

SOUTH AFRICAN SUGARCANE RESEARCH INSTITUTE

PROGRESS REPORT

2022/23



SOUTH AFRICAN SUGARCANE
RESEARCH INSTITUTE

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REX TALMAGE

CHAIRMAN'S *Report*

The sugar industry, like many others worldwide, faces challenges and is on the brink of change. The rescues of Tongaat Hulett and Gledhow businesses have not only caused concerns but also strengthened our commitment to protect the livelihoods of many people in rural communities.

“Seedcane 2023” Initiative

This initiative, which is led by the Sugarcane Research and Sustainable Agriculture Committee (SRASA), shows our proactive approach, and with careful steps, creates a practical path to follow the Local Pest, Disease and Variety Control Committee (LPD&VCC) rules by 2028.

Industry Agreement & Compliance

The updated Sugar Industry Agreement of 2000 emphasises the need for Certified Seedcane. Rule 11.1 deadline, (i.e. for growers to only use Certified Seedcane or Approved Seedcane to plant commercial fields of sugarcane) is now extended to 2028, showing our commitment to work together with LPD&VCCs.

A salute to SASRI

SASRI is at the heart of our sugarcane research. They lead in groundbreaking research that raises sugarcane standards and promises exciting innovations for our industry. Their dedication to knowledge and practical use adds great value.

Challenges, whether local or global, are not just problems; they test our strength. The ongoing business rescues are tough but make us believe in a positive outcome.

SASRI, with its passionate researchers, is ready to lead our ‘Sweet Revolution,’ unlocking sugarcane’s circular economy potential.

Here’s to the journey ahead — one of strength, change, and shared hope!



DR TERRY STANGER

After moving beyond the constraints imposed by the COVID epidemic, operations have transitioned to a new normal. The research staff now operates under a hybrid model, with the stipulation that all crucial meetings occur in person. The laboratory and operational staff, who experienced minimal respite during the pandemic, have maintained their previous working arrangements.

Each season brings its distinct set of challenges, and the 2022/2023 season was no exception. It commenced with KwaZulu-Natal experiencing devastating floods in April and May 2022, which had well-documented repercussions on the sugar industry. Fortunately, there was no severe damage to the SASRI research stations or trials. Amidst discussions on climate change and the heightened likelihood of an upcoming El Niño event during the approaching summer, the uncertainties of the next season loom. Six months into the season, Tongaat Hulett Limited announced that it had been placed into Business Rescue. This move generated substantial industry-wide uncertainty. Nevertheless, SASRI's staff exhibited remarkable resilience, remaining dedicated to fulfilling their mandate of serving the South African sugar industry. We persistently strive to offer profitable and sustainable solutions to all our growers.

DIRECTOR'S *Report*

Significant achievements during the past year encompass 77 research projects in our substantial RD&I portfolio, with eighteen projects finalised and closed out in March 2023; outcomes of these projects are elaborated upon in this Annual Progress Report.

Among these, a new variety (N79) with superior yield and agronomic performance for the Coastal short-cycle regions was approved for gazetting and supplied to selected co-operators for bulking. Satisfactory progress has been made in developing management options for key pest and disease challenges faced by growers with a focus on developing technologies and knowledge resources to enable growers to enhance the performance and management of their crops. Curation of knowledge resources for growers is fundamental to SASRI's commitment to enhance adoption of technology and best management practices.

Seven information sheets on sugarcane pests were updated whilst five new information sheets were completed on irrigation in direct response to grower discussions at the 2022 Research, Development and Extension (RD&E) Committees' Workshop. The full suite can be found on pages 15 and 31 in the research report chapter.

Technology continues to gain momentum. A webGIS application has been developed for the six SASRI research stations. The app may be used on mobile devices and PCs and provides SASRI researchers with access to accurate geo-spatial information for the design, management, and analysis of their field experiments. A digital platform, based on the ArcGIS Survey123 technology, has also been rolled-out to the SASRI plant breeding and biosecurity inspectorate functions. This enables the in-field capture of data in a digital format (smart forms); which seamlessly integrates these data into coherent databases and facilitates the geo-spatial display and interpretation of data as required.

Pests and diseases continue to receive considerable focus. The first confirmed in-field observations of orange rust in South Africa caused significant concern within the industry. Early in the season, orange rust symptoms were observed on 35 of the 56 gazetted varieties (63%) within the plant breeding propagation plots on the SASRI Mount Edgecombe campus. Among these symptomatic varieties, severity of the disease ranged from mild (16% of the varieties) to severe (2% of the varieties), with majority exhibiting either moderate (20%) or moderately severe symptoms (25%). Fortunately, so far orange rust outbreaks have generally been confined to a limited area of the industry and were not as widespread as anticipated.

In a positive next step, the Sterile Insect Technique (SIT) programme has progressed to the field, with the recently initiated SIT proof of concept study. Field releases of F1 male and female moths began on 13 May 2022 at a site in Midlands North. F1 moths that were released had the desired male bias on each occasion, with a male-to-female sex ratio of 3.66 in the range of 3.11 to 5.18. Two eldana surveys were conducted in March (before moth release) and June 2022 (after moth release) when the sugarcane was 8 and 11 months old respectively. Eldana larvae and pupae were surveyed per 100 stalks and no larvae or pupae were recorded during these surveys. Eldana numbers and damage are only expected to increase as the cane ages beyond 18 months. Monthly surveys will continue until the moth releases are completed but initial results are encouraging.

The focus on Seedcane and the impending March 2023 deadline garnered significant attention during the past year. As certain areas were unlikely to meet the seedcane deadline, each Local Pest Disease and Variety Control Committee (LPD&VCC) provided detailed plans addressing specific challenges, objectives, milestones, and necessary guidance to achieve and sustain compliance.

In March 2023, SASA Council approved interim measures proposed by the Sugarcane Research and Sustainable Agriculture Committee (SRASA) extending these measures until 2028. These measures will monitor non-compliant LPD&VCCs' progress toward compliance. Non-compliant LPD&VCCs will report progress to SASA biannually and, within the proposed five-year extension period, SASA, through the LPD&VCCs, will establish and publish appropriate remedial actions in the event of individual grower non-compliance.

A highlight of the year was the XXXI ISSCT Congress held in Hyderabad, India, from 20 to 23 February 2023 and attended by 523 delegates representing 38 countries. The event featured a technical programme which consisted of 130 papers and 55 posters across the five ISSCT Technical Commissions: Agriculture, Biology, Co-products, Factory and Management. Ten presentations were delivered by SASRI specialists. SASRI Researchers performed admirably by claiming some top spots; Best Agriculture Paper was awarded to Extension Specialist, Marius Adendorff (co-authors Dr Ashiel Jumman and Aresti Paraskevopoulos) for their paper on "Adoption of irrigation scheduling in the South African sugarcane industry: the use of a demonstration trial to bring about change". Best Management Paper was awarded to Research Manager, Dr Derek Watt (co-authors Dr Rianto Van Antwerpen, William Gillespie and Dr Riekert Van Heerden) for their paper on "Promoting adoption of soil-health-related regenerative agriculture practices amongst small-scale sugarcane grower communities in South Africa", lastly, Dr Stuart Rutherford, a Principal Scientist (with co-authors Dr Sandy Snyman and Motselisi Koetle) claimed the Best Biology Poster for their poster on "Chemically-induced epimutagenesis for sugarcane improvement".

This annual report provides an overview of our achievements in the past year and offers some insight into the activities and noteworthy outcomes produced in support of our industry - I hope you enjoy reading it.

RESEARCH, TECHNOLOGY DEVELOPMENT AND *Knowledge Exchange*



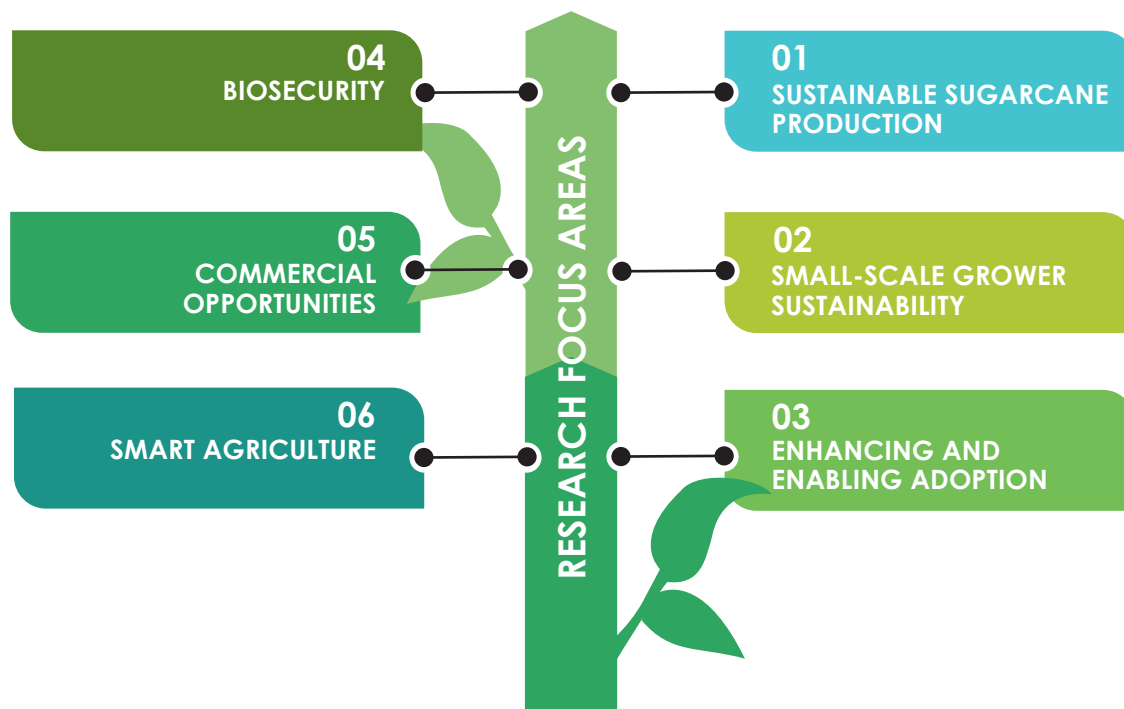
KNOWLEDGE MANAGER
Michelle Binedell



RESEARCH MANAGER
Dr Derek Watt

INTRODUCTION

SASRI research, technology development and knowledge exchange activities during 2022/2023 continued to deliver outcomes to support sugarcane growers in their efforts to maintain and improve the profitability of their farming enterprises. Progress was good, with advances made in the development of several technologies, including those relating to the support of: (a) biosecurity functions; (b) the agro-technical self-sufficiency of small-scale grower communities; (c) grower decision-making; and (d) growers in the effective management of their crops through improved access to refined and updated recommendations.



KEY FOCUS AREAS

Priorities for 2022/2023 were aligned to the five-year strategic plan for 2022/2023 to 2026/2027 developed by the industry for the institute in the key areas of: (a) sustainable sugarcane production; (b) small-scale grower sustainability; (c) enhancing and enabling adoption; (d) biosecurity; (e) commercial opportunities and (f) smart agriculture.

Research, technology development and knowledge exchange within each focus area were guided by strategic objectives set by the industry.

STRATEGIC Objectives

01 SUSTAINABLE SUGARCANE PRODUCTION

- To develop improved varieties that add value to the industry stakeholders operating in each agro-climatic region.
- To develop, refine and support the implementation of sustainable farming practices that enhance crop productivity.
- To consider and advise growers on specific cropping systems that enhance sustainable sugarcane production and that are aligned with the tenets of the Sugar Industry Master Plan.
- To proactively identify and provide guidance on the mitigation of potential production and quality risks to growers and the industry.
- To demonstrate the value that fourth industrial revolution (4-IR) technologies may add to sustainable sugarcane production and SASRI research, operations and services.



02 SMALL-SCALE GROWER SUSTAINABILITY

- To use knowledge of the farming systems and production risks of small-scale growers to develop and support the implementation of customised technologies and better management practices that increase crop yield and reduce biosecurity risks.
- To develop and support the implementation of additional methods to improve small-scale grower access to varieties and seedcane.
- To identify, develop and support the implementation of solutions tailored to the extension, biosecurity, education and training needs of small-scale growers and other industry role-players with whom they interact.
- To identify cost-effective, region-specific and complementary on-farm opportunities for small-scale growers to increase household income.
- To develop and support the implementation of customised farming systems in partnership with industry stakeholders and associations.



