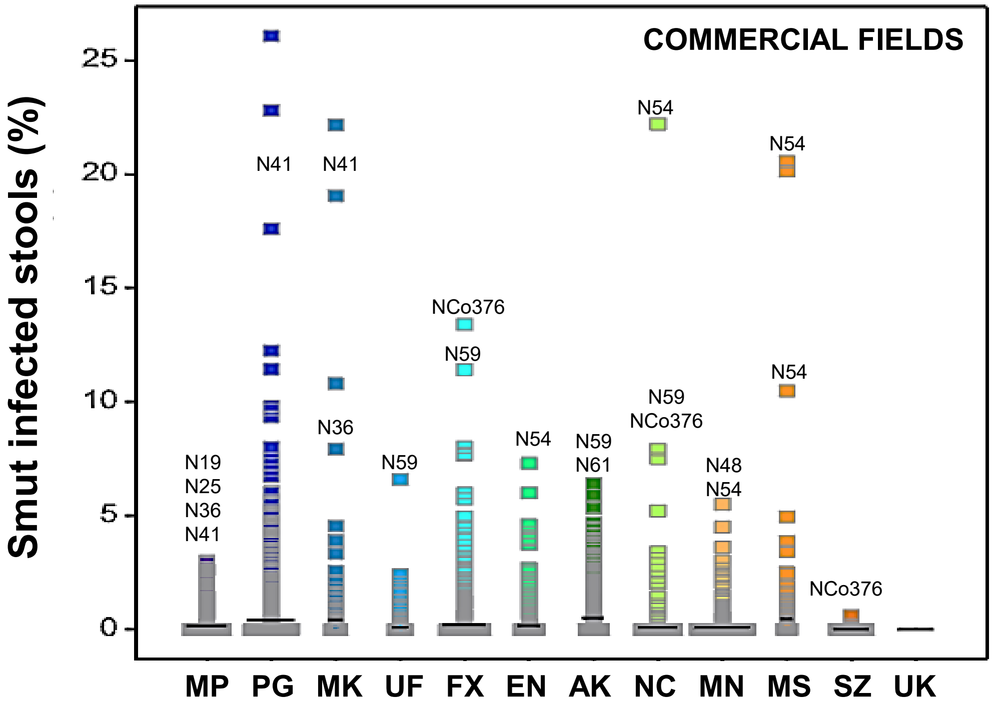

Figure 4. Percent smut-infected stools by Pest and Disease Control Area. Each square indicates smut incidence in an inspected field, different colours are used to differentiate the Pest and Disease Control Areas. Fields with the highest incidence are annotated with the variety name(s). Pest and disease area abbreviations: MP = Mpumalanga; PG = Pongola; MK = Mkhuze / Makhathini, UF = Umfolozi; FX = Felixton; EN = Entumeni; AK = Amatikulu; NC = North Coast; MN = Midlands North; MS = Midlands South; SZ = Sezela; UK = uMzimkhulu.

High levels of smut in N54 contributed to an increase in the incidence and prevalence recorded in the Midlands region (Figures 3a, 3b and 4). Smut incidence exceeded 10% stools infected in three fields of N54 on an irrigated farm in the Midlands South area. These fields are due to be replanted. A focus on eldana and seed-cane inspections has resulted in a limited number of commercial fields being inspected for diseases in recent years in Midlands South. The current estimate of the disease status is based on inspections in 216 fields covering an area of 666 ha (approximately 2% of the area under cane). Smut tends to be less problematic in the Sezela and uMzimkhulu areas.

Mosaic

Mosaic levels remained low in the industry, with the disease being observed in 1% of the fields that were inspected (Figure 5).