03 ENHANCING AND ENABLING ADOPTION

- To develop and implement marketing strategies for SASRI, SASRI technologies, better management practices and recommendations to increase stakeholder confidence and promote adoption.
- To undertake case studies and develop economic models determine the value of SASRI technologies, better management practices and recommendations in order to facilitate their adoption, application and implementation.
- To develop new, and refine and implement existing, knowledge exchange methods that aim to increase adoption, particularly those that demonstrate value practically under local conditions.



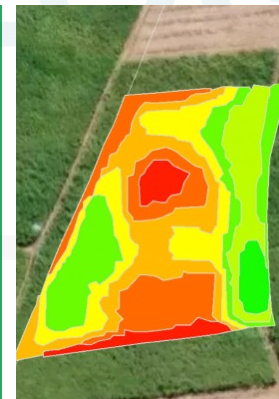
04 BIOSECURITY

- To engage in policy advocacy and actively maintain stakeholder relationships with relevant government departments to retain and maximise the value of legislated self-governance.
- To develop and implement digital, real-time and geo-referenced systems for P&D data collection, monitoring, interpretation and sharing.
- To develop and provide agro-technical support for the implementation of new cost-effective seedcane production technologies that will contribute to biosecurity risk mitigation.
- To promote incursion risk awareness and mitigation planning formally within the industry and informally within sub-Saharan Africa.
- To inform incursion risk mitigation planning by undertaking risk and epidemiological modelling of specific existing and potential new pests and diseases, which account for climate change scenarios.
- To develop and provide implementation support for area-wide integrated approaches for pest and disease management which offer sufficient flexibility for protect resource-poor growers.
- To undertake education, training and marketing activities to raise awareness and promote good biosecurity practice amongst all growers.



05 COMMERCIAL OPPORTUNITIES

- To engage in **policy advocacy** and actively maintain **stakeholder relationships** with relevant **government** departments to retain and maximise the value of legislated self-governance.
- To develop and implement **digital, real-time and geo-referenced systems** for **P&D data collection**, monitoring, interpretation and sharing.
- To develop and provide agro-technical support for the implementation of new **cost-effective seedcane production technologies** that will contribute to biosecurity risk mitigation.
- To promote **incursion risk awareness and mitigation planning** formally within the industry and informally within sub-Saharan Africa.
- To inform incursion risk mitigation planning by undertaking **risk and epidemiological modelling** of specific existing and potential new pests and diseases, which account for climate change scenarios.
- To develop and provide implementation support for **wide-area integrated approaches** for **pest and disease management** which offer sufficient flexibility to protect resource-poor growers.
- To undertake **education, training and marketing** activities to raise awareness and promote **good biosecurity practice** amongst all growers.



06 SMART AGRICULTURE

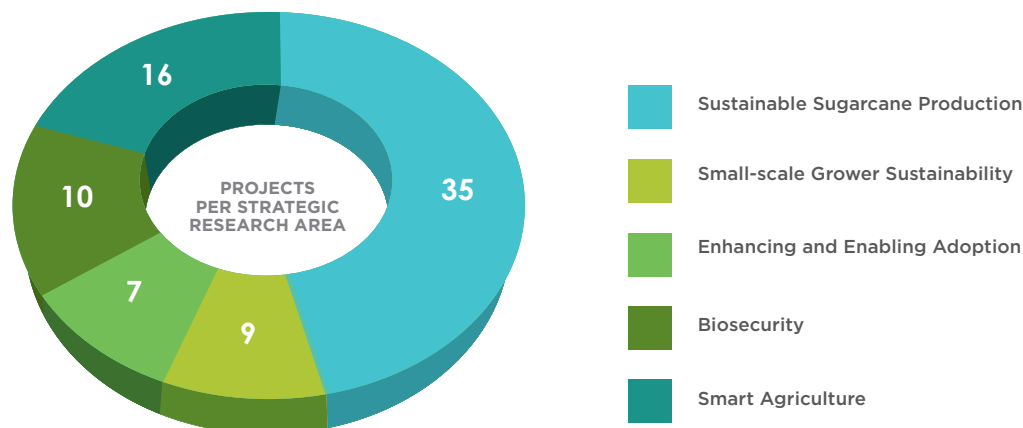
- To apply **aerial sensing technology** and **machine learning** to enable cost-effective and fit-for-purpose applications that enhance **monitoring, decision-making, mapping and scheduling**.
- To demonstrate emerging **4-IR technologies** and **geo-spatial informatics** that add value to existing data used by SASRI in **economic modelling, real-time monitoring and technology value assessments** and that drive improved productivity.
- To develop innovation low and high-tech **on-farm solutions** to enable **real-time diagnostics** and the **precise implementation and monitoring** of a range of **operations** that demonstrate economic benefit.
- To seek and develop implementation opportunities for **smart decision-support systems** that enable growers to customise better management practices according to their requirements, while still farming sustainably.



PROJECT PORTFOLIO COMPOSITION

The 2022/2023 portfolio consisted of 77 research, technology development and knowledge exchange projects spread across the five research focus areas.

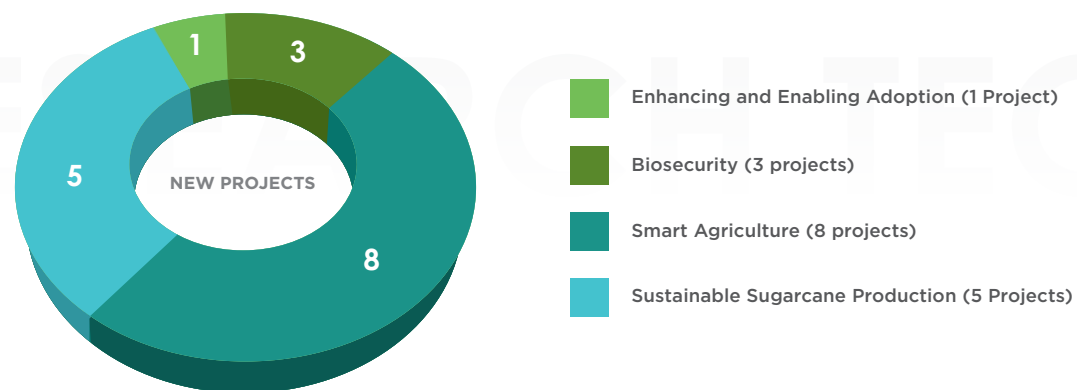
17 new projects commenced in April 2022, with 60 ongoing projects continuing into 2022/2023 from 2021/2022.



NUMBER OF PROJECTS PER STRATEGIC RESEARCH AREA

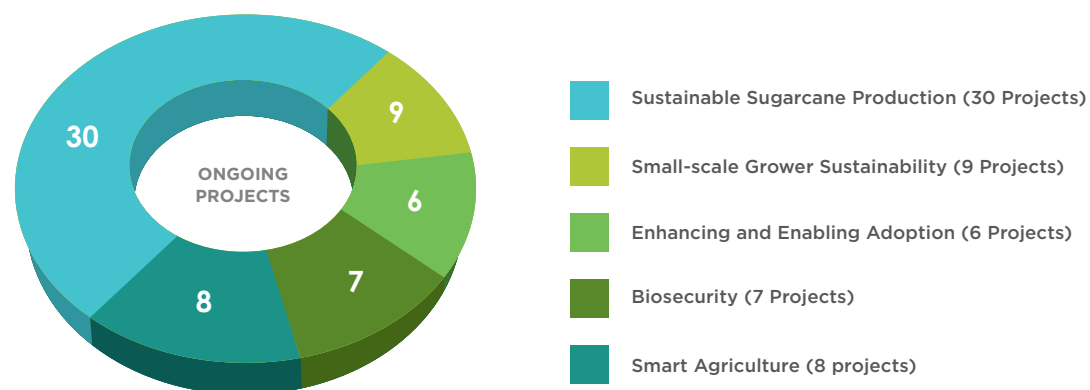
NEW AND ONGOING PROJECTS

NUMBER OF PROJECTS PER STRATEGIC RESEARCH AREA



The composition of new and ongoing project portfolio for 2022/2023 has been informed and guided by several factors, including:

- an ongoing analysis of grower needs conducted by the SASRI large-and small-scale grower extension services to promote portfolio alignment with regional small-scale and large-scale grower priority issues;
- the need for progressive research arising from the outcome of projects completed on or before 31 March 2021;
- opportunities for the transformation of research outputs into practical knowledge and technology products, with associated initiatives to promote adoption;
- advances in science and technology that have the potential to provide innovations in sustainable sugarcane production; and
- national economic, socio-economic, and socio-political factors influencing sugarcane agriculture.



Research and technology development activities of the portfolio were managed within four research programmes, with the required resources drawn from two resource centres and two resource units.



VARIETY IMPROVEMENT RESEARCH

To develop and release varieties with high sugar yield, pest and disease resistance, adaptability, ratooning ability and agronomic and milling characteristics that are desirable to both millers and growers

PROGRAMME MANAGER
Dr Sandy Snyman



CROP PROTECTION RESEARCH

To develop integrated management strategies that minimise the effects of pests, diseases and weeds on crop production in a sustainable manner

PROGRAMME MANAGER
Dr Stuart Rutherford



CROP PERFORMANCE AND MANAGEMENT RESEARCH

To develop models and better management practices to sustain and enhance sugarcane production

PROGRAMME MANAGER
Dr Riekert Van Heerden



SYSTEMS DESIGN AND OPTIMISATION RESEARCH

To investigate, develop and transfer innovative systems that optimise industry performance

PROGRAMME MANAGER
Dr Rian Van Antwerpen



CROP BIOLOGY RESOURCE CENTRE (CBRC)

- Biotechnology
- Entomology
- Molecular Biology
- Plant Pathology

RESOURCE MANAGER
Dr Deborah Sweby



PLANT AND ENVIRONMENT RESOURCE CENTRE (PERC)

- Agricultural Engineering
- Agrochemical Science
- Agronomy
- Crop Nutrition
- GIS Research
- Soil Science

RESOURCE MANAGER
Belinda Naidoo



DIAGNOSTIC AND ANALYTICAL RESOURCE UNIT (DARU)

- Biometrical Services
- Fertiliser Advisory Service
- Mill Room Services
- Diagnostic Services

RESOURCE MANAGER
Keith Collings



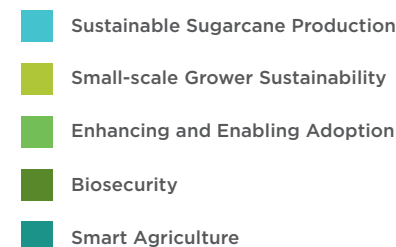
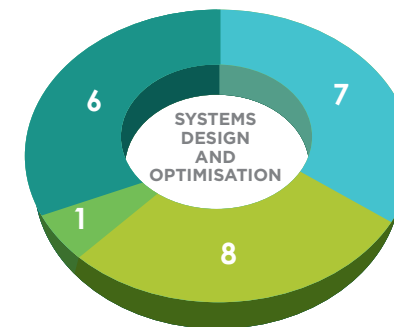
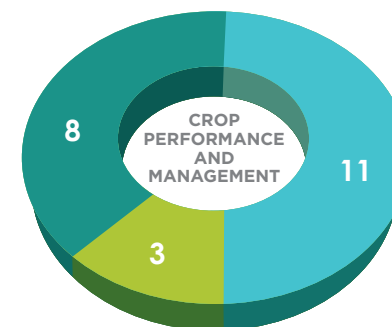
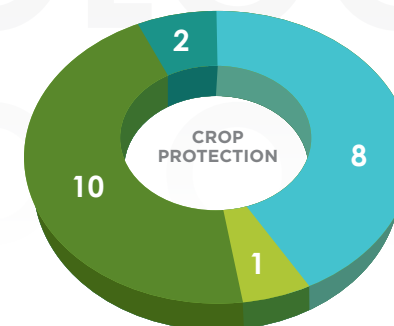
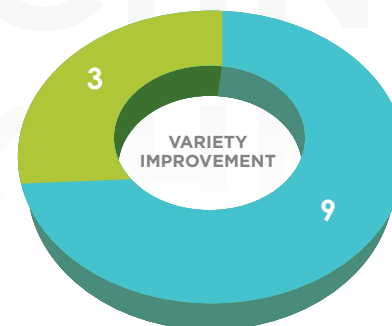
BREEDING AND FIELD SERVICES RESOURCE UNIT (BFRU)

- Plant Breeding
- Crossing and Selection Services
- Field Research Support
- Mechanisation and Instrumentation Services

RESOURCE MANAGER
Dr Sumita Ramgareeb

PROJECT PORTFOLIO MANAGEMENT

NUMBER OF PROJECTS PER STRATEGIC RESEARCH AREA PER PROGRAMME

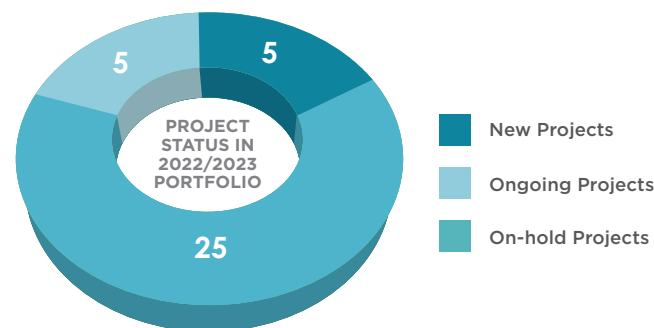
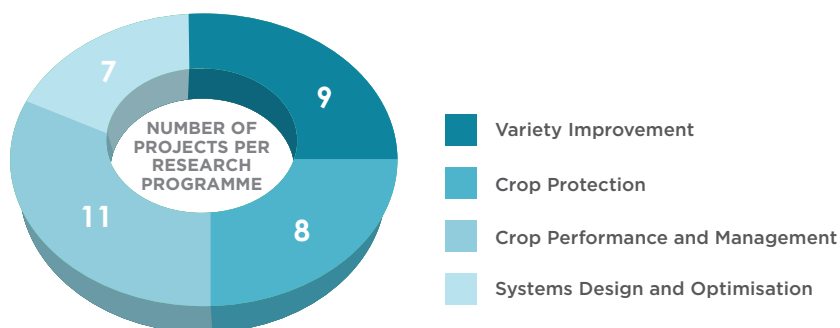


SUSTAINABLE SUGARCANE

Production

STRATEGIC OBJECTIVES

- To develop improved varieties that add value to industry stakeholders operating in each agro-climatic region.
- To develop, refine and support the implementation of sustainable farming practices that enhance crop productivity.
- To consider and advise growers on specific cropping systems that enhance sustainable sugarcane production and that are aligned with the tenets of the Sugar Industry Master Plan.
- To proactively identify and provide guidance on the mitigation of potential production and quality risks to growers and the industry.
- To demonstrate the value that fourth industrial revolution (4-IR) technologies may add to sustainable sugarcane production and SASRI research, operations and services.



Within the 2022/2023 project portfolio addressing Sustainable Sugarcane Production objectives, there were five new projects, 25 ongoing projects and five projects that were on-hold due to capacity constraints.

NEW Projects

VARIETY IMPROVEMENT RESEARCH

Validation of a candidate gene for the *Bru1* brown resistance gene via CRISPR mediated gene knockout

GOAL

Validating a candidate gene for the *Bru1* brown resistance gene using state-of-the-art gene editing technology (CRISPR) to produce a loss-of-function knockout phenotype.



International Consortium
for Sugarcane Biotechnology
(Contracted-out Research)

Targeted gene editing in sugarcane (project on-hold for 2022/2023)

GOAL

Obtaining proof-of-concept that state-of-the-art gene editing technology can be applied to the development of herbicide tolerance in a sugarcane variety of value to small- and large-scale growers.



Institute of Plant
Biotechnology,
Stellenbosch University
(Contracted-out Research)

CROP PROTECTION RESEARCH

Spectroscopic determination of YSA-induced stress in sugarcane

GOAL

Testing the utility of field spectroscopy data and machine learning to construct models for detecting and monitoring yellow sugarcane aphid (YSA). The project is a stage-gate for developing operational models that can be adopted by Extension (Biosecurity) and growers for managing YSA in sugarcane fields.



PROJECT MANAGER
Dr Nitesh Poona

Comparison of diversity and abundance of non-target organisms on Bt and non-Bt sugarcane in South Africa

GOAL

To comply with national regulations pertaining to genetically-modified organisms (GMOs) and demonstrate to growers the benefits of GM technology, in terms of biodiversity impacts, in particular, this research addresses three objectives:
(a) conducting a baseline study on non-target arthropods and developing a checklist of all arthropod species on sugarcane in South Africa; (b) assessing different arthropods sampling methods that are suitable for ecological risk assessments under field conditions; and (c) determining if, in Bt sugarcane fields, the abundance and species composition of non-target arthropod species are in any way different to that occurring in untreated conventional sugarcane, insecticide-treated sugarcane and Bt sugarcane treated with insecticide.



PROJECT MANAGER
Dr Lawrence Malinga

Use of boron for the control of *Eldana saccharina* and *Fusarium* in sugarcane

GOAL

Investigating interactions between boron, *Bacillus thuringiensis* (Bt) insecticide, and the chitin biosynthesis inhibitor insecticide, lufenuron, while nutritionally improving plant defence mechanisms against eldana and *Fusarium*. The specific objectives are investigating: (a) the role of boron nutrition in increasing resistance of sugarcane plants to eldana and *Fusarium*; (b) the effect of boric acid as an additive in improving the efficacy of Bt insecticide used for control of eldana; and (c) the effect of boric acid as an additive in improving the efficacy of the chitin biosynthesis inhibitor insecticide, lufenuron.



PROJECT MANAGER
Khanyi Buthelezi

CROP PERFORMANCE AND MANAGEMENT RESEARCH

Upgrades to the StalkGro decision support program

GOAL

Implementing a new, improved version of the StalkGro Decision Support Program (DSP). Specific objectives are to: (a) increase the spatial resolution of StalkGro; (b) Improve the accuracy of the underlying crop model simulations; (c) add support for different sugarcane varieties; (d) provide support for additional soil options and medium-term climate forecast information; (e) validate the StalkGro predictions against trial datasets; (f) provide multiple language options; and (g) develop a detailed specification for a "Phase 2" to implement StalkGro on SASRI Oracle systems.



PROJECT MANAGER
Matthew Jones

OUTCOMES FROM *Completed Projects*

VARIETY IMPROVEMENT RESEARCH

Transcriptomics of eldana-inoculated sugarcane plants

GOAL

The goal of this project was to examine the responses, at a molecular level, of an eldana resistant variety and a susceptible variety to attack by the pest, with a view to identifying genes associated with resistance or susceptibility that could be used in future as genetic markers to expedite breeding for resistance.



PROJECT MANAGER
Robyn Jacob

OUTCOMES

THE MAIN OUTCOMES FROM THE STUDY WERE AS FOLLOWS:

- A presence/absence variant (PAV) region of DNA surrounding a wound-and pest-induced dirigent-like (*ShDIR31*) gene of unknown function was identified and found to be highly associated with eldana resistance in sugarcane cultivars that were selected from the SASRI long cycle coastal selection programme.
- In genotypes derived from the SASRI Gingindlovu long cycle selection programme, 76% of the eldana resistant genotypes contained the *ShDIR31* gene.
- Subsequent bioinformatic analyses identified a further defence related gene within the PAV region that is situated downstream of the *ShDIR31* gene and promoter elements upstream of the gene.
- The identification of this potential defence locus could be used as a marker to select for eldana resistance in sugarcane genotypes which perform well when aged beyond 12 months.

FURTHER RESEARCH

A PROJECT (PROJECT 23VI03) WITH THE FOLLOWING AIMS WILL COMMENCE IN 2024/2025:

- To investigate the PAV defense locus¹ further by determining the extent of the region and identifying other genes which may be present in the region.
- To characterise additional eldana variety evaluation trials and second stage selection trials using the *ShDIR31* gene as a genetic marker to increase confidence in the association with eldana resistance.
- The wound induced *ShDIR31* promoter will be isolated for use in SASRI's genetic modification program.
- If the association of the PAV region and eldana resistance is confirmed by incorporation of additional genotypes, further characterisation of the candidate genes that were identified in will be explored. The project would then be extended to explore these candidate genes further by introducing the genes into susceptible cultivars in a transgenic approach.



¹ A locus is the physical site or location of a specific gene on a chromosome.

CROP PERFORMANCE AND MANAGEMENT RESEARCH

Optimal harvest ages for different production regions

GOAL

The goal of this project was to provide further clarity on important harvesting age issues that have arisen across the industry.

- Growers in the irrigated northern regions have queried the potential value of harvesting older cane.
- The economics of ageing of cane beyond twelve months has become an important consideration for coastal growers due to the availability of a wider variety of eldana management options, including IRAC²-compliant spray programmes.
- The recent release of faster growing varieties for cultivation at high altitudes has prompted growers to question whether harvesting of cane at 18 to 20 months, rather than at 24 months, is now an economically viable option.

Growers sought clarity on the optimal harvest age for all the regions to maximise profits over a full cropping cycle.

OUTCOMES

The main outcomes from the study were as follows:

- An economic decision support tool was developed in collaboration with the South African Canegrowers' Association to enable interrogation of harvest age decisions based on whole-cycle economics. Optimum physiological harvest ages were confirmed for each production region of the industry.
- Analysis of commercial datasets confirmed that irrigated varieties each have unique optimal harvest ages under commercial growing conditions in Mpumalanga.

FURTHER RESEARCH

Additional exploration of Nkomazi mill commercial datasets will provide an opportunity to further test factors affecting optimal harvest, including the impacts of: (a) variety; (b) microclimates; (c) chemical ripening; (d) pests and diseases; and (e) flowering.

Revision of SASRI publications containing best management practices: Planting, harvesting and irrigation

GOAL

The goal of this project was to update and, where necessary, produce new SASRI publications to provide technical recommendations to growers relating to planting and harvesting, as well as irrigation.



PROJECT MANAGER
Thobile Nxumalo



SASRI is grateful of the data provided by RCL and the essential expertise provided by economists from the SA Canegrowers' Association)



PROJECT MANAGER
Dr Ashiel Jumman

² The Insecticide Resistance Action Committee (IRAC), which was formed in the United States in 1984, works as a specialist technical group of the industry association CropLife to provide a coordinated industry response to prevent or delay the development of insecticide resistance in insect and mite pests. The Committee is recognised by the Food and Agriculture Organization (FAO) and the World Health Organization (WHO) as an advisory body on matters pertaining to insecticide resistance. IRAC assists growers, advisors, extension staff, consultants and crop protection professionals to define effective and sustainable insecticide resistance management (IRM) strategies.

OUTCOMES

Following extensive consultation and editorial review processes, these projects developed a series of updated and new technical information sheets on planting, harvesting and irrigation.



PLANTING AND HARVESTING

UPDATED AND NEW INFORMATION SHEETS

- Subsoiling / Ripping (6.14)*
- The pros and cons of mulching or burning at harvest (6.13)
- Soil Compaction (6.10)
- NovaCane® planting guide (1.4)
- Land preparation#
- Planting#

IRRIGATION

UPDATED AND NEW INFORMATION SHEETS

- Irrigation fundamentals (5.1)
- Irrigation strategies during water limited periods (5.2)
- Basics of irrigation scheduling (5.3)
- Irrigation scheduling toolbox (5.4)
- Chemigation: Principals and Fundamental equipment (5.5)
- Chemigation: Considerations for chemical selection and fertigation guidelines (5.6)
- Introduction to irrigation systems (5.7)
- Irrigation system selection (5.8)
- Irrigation energy inputs (5.9)
- Properties of saline/sodic soils and their reclamation (5.11)
- Irrigation water quality for sustaining soil health and crop yield (5.12)
- Water quality considerations for optimal performance of irrigation equipment (5.13)
- Irrigation system maintenance (5.14)
- Irrigation costs estimates (5.15)
- Assessing economic viability of irrigation (5.16)
- 5.17 Placement of soil water sensors for irrigation scheduling (5.17)
- Evapotranspiration (ET) Calendars (5.18)
- The negative effects of modifying irrigation systems outside of design specifications (5.19)
- Operating Rules of Irrigation Systems (5.20)

* SASRI Information Sheet reference number
Final drafts under review

FURTHER RESEARCH

Future work will include the development of information sheets for: (1) the calibration of soil water sensors; (2) cost estimations for subsurface drainage; (3) management and maintenance of subsurface drainage systems; and (4) irrigation record keeping for improved irrigation management.