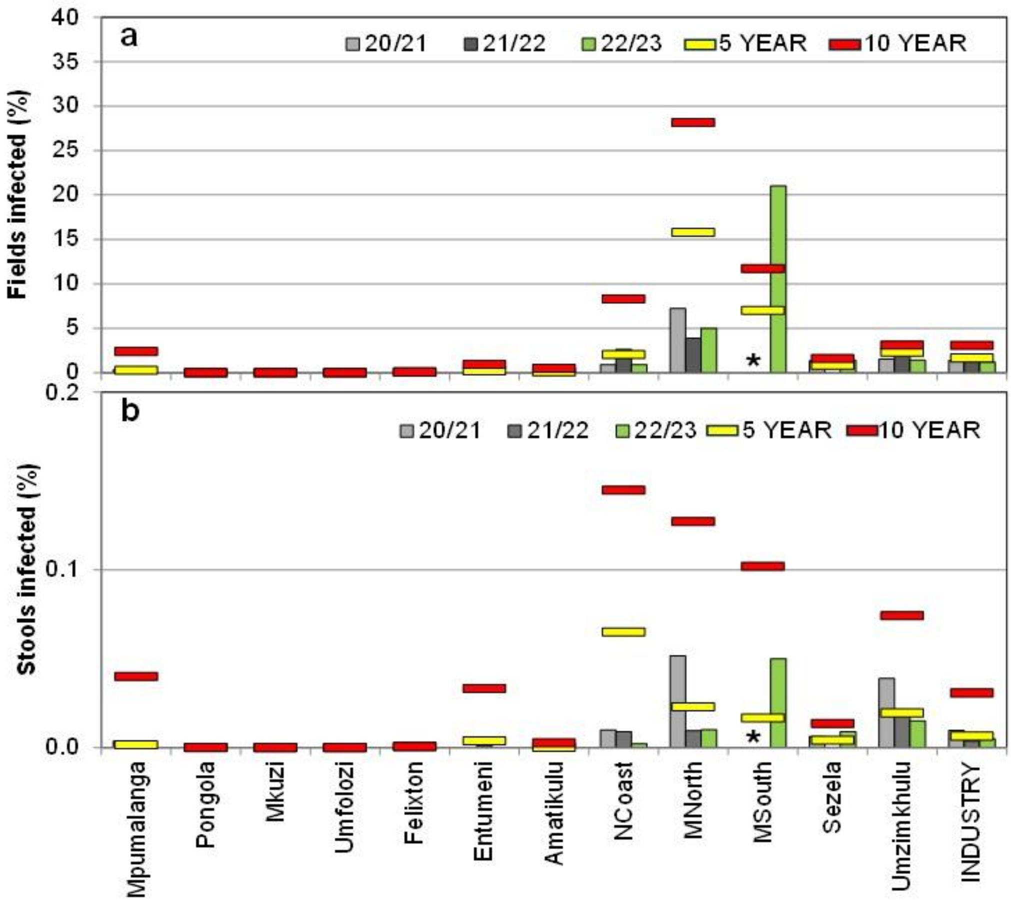

Figure 5. Mosaic (a) prevalence and (b) incidence in the South African sugarcane industry, June 2023 to May 2024 (commercial fields only), compared with the previous two seasons; *indicates small sample size

Mosaic is more common in the southern and midlands areas, but was detected in Pongola in February 2024. This was the first report of the disease in this area since 1997, when it was found in N19. To date, mosaic has been identified on three farms (six fields of N57 and two fields of N36), with the infected fields covering an area of approximately 24 ha. Five of these fields (12 ha) have been eradicated and the remainder have been rogued and will be eradicated after harvest. The current permissible limit for mosaic in Pongola is zero. Varietal resistance has been key in managing mosaic in the industry. The varieties that were most commonly infected were N12, NCo376 and N57 (Figure 6). Notably, no mosaic was detected in the 55 N12 Zapyr fields that were inspected, all but one of which were seed-cane fields covering approximately 56 ha.