UPDATES FROM *Ongoing Projects*

VARIETY IMPROVEMENT RESEARCH

NEW VARIETIES

- Variety N79, which was selected on the SASRI Empangeni Research Station, was gazetted in 2022/2023 for release and bulking in the Coastal short-cycle regions of the industry.
- The variety is recommended for cultivation on high potential soils in Mkuze Makhathini, Umfolozi, Felixton, Amatikulu, North Coast (coastal areas), Sezela (coastal areas) and Umzimkulu (coastal areas).
- The variety is characterised by high cane yield, high RV%, high tons RV, excellent ratooning and broad adaptability, as well as eldana, mosaic and smut resistance.



PROJECT MANAGER
Dr Marvellous Zhou

SASRI BREEDING RESEARCH TEAM



Dr Marvellous Zhou



Dr Shailesh Joshi



Moipei Lichakane



Tondani Mishasha

PERFORMANCE OF NEW VARIETIES

- Preliminary testing in Pongola revealed that the rainfed variety N67 shows potential for good performance under irrigated conditions, possibly equalling that of N53, although further testing over multiple seasons is in progress for confirmation.
- In the Midlands, when harvested at 18 months, newly released varieties (N78, N75, N74, N69, N68 and N62) were observed to perform better than all the other varieties tested.
- The RV yield performance of N66 was lower than that of the control variety N48, supporting observations made by the SASRI breeding and research team on the slow maturing features of the variety and their recommendation that it be harvested at 24 months. This feature indicates that N66 may complement N12 in the region, especially at high altitude.



PROJECT MANAGER
Thobile Nxumalo

INTROGRESSION BREEDING

- Investigations have been conducted to determine if hybridisation³ can occur either via human intervention in climate-controlled conditions or naturally under field conditions amongst selected commercial sugarcane cultivars and indigenous wild *Saccharum* (sugarcane) relatives.
- Results obtained revealed that indigenous wild sugarcane relatives flower earlier than commercial hybrids, precluding the possibility of natural hybridisation.
- Additionally, attempts to generate artificial crosses between the wild sugarcane relative, *Miscanthidium*, and commercial cultivars did not result in seed set.



PROJECT MANAGER
Dr Shailesh Joshi

³ Plant hybridisation is the process of crossbreeding between genetically dissimilar parents to produce a hybrid.

INTROGRESSION BREEDING

- Molecular phylogenetic analyses revealed that commercial sugarcane varieties and *Miscanthidium* have different basic chromosome numbers, which also limits the possibility of natural hybridisation.
- These results suggest a low risk of natural hybridisation amongst wild sugarcane relatives and a commercial genetically modified (GM) sugarcane variety, information which will form an important component of the regulatory dossier that will be submitted to the Genetic Resources Directorate of the Department of Agriculture, Land Reform and Rural Development, should the industry elect to proceed with the future commercial release of a GM variety.

IMPROVING CANE STRESS TOLERANCE

- Mutation breeding methods are being used at SASRI to generate sugarcane lines with epigenetic mutations (epilines) that result in improved tolerance of drought and heat stress.
- Recent research has identified six epilines of N41 that, when exposed to drought and heat stress, retain morphological characteristics like the unstressed N41 control plants.
- The epimutants have been acclimated in the biotechnology glasshouse and are awaiting *ex vitro* drought response assessment.



CROP PERFORMANCE AND MANAGEMENT RESEARCH

ASSESSING SOIL HEALTH

- A rapid low-cost permanganate oxidisable carbon (POXC) test, intended for routine soil health indexing was recently reported in the literature and this research aims to evaluate and refine the method for potential routine use by the SASRI Fertiliser Advisory Service (FAS).
- Recent investigations revealed a general lack of strong crop management effects on POXC measurements from soil samples taken over the depth of 0 to 20cm, which limits the use of the method as part of routine soil testing using samples collected for standard fertility analysis.
- For effective soil health indexing with the POXC method, it is likely that growers would be required to sample their soils at shallower depth (0-5cm), although additional studies are underway to further test this preliminary observation.



CANE QUALITY MANAGEMENT

- Due to the fast growth rate and lodging propensity at high cane yield of N54, growers in the Midlands are finding it difficult to manage the cane quality of the variety.
- Consequently, a participatory demonstration trial with N54 was established near Wartburg to test a new ripener combination treatment: fluazifop-p-butyl (e.g. Fusilade Forte®) and trinexapac-ethyl (e.g. Moddus®).
- Results indicate that the new ripener combination treatment could be profitable as an early season ripening strategy for N54 in the Midlands.
- Further research is underway at the SASRI Bruyns Hill Research Station to refine ripening recommendations in N54 and other Midlands varieties.



WATER MANAGEMENT

- Situational analyses were conducted via semi-structured conversational interviews with six large-scale growers (LSGs) and six small-scale growers (SSGs) in Mpumalanga to assess the impact of load shedding on irrigation practices.
- In-person grower interviews were conducted to determine the impact from both the bulk water and infield irrigation management perspectives.
- Based on these analyses, SASRI has prepared an internal report describing the various aspects and impacts of load shedding on both LSGs and SSGs, which is available on request. The report further describes the importance of load shedding within the broader context of irrigation operations and irrigated sugarcane crop production practices.



CROP ESTIMATES DECISION SUPPORT TOOL

- Good progress has been made in the development of a simple, user-friendly web-based decision support program (DSP) to assist growers in producing monthly crop estimates.
- The DSP will soon be circulated to Extension Specialists for evaluation and comment, and holds great promise as a tool for growers, mill supply managers and other value chain stakeholders to estimate crop sizes more objectively and consistently.



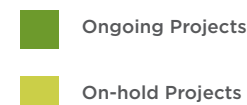
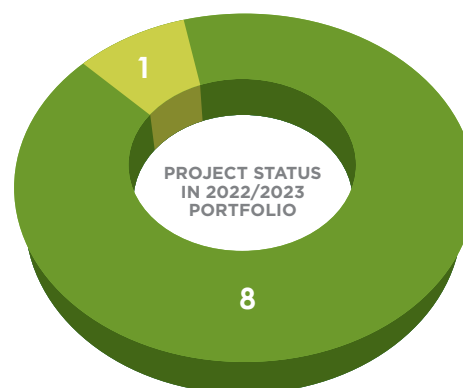
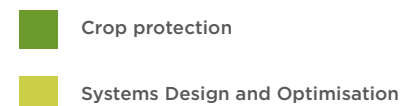
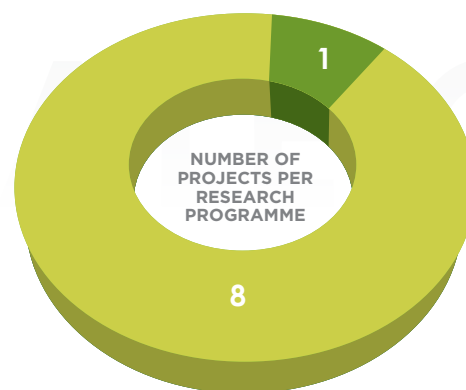
STRATEGIC OBJECTIVES

- To use knowledge of the **farming systems** and production risks of small-scale growers to develop and support the implementation of **customised technologies** and **better management practices** that increase **crop yield** and **reduce biosecurity risks**.
- To develop and support the implementation of additional methods to improve small-scale grower access to **varieties and seedcane**.
- To identify, develop and support the implementation of solutions tailored to the **extension, biosecurity, education and training** needs of small-scale growers and other industry role-players with whom they interact.
- To identify cost-effective, region-specific and **complementary on-farm opportunities** for small-scale growers to increase household income.
- To develop and support the implementation of **customised farming systems** in **partnership** with industry stakeholders and associations.



Within the 2022/2023 project portfolio addressing Small-scale Grower Sustainability objectives, there were eight ongoing projects and one project that was on-hold due to capacity constraints.

SMALL-SCALE GROWER Sustainability



OUTCOMES FROM *Completed Project*

SYSTEMS DESIGN AND OPTIMISATION RESEARCH

Advancing cane
quality management
in the small-scale
grower sector

PROJECT GOALS

The goal of this project was to improve cane quality management on a pilot scale in the small-scale grower sector using an approach consisting of informed ripening decision-making, drone mediated chemical ripener application, and informed harvest scheduling.

OUTCOMES

The main outcomes from the study were as follows:

- A customised participatory research methodology was developed that is suitable for engagements with small-scale growers.
- The ability of crop spraying drones to effectively apply chemical ripeners to small, irregularly shaped and dispersed fields that are common in the small-scale grower sector was demonstrated.
- The profitability of drone ripening was established in a total of 16 demonstration trials situated in eleven diverse small-scale grower regions in both rainfed and irrigated production systems.
- ERC yield increases in response to the ripening ranged between 0.21 and 1.78 t/ha.
- Economic analysis, considering ERC yield increases as well as the ripening, harvesting and transport costs applicable to the small-scale growers, revealed gross margin benefits from ripening in the range of R1,567 to R8,896/ha.
- These gross margin benefits are comparable to those typically observed in large-scale commercial demonstration trials.
- Several challenges were identified for the broader roll-out of drone-mediated chemical ripening across the small-scale grower sector and potential solutions to some of these challenges will need to be explored jointly by all stakeholders at a local level.

FURTHER RESEARCH

- Although many successful demonstration trials were conducted in the current pilot study, many more small-scale growers remain to be reached regarding the potential benefits of cane quality management using chemical ripening agents applied via drones.
- A targeted knowledge exchange project will commence in 2024/2025 to reach to a wider small-scale grower audience using tailor-made communication tactics.



PROJECT MANAGER
Dr Riekert van Heerden

UPDATES FROM *Ongoing Projects*

SYSTEMS DESIGN AND OPTIMISATION RESEARCH

Capacitating
Small-scale Grower
Extension (Extension
Venture Agreement)

- Variety selection by small-scale growers (SSGs) according to the soil type in their fields is important, as: (a) top-dressing fertiliser application needs to be based on predicted yields; and (b) the decision affects yield and income for several years.
- Soil information in SSG regions is mostly unknown with the result that no definitive and precise advice can be given, contributing to sub-optimal yields.
- The aim of this project is to capacitate SSG extension in estimating yield potential using simple soil data so that they can support the decision-making of their growers.
- The soil survey phase in the Gcumisa region has been completed.
- Development of an Excel database and the creation of soil maps and tables with the MyCanesim model are in the initial phase of development.
- Once the maps and database have been completed, they will be handed over to the DARD Agricultural Advisor in the region to continue with database development for the region.
- The next phase of the work is to be undertaken in the Felixton mill supply area.



PROJECT MANAGER
William Gillespie



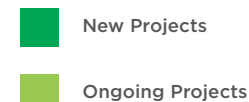
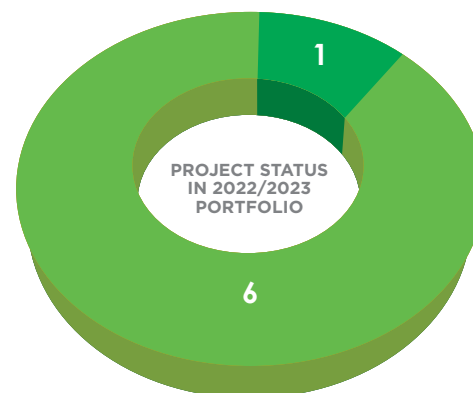
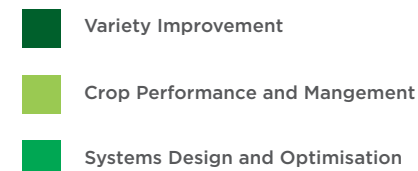
STRATEGIC OBJECTIVES

- To develop and implement marketing strategies for SASRI, SASRI technologies, better management practices and recommendations to increase stakeholder confidence and promote adoption.
- To undertake case studies and develop economic models that determine the value of SASRI technologies, better management practices and recommendations to facilitate their adoption, application and implementation.
- To develop new, and refine and implement existing, knowledge exchange methods that aim to increase adoption, particularly those that demonstrate value practically under local conditions.



Within the 2022/2023 project portfolio addressing Enhancing and Enabling Adoption objectives, there was one new project and six ongoing projects

ENHANCING AND ENABLING *Adoption*



NEW Project

CROP PERFORMANCE AND MANAGEMENT RESEARCH

The development and linking of soil management units to better management practices in the Northern Irrigated Regions

GOAL

Collaborating with growers in the delineation of soil-management units (SMUs) in the Northern irrigated region to contextualise better management practices (BMPs) aimed at improving the profitability and sustainability of sugarcane cultivation and assisting with diversification efforts.



PROJECT MANAGER
Rowan Stranack

OUTCOMES FROM Completed Projects

VARIETY IMPROVEMENT RESEARCH

Genetically modified sugarcane: Preparative research to meet regulatory dossier requirements

PROJECT GOALS

The South African sugar industry, through SASRI, is developing two genetically modified (GM) sugarcane varieties that are insect resistant and herbicide tolerant and, in advance of possible commercialisation in 2030, preparative research for the regulatory dossier was undertaken in this project to:

- evaluate the likelihood of gene flow from commercial sugarcane hybrids to compatible wild relatives (*Miscanthidium junceus*⁴ and *M. capense*⁵);
- mathematically model refugia⁶ requirements for a scenario in which the GM varieties are deployed simultaneously with the sterile insect technique;
- develop a predictive eldana risk index to assist decision making for the release of the GM sugarcane varieties to particular areas;
- and develop communication resources for GM cane.



PROJECT MANAGER
Dr Sandy Snyman

⁴ *Miscanthus junceus* (Broom Grass/Besemgras/Umpumelelo) is distributed from the Democratic Republic of the Congo southward through southern Africa to Swaziland and South Africa. The species always occurs in or near water and, in the Okavango delta, it is the most common grass in permanent water, while in Mpumalanga, it dominates shallow-water vegetation.

⁵ *Miscanthus capense* (Daba Grass/Ruigtegras/Umpumelelo) is widely distributed in South Africa and is found in bushveld, grasslands, and along forest margins and the banks of rivers and streams in the Free State, KwaZulu-Natal, Eastern Cape, Northern Cape and Western Cape. The species is an integral part of the fynbos and the Drakensberg wetlands flora.

⁶ Refugia are patches of non-GM crop that are cultivated along with the GM version of the crop and are beneficial in reducing the risk of the emergence of resistance in the target pest to the gene inserted into the crop for insect resistance.

Genetically modified sugarcane: Preparative research to meet regulatory dossier requirements

OUTCOMES

The main outcomes from the study were as follows:

- Gene flow from transgenic sugarcane to compatible wild relatives was found to be improbable due to: (a) asynchronicity amongst the flowering times of the wild relatives and sugarcane; and (b) absence of seed set in sugarcane after being subjected to conditions designed to induce synchronous flowering and promote pollination amongst the wild relatives and sugarcane.
- Various mathematical simulation models have been developed that will enable the planning of refugia requirements to reduce the risk of eldana developing resistance to the GM cane varieties. One of the modelling approaches enables the examination of the effect on refugia requirements of the simultaneous deployment of GM varieties and the sterile insect technique.
- The planned eldana risk index to predict outbreaks of the insect was not completed due to loss of key expertise from the project team. However, in parallel research, software specifications for a monitoring system for eldana resistant GM cane were developed.
- Progress with the GM sugarcane variety communication strategy has included: (a) an assessment of industry stakeholder perceptions of the technology through questionnaires and interviews; and (b) the development of resources, including videos and posters, that will be used during future engagement with industry stakeholders and the public on GM sugarcane matters in advance of the commercial cultivation of GM sugarcane.
- Presently, communication with industry stakeholders and the public is managed by the SASA External Affairs Division.

FURTHER RESEARCH

- Additional characterisation of the GM sugarcane varieties will be required to determine: (a) possible collateral effect on non-target arthropods; (b) the agronomics of the herbicide tolerance trait; (c) comparison of the composition of the GM varieties with their non-GM counterparts; (d) tracking the possible flow of transgenic DNA and proteins during industrial processing.
- Additional environmental biosafety aspects that remain include: (a) the development of a laboratory insect bioassay for monitoring the incidence of eldana resistance to the GM varieties once sugarcane is cultivated commercially; (b) the development and testing of eldana moth traps to monitor insect levels in GM sugarcane once deployed in the industry; and (c) possible positive synergistic effects during the parallel deployment of the GM technology and the sterile insect technique.



UPDATES FROM *Ongoing Projects*

CROP PERFORMANCE AND MANAGEMENT RESEARCH

Participatory Research Methodologies

- A participatory demonstration plot methodology is being devised and implemented to enhance grower adoption of Better Management Practices (BMPs) for soil health and crop nutrition.
- A draft participatory demonstration trial framework has been developed, with a focus on decision support platforms for the primary decision steps for soil health and crop nutrition management.
- A conceptual framework to implement BMPs for use in the demo plots has been proposed based on three core steps: (a) establishing base knowledge regarding the site and operational aspects where key issues are identified; (b) identifying the BMPs within the site and operational constraints and needs and implement these; and (c) monitoring the impact of the applied BMPs and establishing feedback loops to remedy or adapt unsuccessful strategies from the previous iteration.



PROJECT MANAGER
Dr Louis Titshall

SYSTEMS DESIGN AND OPTIMISATION RESEARCH

Design and Implementation of Knowledge Exchange Campaigns

- A tool designed to enhance the planning and execution of knowledge exchange campaigns with growers has been developed and is now under testing in a case study.
- After consultation with Extension Specialists and Biosecurity Officers, chemical roguing for smut was selected as the subject of the case study.
- The tool will be used to design and implement a knowledge exchange campaign to enhance adoption of this best management practice, which will be of benefit to growers in the irrigated northern regions.



PROJECT MANAGER
Dr Ashiel Jumman

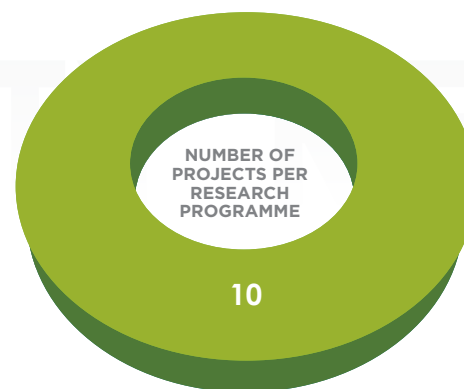
STRATEGIC OBJECTIVE

- To engage in **policy advocacy** and actively maintain stakeholder relationships with relevant **government** departments to retain and maximise the value of legislated self-governance.
- To develop and implement **digital, real-time**, and **geo-referenced** systems for **P&D data** collection, monitoring, interpretation and sharing.
- To develop and provide agro-technical support for the implementation of new **cost-effective seedcane production technologies** that will contribute to biosecurity risk mitigation.
- To promote **incursion risk awareness** and **mitigation planning** formally within the industry and informally within sub-Saharan Africa.
- To inform incursion risk mitigation planning by undertaking risk and **epidemiological** modelling of specific existing and potential new pests and diseases, which account for climate change scenarios.
- To develop and provide implementation support for **area-wide** integrated approaches for **P&D management** which offer sufficient flexibility to protect resource-poor growers.
- To undertake **education, training** and **marketing** activities to raise awareness and promote **good biosecurity practice** amongst all growers.

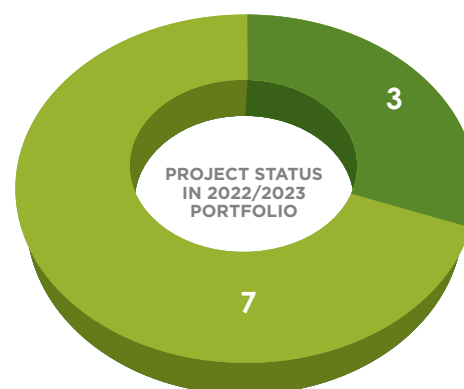


Within the 2022/2023 project portfolio addressing **Biosecurity** objectives, there were **three new projects** and **seven ongoing projects**

BIOSECURITY *Research*



Crop Protection



New Projects

Ongoing Projects

BIOSECURITY RESEARCH

NEW Projects

CROP PROTECTION RESEARCH

Eldana F1 SIT:
Field proof-of-concept study

Establishing proof-of-concept of the capacity of the novel F1 sterile insect technology (SIT) developed by SASRI to reduce eldana population size (measured by stalk damage) under field conditions. The study is a follow-on to the proof-of-concept study undertaken on potted cane plants grown outside in mesh enclosures.



PROJECT MANAGER
Dr Lawrence Malinga

The effect of steel slag amendments on yellow sugarcane aphid infestations and cane yields

Empowering growers to conduct their own on-farm strip trials to test whether silicon amendments can assist them in managing YSA and increasing yields under their conditions. SASRI will assist growers by providing advice on trial design, management and interpretation of results.



PROJECT MANAGER
Dr Iona Basdew

Biodiversity management and its place in sugarcane agriculture

Conducting an awareness campaign amongst growers on the concept of biodiversity management and regenerative agriculture from the perspective of pest control. The project aims to support growers in their testing of the practices on their farms.



PROJECT MANAGER
Dr Iona Basdew

OUTCOMES FROM Completed Projects

CROP PROTECTION RESEARCH

Economics of establishing Certified nurseries with different plant sources

PROJECT GOALS

- To conduct a full economic evaluation of the use of conventional hot water treated (HWT) seedcane, NovaCane® plantlets and HWT transplants to establish a nursery seedbed under different scenarios.
- To develop a Microsoft® Excel calculator to allow annual updates of the economics of producing seedcane under different scenarios.



PROJECT MANAGER
Sharon McFarlane

Economics of establishing certified nurseries with different plant sources

OUTCOMES

The main outcomes from the study were as follows:

- Regionalised calculators for estimating the cost of Certified Seedcane production were developed.
- Annual updates of the input sheets will ensure the information generated remains current.
- Based on the outputs of the calculator, the following conclusions were made.
 - The option of cycling Certified Seedcane through an existing HWT facility was found to be the most cost-effective system for producing Certified Seedcane. This was substantially cheaper than establishing Certified Nurseries with NovaCane® plantlets, regardless of whether there was an option to cycle the resulting Certified Seedcane through a HWT facility or not. While HWT transplants were a cheaper alternative to NovaCane® plantlets, establishment costs were higher using this plant source than conventional seedcane.
 - The installation of a new HWT facility was more cost-effective than establishing a Certified Nursery with NovaCane® plantlets or transplants on an annual basis if CAPEX costs were covered by a 10-year loan.
- NovaCane® remains an important disease-free, true-to-type option for establishing Certified Nurseries and for the release of new SASRI varieties. It is also the only known method available for eliminating viral pathogens from sugarcane planting material. Methods to make this source of planting material more economically viable in a Certified Seedcane production system should continue to be explored.

FURTHER RESEARCH

Interest has been expressed, particularly in Mpumalanga, in the production sugarcane transplants. Further research would require the determination of the costs associated with this operation for inclusion in the Excel calculator.

Variety Evaluation: Nematicide, insecticidal and plant physiological effects of BANDITO®

PROJECT GOALS

Bandito®, a granular soil applied nematicide and insecticide, was recently registered for use on plant and ratoon sugarcane in South Africa for nematode, YSA and thrips control and this research sought to examine the beneficial effects of the product on sugarcane yield, resulting from improved pest control and growth stimulation.



PROJECT MANAGER
Slindile Ngayi

Variety Evaluation:
Nematicide, insecticidal
and plant physiological
effects of BANDITO®

OUTCOMES

The main outcomes from the study were as follows:

- Most varieties examined displayed improved cane yield, for both tc/ha and tRV/ha, when treated with Bandito® compared with controls (untreated) of the same varieties.
- A link between plant stress (measured by actual yield being less than 80% of modelled yield) and response was apparent.
- In some varieties, the improved cane yield was statistically significant, although in some instances the improvement in cane yield was not statistically significant when compared with controls.
- When Bandito® was applied to young cane before stalk growth, varieties responded well, which may be caused by the effects of the product in controlling nematodes and improving the root system when the roots are actively growing.
- For improved control of pests such as nematodes, YSA and thrips and for higher cane yield, Bandito® applied to young cane or in late spring is beneficial.
- The research indicates that, if planted on soils with 10% or less clay, cane should be treated with Bandito® for better nematode, YSA and thrips control and for increased cane yield during stress events.

FURTHER RESEARCH

No further research is required.