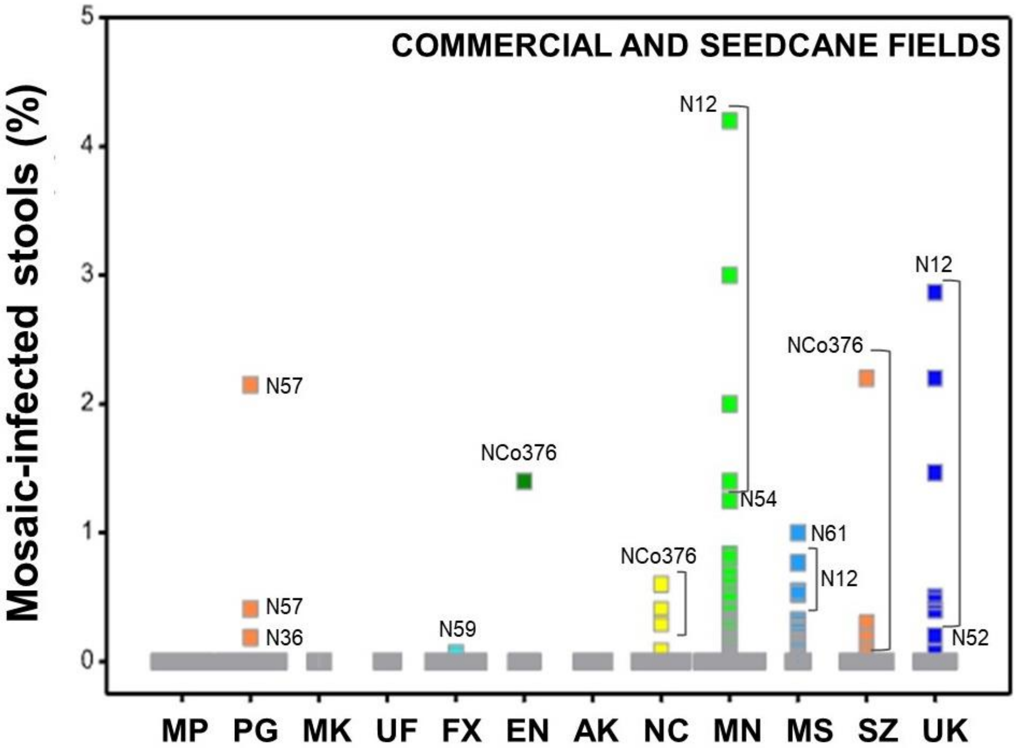

Figure 6. Percent mosaic-infected stools by Pest and Disease Control Area in commercial and seed-cane fields. Each square indicates mosaic incidence in an inspected field, different colours are used to differentiate the Pest and Disease Control Areas. Fields with the highest incidence are annotated with the variety name(s). Pest and disease area abbreviations: MP = Mpumalanga; PG = Pongola; MK = Mkhuze / Makhathini, UF = Umfolozi; FX = Felixton; EN = Entumeni; AK = Amatikulu; NC = North Coast; MN = Midlands North; MS = Midlands South; SZ = Sezela; UK = uMzimkhulu.

Ratoon stunt (RSD)

Ratoon stunt (RSD) was diagnosed in 6% of the commercial fields tested (Figure 7), which represented approximately 2 130 ha of the 22 000 ha that were sampled. This was higher than the previous season and the 5- and 10-year means. The disease was diagnosed in more than 15% of the commercial fields tested in Pongola and Umfolozi. The RSD incidence in seed-cane was higher than in the previous two seasons, with 1.9% of the fields testing positive in 2023-24. This increase was influenced by a number of samples collected from commercial fields, which were intended for use as seed-cane from one farm in Umfolozi, testing positive for RSD. In addition, five of the 93 seed-cane fields tested in Umzimkhulu were found to be infected. With the continued drive to meet the seed-cane 2028 target of establishing certified and approved nurseries to meet the seed-cane needs of each LPD&VCC Area, the undesirable practice of using commercial fields for seed-cane purposes is expected to decrease over time.