Sterile insect
technique for eldana
management: Resource
development and pilot
release programme

PROJECT GOALS

The goal of this proof-of-concept study, conducted on cane grown in pots housed within insect-proof meshed enclosures, was to explore the feasibility of using a remote irradiation facility to induce the eldana male sterility required for the novel sterile insect technique (SIT) developed by SASRI.

The specific objectives were to:

- develop effective packaging and transport of pupae and eggs for long-distance transportation;
- evaluate the impact of irradiation on the development of the eldana F1 generation; and
- evaluate the effectiveness of the release of F1 sterile pupae and moths in reducing eldana population size.



PROJECT MANAGER
Dr Lawrence Malinga

Sterile insect technique for eldana management: Resource development and pilot release programme

OUTCOMES

The main outcomes from the study were as follows:

- Long-distance transportation has no negative impact on moth emergence and F1 generation egg development.
- F1 moth emergence was significantly male-biased compared with the mother colony, with the ratio increasing the mating opportunities for F1 sterile males and mother colony females, resulting in no offspring.
- F1 female pupal weight was lower than the mother colony female pupal weight. Although the factors affecting pupal weight were not studied in detail, reduced female weight should result in reduced egg laying.
- Irradiation did not have a negative impact on the fitness of the introduced eldana population.
- Disappointingly, weekly releases of F1 pupae did not result in consistent and statistically significant reductions in eldana population size and stalk damage in the test cages compared with the control cages, although some promising indications were observed in the potential efficacy of the F1 SIT approach.
- The study demonstrated that an in-house irradiator is not an essential requirement for the development of an effective SIT programme, provided the fitness of the F1 males is not compromised in any way.

FURTHER RESEARCH

A further proof-of-concept study (Project 21CP04: *Eldana F1 SIT: Field proof-of-concept study*) commenced on 1 April 2022 to build upon the findings of this initial study).

Further research is required to:

- optimise oviposition through oviposition substrate selection and egg mass characteristics of eldana female moths under laboratory conditions;
- test the F2 fertility and larval survival;
- investigate the effect of temperature on male to female emergence ratio;
- develop a mechanical moth collector for mass production of eldana for SIT field release;
- assess the impact of handling and transportation on the fitness of eldana moths for SIT field release;
- develop effective trapping methods to monitor the F1 moth population in the field, using pheromones;
- assess the effect of different irradiation doses on egg fertility; and
- develop a detailed cost-benefit analysis to assess the financial viability of the project.

Revision of
SASRI publications
containing best
management practices:
Diseases and weeds

PROJECT GOALS

The goal of this project was to update and, where necessary, produce new SASRI publications to provide technical recommendations to growers relating to diseases and weeds.



PROJECT MANAGER
Sharon McFarlane

OUTCOMES

Following extensive consultation and editorial review processes, the project developed a series of updated and new technical information sheets on diseases and weeds.



PROJECT MANAGER
Anushka Gokul

Information sheets developed and updated on diseases and weeds

DISEASES		WEEDS
UPDATED INFORMATION SHEETS <ul style="list-style-type: none"> - Ratoon Stunt (RSD) (9.1)* - Smut (9.2) - Mosaic (9.3) - Sugarcane rust (9.4) - Sour rot (9.5) - Pineapple sett rot (9.7) - Pokka boeng (9.8) - Inspecting for diseases and off-types (9.11)# - Roguing (9.12) 	NEW INFORMATION SHEETS <ul style="list-style-type: none"> - Fungi commonly associated with borer damage (9.6)# - Maize Streak (9.9) # - Yellow leaf syndrome (9.10)# 	NEW AND UPDATED INFORMATION SHEETS <ul style="list-style-type: none"> - Watergrass control (10.1) - Herbicide Toxicity (10.3) - Spraying herbicides with low volume, controlled droplet application (CDA) systems (10.4) - Water quality for herbicides (10.5) - Understanding the label on herbicide containers and combined with toxicity (10.6)

* SASRI Information Sheet reference number

Final drafts under review

Revision of
SASRI publications
containing best
management practices:
Diseases and weeds

In addition, various knowledge resources for weeds were updated.

UPDATED KNOWLEDGE RESOURCES: WEEDS

Books

Weeds of the SA sugar industry
Integrated Weed Management for creeping grasses

Posters

Biosecurity poster: *Parthenium weed*

Applications

Herbicide Selection Guide

Senior Certificate Course Notes: Weeds

Future work is to include the development of information sheets and knowledge resources for diseases and weeds as follows.

- Seedcane Manual (currently under review).
- Diseases Manual (to be updated once the Seedcane Manual review is completed).
- Video clips on diseases (importance, diagnosis, management) for posting on the SASRI website.
- Expansion of the current Herbicide Selector application to form an Agrochemical Selector that includes insecticides and fungicides.

UPDATES FROM *Ongoing Projects*

CROP PROTECTION RESEARCH

Orange Rust

- From March to April 2022, orange rust symptoms were observed on 35 of the 56 gazetted varieties (63%) contained within the plant breeding propagation plots on the SASRI Mount Edgecombe campus.
- In the 35 symptomatic varieties, severity of the disease ranged from mild (16% of the varieties) to severe (2% of the varieties), with most having either moderate (20%) or moderately severe symptoms (25%).
- The disease has now been observed in most areas of the industry apart from Mpumalanga and the Midlands.



PROJECT MANAGER
Sharon McFarlane

Longhorn Beetle Technology Update

- A new method of rearing longhorn beetles has been developed in the SASRI Insect Rearing Unit that may ultimately provide sufficient specimens for any additional research that may be required



Insect Rearing Unit
Supervisor
Denise Gillespie

In-field RSD Test

- A lateral flow device (LFD) is under development to provide a simple test to diagnose ratoon stunt (RSD).
- The Technology Innovation Agency, SASRI's collaborator in this project, has: (a) developed two monoclonal antibodies for detecting the bacterium causing RSD, which are being tested: and (b) procured tenders for LFD development.
- An invitation for tenders for LFD development was published on 7 March 2022 with the closing date for applications on 18 March 2022.
- Three applications are currently under assessment.



PROJECT MANAGER
Sharon McFarlane



Sterile Insect Technique Field Study

- In the recently initiated SIT proof of concept field study, field releases of F1 male and female moths began on 13 May 2022 at a site in the Midlands North.
- F1 moths that were released had the desired male bias on each occasion, with a male-to-female sex ratio of 3.66 in the acceptable range of 3.11 to 5.18.
- Two eldana surveys were conducted in March (before moth release) and June (after moth release) when the sugarcane was 8 and 11 months old, respectively.
- Eldana larvae and pupae were surveyed per 100 stalks and no larvae or pupae were recorded during these surveys.
- Eldana numbers and damage are only expected to increase as the cane ages beyond 18 months.
- Monthly surveys will continue until the moth releases are completed.



PROJECT MANAGER
Dr Lawrence Malinga

Yellow Sugarcane Aphid Management

- A new colour-coded format for the presentation of variety yellow sugarcane aphid and thrips resistance ratings has been developed to assist growers.
- In a research trial of six varieties sited in Pongola, Bandito® had a positive effect on RV yield of a third ratoon crop harvested at 15 months. For N57, which is known to be YSA susceptible, an increase of 6 tRV/ha was realised with an approximate value of R32,000 /ha.



PROJECT MANAGER
Dr Malcolm Keeping



PROJECT MANAGER
Slindile Ngayi

Weed Management

- Captora® is a promising imidazolinone product for post-emergent use with N12 Zapyr, and with genetically modified (GM) imidazolinone tolerant sugarcane in the future.
- As this product is already registered for use in imidazolinone tolerant sunflowers, a simple label extension is all that would be required for its use in tolerant sugarcane. Syngenta are to be approached to determine interest.



PROJECT MANAGER
Anushka Gokul

Hot Water Treatment

- The standard hot water treatment (HWT) (50°C for 2h) was shown not to have an adverse effect on bud break (germination) of N69, N70, N71, N72, N73, N74 and N75.
- An interesting trend was noted in which N69, N70, N71, N72, N73, N74 and N75 displayed increased vigour, in terms of shoot and root growth, when compared with the control varieties, NCo376 and N12.



PROJECT MANAGER
Sharon McFarlane

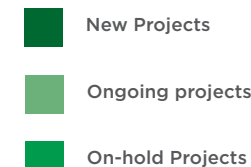
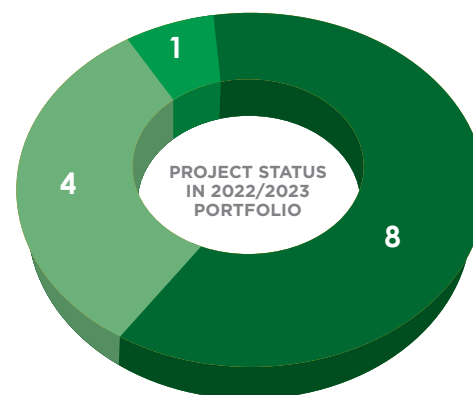
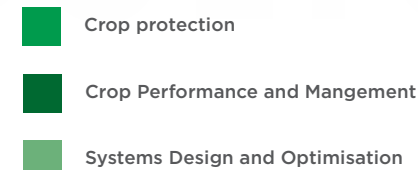
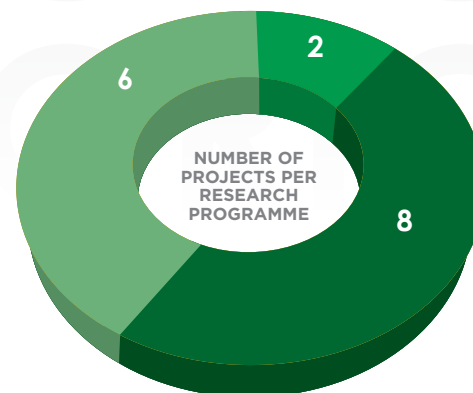
STRATEGIC OBJECTIVES

- To apply **aerial sensing technology** and **machine learning** to enable cost-effective and fit-for-purpose applications that enhance monitoring, **decision-making, mapping and scheduling**.
- To demonstrate emerging **4-IR technologies** and **geo-spatial informatics** that add value to existing data used by SASRI in **economic modelling, real-time monitoring** and **technology value assessments** and that drive improved productivity.
- To develop innovative **low- and high-tech on-farm solutions** to enable real-time diagnostics and the **precise implementation** and monitoring of a range of **operations** that demonstrate economic benefit.
- To seek and develop implementation opportunities for **smart decision-support systems** that enable growers to **customise better management practices** according to their requirements, while still farming sustainably.



Within the 2022/2023 project portfolio addressing **Smart Agriculture** objectives, there were eight new projects, four ongoing projects and one project that was on-hold due to capacity constraints.

SMART *Agriculture*



NEW Projects

CROP PROTECTION RESEARCH

Spectroscopic determination of YSA-induced stress in sugarcane

GOAL

Testing the utility of field spectroscopy data and machine learning to construct models for detecting and monitoring yellow sugarcane aphid (YSA). The project is a stage-gate for developing operational models that can be adopted by Extension (Biosecurity) and growers for managing YSA in sugarcane fields.



PROJECT MANAGER
Dr Nitesh Poona

CROP PERFORMANCE AND MANAGEMENT RESEARCH

Modelling leaf nutrient concentrations in sugarcane using *in situ* hyperspectral data

GOAL

Developing a methodology for using *in situ* hyperspectral data and machine learning techniques to estimate nutrient concentrations in sugarcane leaves. The results of the study will form the foundation for follow-on research that will seek to develop and test optimised narrowband spectral indices to improve nutrient prediction and explore the potential upscaling of the developed models to UAV and/or space-borne platforms.



PROJECT MANAGER
Dr Louis Titshall

Phased investigation of the usefulness of SAR images for sugarcane crop assessments

GOAL

Evaluating the utility of synthetic-aperture radar (SAR) data for modelling sugarcane biomass. The results will provide insights into the future utility of SAR for precision agriculture applications.



PROJECT MANAGER
Dr Nitesh Poona

Using remote sensing to locate the distribution of salts and waterlogging in soils

GOAL

Demonstrating proof-of-concept of the potential use of remotely sensed data to map the spatial distribution of soils affected by salts and water-tables/waterlogging in a case study.



PROJECT MANAGER
Dr Rian Van Antwerpen

A plant and soil spectral library for the SA sugar industry

GOAL

Developing a spectral library comprising fully annotated sugarcane and soil spectral signatures and, eventually, for other complementary crops (e.g. macadamias) and key weed species (e.g. *Cynodon dactylon*). The library will provide a resource for the future development of smart agriculture applications.



PROJECT MANAGER
Dr Nitesh Poona

SYSTEMS DESIGN AND OPTIMISATION RESEARCH

A geospatial workflow for extracting crop panel/field boundaries for the area under cane

GOAL

Developing a methodology and workflow for delineating crop panel/field boundaries using Sentinel-2 and Planet1 satellite data for delineating crop panel/field boundaries.



PROJECT MANAGER
Dr Nitesh Poona

Land-cover mapping and monitoring for the sugar industry

GOAL

Developing a workflow for mapping land cover monitoring land cover change using satellite imagery.

Development of an application to record and detail extension contacts with growers and other noteworthy observations

GOAL

Creating a shareable and geo-referenced smartphone application for record-keeping by Extension and Biosecurity specialists.



PROJECT MANAGER
Ingrid Thompson

OUTCOMES FROM *Completed Projects*

CROP PERFORMANCE AND MANAGEMENT RESEARCH

Development of aerial imagery methodology to inform crop stress and high throughput phenotyping

PROJECT GOALS

The goal of the research was to evaluate the feasibility of using aerial phenotyping as a tool to expedite sugarcane breeding.

The project investigated the use of high-resolution aerial imagery obtained via drones to determine crop status, specifically green canopy cover and physiological status, from the visible, infra-red and thermal bands of the electromagnetic spectrum. It was envisaged that crop performance could be inferred from these spectral data and used to support breeding by identifying desirable screening traits and superior genotypes, to ultimately increase breeding efficiency and genetic gains.



PROJECT MANAGER
Natalie Hoffman

OUTCOMES

- The research demonstrated that breeding efficiency for irrigated cultivars can be enhanced by utilising aerially captured crop reflectance data.
- Strong evidence was obtained to suggest that the aerial phenotyping technology may be better suited for implementation in the advanced (multi-plot) stages of the selection programme, and further research is planned to investigate this potential.
- A novel relationship was found for phenotyping of drought tolerant genotypes using canopy temperature differences between water treatments. However, further investigation is required to confirm the relationship.

Development of aerial imagery methodology to inform crop stress and high throughput phenotyping

OUTCOMES

- Aerial phenotyping offers further advantages, as the technology: (a) could be implemented with relative ease; (b) is relatively low cost; and (c) is acceptably reliable when compared with conventional phenotyping methods.
- A protocol was developed for capturing and processing aerial imagery for calculating the relevant vegetation indices.
- The research contributed a firm foundation for follow-on work in digital (smart) agriculture at SASRI.
- SASRI has acquired the appropriate hardware and software, as well as the skills (e.g. registered drone pilots, trained technicians, and established GIS processing protocols) for implementing the technology after a thorough review and evaluation of the different options available.

FURTHER RESEARCH

- The study demonstrated the potential for identifying desirable screening traits and superior genotypes using aerial phenotyping technology, particularly for large-scale multi-plot experiments with a diverse genetic population. The potential for this to be implemented in breeding will be tested in the follow-on research, which aims to test the utility of leaf and canopy spectral measurements for predicting quality and yield traits in early-stage (single lines) and advanced (multi-plot) breeding trials.
- The hardware and software technologies used in the investigations were critically evaluated for accuracy and whether they are fit-for-purpose, which led to the acquisition of more sophisticated aerial phenotyping equipment (DJI M300 drone and Micasense Altum-PT multi-spectral camera), which will be utilised in further SASRI digital agriculture research and technology development.
- It is envisaged that in future, digital agriculture technology at SASRI will be expanded to include aerial phenotyping technology such as hyperspectral sensing, coupled with more automated, cloud-based image processing procedures, and advanced computational algorithms such as artificial intelligence, including machine learning and deep learning for data processing and analysis.

Development of near and mid infrared spectral libraries for rapid, routine diagnostics and analysis of soil fertility and salinity and plant nutritional status

PROJECT GOALS

The goal of this study was to evaluate the potential for the replacement of conventional laboratory methods used by the SASRI Fertiliser Advisory Service (FAS) with more cost-effective near infrared spectroscopy (NIRS) for leaf nutrient analysis and mid infrared spectroscopy (MIRS) for soil property analysis.



OUTCOMES

The main outcomes from the study were as follows:

- For leaf nutrient content analyses, NIRS predicted total leaf N well, but not other nutrients and, as a result, is an unsuitable replacement to current conventional analyses for all nutrients.
- For soil analysis, MIRS enabled refinement of existing C and clay prediction models, which enabled a reduction of error in the classification of the soil N-mineralisation classes that are used for determining soil N recommendations.
- The MIRS technology was found to predict pH, calcium (Ca), magnesium (Mg), and total cations moderately well and could potentially, with further refinement, be used to develop a cost-effective soil acidity and lime/gypsum recommendation package in FAS. However, MIRS cannot predict other soil properties well and hence, cannot be recommended for application to routine soil nutrient diagnostics.

FURTHER RESEARCH

Further research is required to:

- investigate possible improvements in leaf nutrient content predictions that could be achieved by using more granular data, for example variety and agroclimatic zone;
- explore the potential of using the better performing models for soil properties developed in this study for variability mapping of fields for precision agriculture applications; and
- use the model developed for total soil nitrogen (N), which is moderately accurate, to complement existing N-mineralisation estimates and refine N recommendations.

Using remote sensing to locate the distribution of salts and waterlogging in soils

PROJECT GOALS

The goal of this proof-of-concept study was to assess whether remote sensing technologies can: (a) simultaneously detect the signatures of soil water status in the root zone and crop stress; and (b) determine whether these signals can be used as a proxy for the identification of soils affected by salts, shallow water tables and waterlogging.



OUTCOMES

No significant relationships were detected amongst the daily crop stress events estimated by remote sensing and any of the estimated or measured soil and crop parameters.

The outcome is largely predicated on the following:

- At the two study sites in Richards Bay and Mkuze, no statistically significant correlations were detected between measured soil water content and those estimated by remote sensing.
- At Mkuze, the range of measured soil water contents was wider than that estimated by remote sensing and, as a result, the estimated trends in crop stress could not be explained.
- Remote sensing data estimated the seasonal dry biomass trend very well at the Richards Bay ($r^2 = 0.85$) and Mkuze ($r^2 = 0.50$) sites, although measured monthly dry biomass did not correlate with the remotely sensed crop stress estimates.
- Correlations amongst dry biomass, electrical conductivity and exchangeable sodium percentage ranged from $r^2 = 0.6$ to 0.2 and are considered insufficiently reliable for the desired applications.
- Stomatal conductance measurements were found to be highly variable, and the field data were unable to confirm that the estimated plant stress index, derived from remotely sensed data, was sufficiently accurate.

FURTHER RESEARCH

No further research is planned at this stage. Any future investigations should:

- be conducted during dry seasons when salt accumulation is more likely to induce significant crop stress and yield loss; and
- be conducted over three or more seasons.

UPDATES FROM *Ongoing Projects*

CROP PERFORMANCE AND MANAGEMENT RESEARCH

Smartphone App for Ripening Decisions

PROJECT GOALS

- Informed chemical ripening decision-making is a key component of precision cane quality management. Chemical ripening benefit is strongly influenced by crop maturity state at spraying, which is determined by the complex interplay of genetic, environmental and crop management factors.
- For this reason, SASRI developed a cane quality management smartphone application called PurEst®, which in combination with the use of a hand-held refractometer, can assist growers in the identification of fields suitable for chemical ripening as well as gauging the relative harvest readiness (out of a maturity perspective) of fields.
- An update of the PurEst® application (Version 3.0.2) was released in March 2022.
- New features include: (a) the ability to share records in CSV or PDF formats by email and messaging (e.g. WhatsApp); (b) check boxes for selecting records for sharing or deleting; (c) a function to easily access variety-specific ripening recommendations; and (d) a tabular display of average Brix% values of tested stalks within the record details.



SYSTEMS DESIGN AND OPTIMISATION RESEARCH

Geo-spatial Platforms Supporting Research and Services

PROJECT GOALS

- WebGIS applications have been developed for the six SASRI research stations.
- A user manual for the app has been developed and the Pongola Research Manager, Mount Edgecombe Research Station Manager and the Research Stations Manager have received training.
- The app has already been used successfully by the Research Stations Manager for problem-solving on the Empangeni Research Station.



Digital Data Capture for Biosecurity and Breeding Functions

PROJECT GOALS

- A digital platform, based on the Survey123 technology, is under development to: (a) enable the in-field capture of data in a digital format (smart forms); (b) seamlessly integrate these data into coherent databases; and (c) facilitate the geo-spatial display and interpretation of data as required.
- During the reporting period, significant progress was made with the roll-out of the technology to the SASRI plant breeding and biosecurity inspectorate functions.



EXTERNAL RESEARCH *Service Providers*

On behalf of the industry, SASRI enters contracts with specific research service providers for investigations for which the institute does not have the requisite skills or infrastructure.

In 2022/2023 research agreements were in place with Stellenbosch University, the Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD) and Chacra Experimental Agrícola Santa Rosa (CHACRA).

Biotechnological investigations to improve sugarcane drought tolerance

- SASA/SASRI has contracted the Institute of Plant Biotechnology at Stellenbosch University to conduct proof-of-concept research into enhancing sugarcane drought-stress tolerance using mutation breeding and genetic modification approaches. Year 2022/2023 was the second in a three-year funding cycle from April 2021 to March 2024 which was approved by SASA Council.
- Some of the proof-of-concept studies have yielded promising preliminary results under glasshouse and poly-tunnel conditions, which will be continued in the further three-year funding cycle.



Upgrading the sugarcane genome hub with the new sugarcane genome assemblies and with news tools

- This research is being conducted by Dr Angélique D'Hont and her team at the Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD) in Montpellier, France. The project is co-funded by several member countries and organisations of the International Consortium for Sugarcane Biotechnology (ICSB), which includes SASA/SASRI.
- The investigation will develop an integrated web-based database, 'the sugarcane genome hub', with centralised online access to all currently available sugarcane genome assemblies and with bioinformatic tools to facilitate the exploitation of these genomic resources by ICSB members.



Validation of a candidate gene for the *Bru1* brown resistance gene via CRISPR mediated gene knockout

- This research is being conducted by Dr Germán Serino and his team at the Chacra Experimental Agrícola Santa Rosa (CHACRA) in Salta, Argentina. The project is co-funded by several member countries and organisations of the International Consortium for Sugarcane Biotechnology, which includes SASA/SASRI.
- As indicated by the title, this project aims to: (a) validate a candidate gene for *Bru1* encoding brown rust resistance in sugarcane; and (b) provide further technical impetus to the use of gene editing technology in the complex polyploid genomic environment of sugarcane.



RESEARCH Grants

In 2022/2023, SASRI secured and gratefully acknowledges grants from funding agencies to support research, technology development and knowledge exchange.

International Atomic Energy Agency

- A research grant was received from the International Atomic Energy Agency (Vienna, Austria) within the FAO/IAEA Coordinated Research Project (CRP), “Improve the Mass-rearing of Lepidoptera Pests for SIT Programmes”.
- The grant supports an investigation entitled “Advancing the Application of the Sterile Insect Technique (SIT) by Examining the Impact of Some Processes on the Management of Sugarcane Borer *Eldana saccharina* in South Africa”.



PROJECT MANAGER
Dr Lawrence Malinga



Food and Agriculture
Organization of the
United Nations



IAEA
International Atomic Energy Agency

Wits Health Consortium (Pty) Ltd

Sandia National Laboratories

- A research grant was awarded by Sandia National Laboratories⁷ to a national project entitled “Assessment of X-ray irradiation as an alternative to gamma irradiation for the South African SIT programs”.
- The grant is administered by the Wits Health Consortium.
- SASRI, through the National Institute for Communicable Diseases, has been sub-contracted to evaluate the effects of gamma and X-ray irradiation on the physiological and reproductive fitness of *Eldana saccharina* and demonstrate the benefits of X-ray radiation on the management of the eldana population.