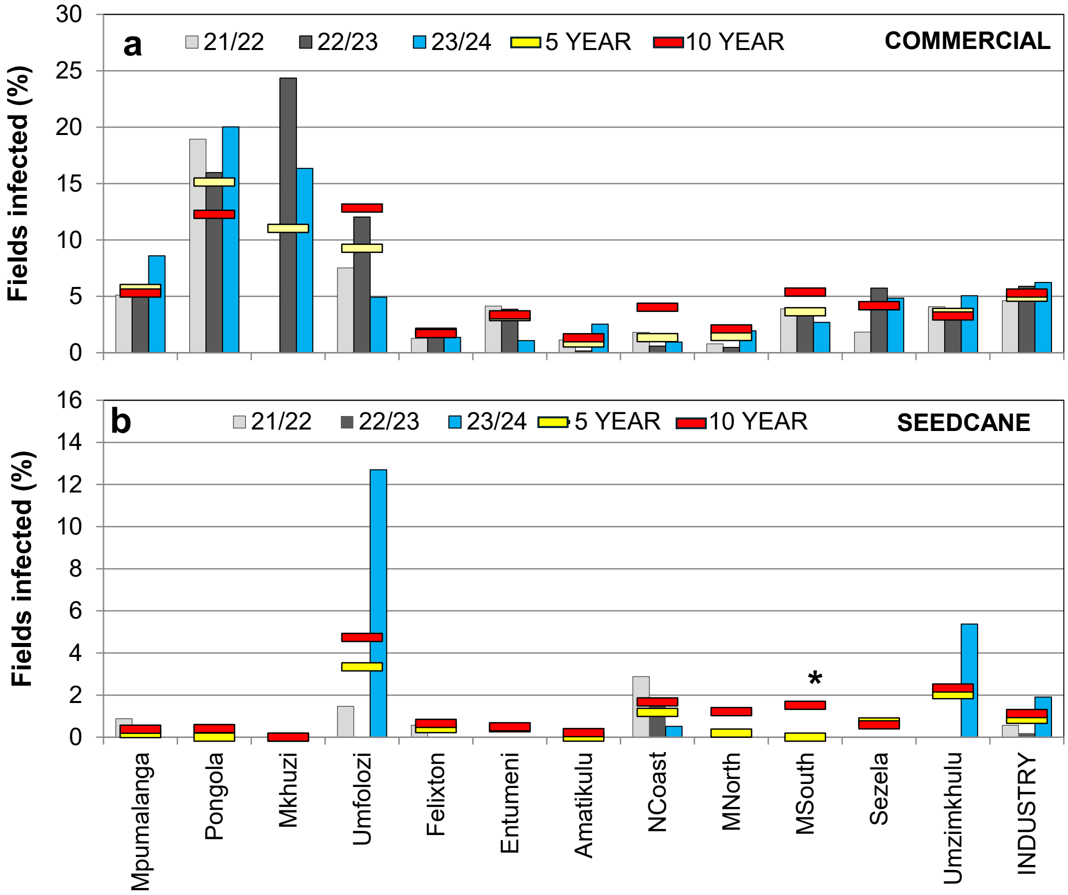

Figure 7. Ratoon stunt (RSD) incidence in (a) commercial and (b) intended seed-cane sources in the South African sugarcane industry, June 2023 to May 2024, compared with the previous two seasons; * indicates small sample size

Rust

Observational disease data are now being recorded when fields are being inspected for smut, mosaic and eldana, by using the ArcGIS Survey123 application that was developed at SASRI for the Biosecurity Inspectorate (Thompson *et al*., 2025). Based on these data, 3% of the approximately 62 400 ha of sugarcane inspected showed varying degrees of rust infection. This is most likely an underestimate. Distinguishing some of the foliar symptoms in the field and rating the extent and severity of the symptoms can be challenging, and therefore, ongoing training is required. The accuracy of the data should also improve, as the Inspectorate becomes more familiar and confident with the technology.

Most varieties have shown some susceptibility to orange rust, with moderate-to-severe symptoms being observed on several varieties from January through May each season (Table 1).

Table 1. Orange rust observations in the South African sugar industry

Rainfed varieties			
Not common		Common and sometime severe	
N48	N61	N12	N62
N54	N72	N12 Zapyr	N63
N55	N74	N39	N66
N59		N41	N75
		N52	N76
		N58	
Irrigated varieties			
Not common		Common and sometime severe	
N19	N40	N19	N57
N36	N53	N23	N60
		N41	N70
		N49	

Yield losses of 10 to 26% have recently been reported in orange rust-infected fields in Reunion (Dijoux *et al*., 2023), and 19% in moderate-to-severely infected N60 in South Africa (Kistan & McFarlane, 2024). Sporadic outbreaks of brown and tawny rust were reported in spring and early summer. Although not widely used, fungicides were generally applied by drone.

Biosecurity training

Pest and Disease training for Biosecurity personnel was conducted across all regions. The training was comprised of in-field pest and disease identification, Eldana and disease surveys, proper in-field sanitation of knives when collecting stalk samples, the identification of predatory insects, white grub surveys and navigation through the Survey123 App. This training is essential for ensuring the accuracy and reliability of the survey data that are submitted for analysis and used to inform decisions regarding pest and disease issues in the growers' fields. During these training events, the supervisors and inspectors are also reminded that their vigilance is key when conducting surveys to detect new pest and disease threats in the industry.

Conclusion

The issues encountered this season with Eldana and YSA infestations, are likely to persist into the forthcoming season, particularly due to the carry-over problems experienced in most regions. The YSA research portfolio is frequently enriched with new facets, in order to gain optimal value from the results. It is envisaged that these data that consider the soil, plant and environmental factors will be translated into field applicable methodologies, in order to better manage the infestations in the long-term.

With the continued drive to establish commercial fields with approved seed-cane, a decrease in the incidence of systemic diseases, such as smut and RSD, is expected over time. However, the extended warm, dry winters, as well as the extreme summer temperatures experienced in recent years, may fuel outbreaks of smut and contribute to greater yield reductions when the crops are infected with RSD and smut. The prevalence and severity of rust is also strongly influenced by climatic conditions. Research on supplementing and adapting integrated strategies is ongoing for the improved and more sustainable management of the most important diseases in the industry.

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