PROJECT MANAGER
Dr Lawrence Malinga



Sandia
National
Laboratories



WITS HEALTH
CONSORTIUM



NATIONAL INSTITUTE FOR
COMMUNICABLE DISEASES
Division of the National Health Laboratory Service

⁷ Sandia National Laboratories is operated and managed by National Technology and Engineering Solutions of Sandia, LLC., a wholly owned subsidiary of Honeywell International, Inc. National Technology and Engineering Solutions of Sandia operates Sandia National Laboratories as a contractor for the US Department of Energy's National Nuclear Security Administration (NNSA) and supports numerous federal, state, and local government agencies, companies, and organizations (<https://www.sandia.gov/>).

Water Research Commission

- SASRI collaborated in a research project funded by the Water Research Commission.
- The University of KwaZulu-Natal is the lead organisation on the project entitled “Development of datasets for multi-scale water resource assessments”.
- The overall WRC project aims to develop a pre-packaged database of Quinary Catchment level catchment attributes for application in water resource related assessments through hydrological and agricultural modelling (Water Resource Assessment (WRA) Quinary Catchment Database) and to develop or implement an online data portal system to store and provide access to the datasets (WRA Data Portal).



PROJECT MANAGER
Phillemon Sithole



Biosafety South Africa

A research grant was received from Biosafety South Africa (Technology Innovation Agency, Department of Science and Innovation) for developing new knowledge for use in the preparation of the regulatory dossier that will be required for the future potential release of an insect-resistant and herbicide-tolerant genetically modified sugarcane variety (Bt GM sugarcane).



PROJECT MANAGER
Dr Sandy Snyman



INTERNATIONAL CONFERENCES *and Meetings*

In 2022/2023, SASRI researchers participated in international meetings and conferences, including: (a) a FAO/IAEA Coordinated Research Project (CRP) meeting on the project “Improve the Mass-rearing of Lepidoptera Pests for SIT Programmes”; (b) the Thirty-first Congress of the International Society for Sugar Cane Technologists (ISSCT); and (c) a Business Meeting of the International Consortium for Sugarcane Biotechnology (ICSB).

SASRI researchers wish to acknowledge the travel funding provided by the sugar industry. Drs Sandy Snyman and Shallesh Joshi are grateful of funding provided by Biosafety South Africa, while Dr Sumita Ramgareeb and Marius Adendorff acknowledge travel grants from the South African Sugar Technologists' Association.



FAO/IAEA FIRST RESEARCH COORDINATION MEETING

FAO/IAEA Coordinated Research Project (CRP),
“Improve the Mass-rearing of Lepidoptera Pests
for SIT Programmes”

VIENNA, AUSTRIA
5 – 9 SEPTEMBER 2022



Dr Lawrence Malinga



XXXI ISSCT CONGRESS

HYDERABAD, INDIA
20 - 23 FEBRUARY 2023



Dr Rian Van Antwerpen



Dr Shallesh Joshi



Dr Lawrence Malinga



Dr Abraham Singels



Dr Sumita Ramgareeb



Dr Stuart Rutherford



Dr Derek Watt



Dr Marvellous Zhou



Marius Adendorff



Dr Sandy Snyman



Dr Derek Watt



Dr Sandy Snyman



ICSB BUSINESS MEETING

PUNE, INDIA
25 - 26 FEBRUARY 2023

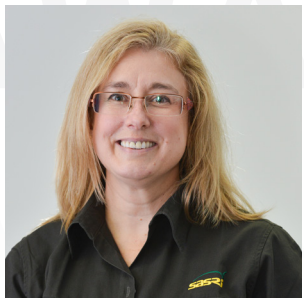


Dr Sandy Snyman



Dr Shallesh Joshi

AWARDS AND Achievements



MOLECULAR BIOLOGIST
Gwethlyn Meyer

BEST POSTER AWARD

Gwethlyn Meyer, was awarded the **Best Poster Award** at the South African Sugar Technologists' Association (SASTA) 94th Congress in August 2022. She co-authored the poster, "*Behind the Scenes: Generation and Analysis of Genetically Modified Insect Resistant Sugarcane*", with Hlobisile Khanyi, Ewald Albertse, Robyn Jacob and Sandy Snyman.



PROJECT MANAGER
Peter Tweddle

BEST POSTER AWARD

Peter Tweddle received a "**Highly Commended**" **Poster Award** for his poster, "*Quantifying the Impact of Lodging on Grower Revenue*", at the South African Sugar Technologists' Association (SASTA) 94th Congress in August 2022.



PROJECT MANAGER
Dr Ashiel Jumman

BEST PAPER AWARD

Ashiel Jumman received the Kynoch Award for Best Paper in the Agricultural Section of the South African Sugar Technologists' Association (SASTA) 94th Congress in August 2022. He co-authored the paper, "How to Get a Farmer to Test an Innovation, as a Precursor to Wider Scale Adoption?" with Carel Bezuidenhout.



PROJECT MANAGER
Sharon McFarlane

BEST PAPER AWARD

Sharon McFarlane with co-authors Carla Kistan, Aimee Koch, N Msimango, Karlien Trumpelmann and Theuns Theunissen received the **Kynoch Award for Best Paper in the Agricultural Section of the South African Sugar Technologists' Association (SASTA) 94th Congress in August 2022**, for their paper on, "*Roguing for Smut*".

AWARDS & ACHIEVEMENTS

AWARDS AND *Achievements*



EXTENSION SPECIALIST
Marius Adendorff

BEST PAPER AWARD

Marius Adendorff (co-authors Dr Ashiel Jumman and Aresti Paraskevopoulos) received the **Best Agriculture Paper**, for their paper on *“Adoption of irrigation scheduling in the South African sugarcane industry: the use of a demonstration trial to bring about change”*, at the International Society of Sugar Cane Technologists (ISSCT) Congress, held in Hyderabad, India in 2022.



RESEARCH MANAGER
Dr Derek Watt

BEST PAPER AWARD

Dr Derek Watt (co-authors Dr Rianto Van Antwerpen, William Gillespie and Dr Riekert Van Heerden) was awarded the **Best Management Paper** for his paper on *“Promoting adoption of soil-health-related regenerative agriculture practices amongst small-scale sugarcane grower communities in South Africa”* at the International Society of Sugar Cane Technologists (ISSCT) Congress, held in Hyderabad, India in 2022.



PROGRAMME MANAGER
Dr Stuart Rutherford

BEST POSTER AWARD

Dr Stuart Rutherford (co-authors Dr Sandy Snyman and Motselisi Koetle) claimed the **Best Biology Poster** for their poster on *“Chemically-induced epimutagenesis for sugarcane improvement”*, at the International Society of Sugar Cane Technologists (ISSCT) Congress, held in Hyderabad, India in 2022.

TECHNOLOGY Transfer



TECHNOLOGY TRANSFER

Michelle Binedell

Knowledge Manager

The 2022/23 season saw business returning to normal, albeit with a renewed interest to remain communicative and passionate for sharing SASRI's technology, products, services and advice.

POPULAR PUBLICATIONS

In the 2022/23 year, SASRI continued to disseminate information through its suite of publications. *The Link* and *Ingede* magazines are aimed at our English/Afrikaans and isiZulu speaking growers. These editions focussed on many of the technical issues pertinent to specific growing regions of the industry.

THE LINK

Three editions of *The Link* were published in 2022/23 providing technical content on the performance, as well as the role of interbreeding, in the improvement of new varieties. Once again, the management of yellow sugarcane aphid (YSA) remained a hot topic, along with cane quality management and the management of weeds. Of particular interest, was an alert to growers of the discovery of orange rust on cane.

The September 2022 “Spring” edition contained articles detailing the considerations that need to be made to improve fertiliser use, foliar feeding, and the effects of salts on soils and yield. Several SASRI services were also promoted in this edition – namely the Fertiliser Analytical Laboratory (FAS), publications on the website and the delivery of farming advice through grower days and study group events.

The January 2023 edition provided extensive advice on activities associated with the off-crop, as well as a warning on the blanket application of fertilisers. Once again, Topical tips, a Director's message and weather updates kept readers informed of strategic initiatives, research updates and impending weather conditions.



THE INGEDE

The popular isiZulu publication, *Ingede* is distributed by hand to small-scale growers by Extension Specialists, Agricultural Advisors and other industry stakeholders. In addition to the printed copy, narrated *Ingede* articles (voice notes) were recorded and sent out to growers via WhatsApp.

The May 2022 edition focussed on important aspects of sugarcane agriculture for the small-scale grower (SSG). These included Topical Tips (a regular feature of each *Ingede*), appropriate for each month in the farming calendar, as well as an update on orange rust, cane quality management and the parthenium weed. Of great interest was a story of a grower in Sezela who successfully ripened his field using drone application.

Following the devastating floods in KwaZulu-Natal in April 2022, the September 2022 edition provided much needed advice on rehabilitation and soil conservation. Appropriate to the planting season, the FAS's sample collection sites were published. Two articles pertinent to the youth, provided information of SASA's Youth Programme, as well as application details for the Sugar Industry Trust Fund for Education (SITFE) scheme.

The January 2023 edition warned growers to be on the lookout for yellow sugarcane aphid (YSA), published the results of a variety trial in Amatikulu and encouraged nutrient management planning. A human-interest story of a young women's journey in sugarcane farming and a celebration of awards received by the SASRI Extension team at the South African Society for Agricultural Extension (SASAE) Conference, were the content of the last two articles in this edition.



OTHER NEWSLETTERS AND ARTICLES

Direct communication to growers in the numerous regions took place through the development of 19 *Extension newsletters*. These communicated upcoming events, alerts and latest trial results.

Nine articles were produced for *Coastals News*, once again showcasing SASRI's achievements and promoting best practice.

BOOKLETS AND GUIDES

Annual updates of the Mechanisation Reports were completed and posted to the SASRI website.

INFORMATION SHEETS

Information Sheets provide a platform for the communication of research outcomes, as well as guidelines and advice on the management of the sugarcane crop.

Several information sheets were updated with latest recommendations arising from research projects, as well as expert knowledge. These included varieties N76, N77 and N78, as well as four new irrigation information sheets, two related to eldana control and two on rust and watergrass control.

RADIO

During 2022/23, radio broadcasts continued to reach many of the rural communities in South Africa. Shows focused mainly on agronomic issues, with one of the most interesting being an alert on how to manage carry-over sugarcane and awareness on the discovery of orange rust on the South African sugarcane industry as of February 2022.

Radio broadcasts (supported through a Radio Forum) are incredibly important tools that enable communication between Specialists/Advisors and farmers, with an ability to reach remote areas of the Industry.

GROWER INTERACTION

The start of the new season in March 2022 saw an increase in face-to-face interactions with industry stakeholders. SASRI hosted a total of 547 visitors and conducted 2 456 industry field visits and online communications. A total of 175 grower days and exhibitions were hosted with staff attending 354 conferences and workshops whilst contributing to 386 industry meetings.

POSTGRADUATE SYMPOSIA

A full day of presentations by postgraduates working in research projects within the SASRI programme of work was held on 6 December 2022. This symposium comprised four sessions chaired by SASRI Programme Managers involved in student supervision. The talks were presented by eight postgraduates within the fields of agronomy, plant breeding, biotechnology and entomology. It proved to be a valuable platform for exposing innovative outcomes that have been generated by young, developing scientists.

A similar symposium was hosted for SASRI's intern cohort involved in projects that add value to the industry. Eleven interns delivered papers and reflected on the experience gained during their time at the Institute.

The quality of all presentations was consistently high, reflecting SASRI's ongoing commitment to maintaining the highest levels of scientific excellence.

CERTIFICATE COURSES

In 2022/23 Certificate Courses were once again conducted after the devastating impact of the COVID pandemic. Two classroom-based Senior Courses and two Junior Courses were held with a total of 207 students receiving relevant training in sugarcane production practices.

A hugely popular modular course programme continued in the Eston and Umfolozi regions. These modular courses are offered on demand in various regions, with course content customised according to local needs.

SOCIAL MEDIA

SASRI's LinkedIn and Facebook pages continued to gain followers and interest during the reporting year. These platforms were used more frequently to disseminate content related to latest research findings, published outcomes, grower days and achievements.

SASRI WEBSITE

The SASRI website has continued to grow in content as new publications are produced. The site provides both growers and millers with a myriad of knowledge resources and links to products and services useful for cane production. Projects current to the year are listed per research programme providing a glimpse of the key areas of research that contribute to the achievement of SASRI's mandate.



EXTENSION



Rowan Stranack
Extension and Biorisk Manager

Types of Extension Services Offered

LARGE-SCALE GROWERS

SASRI provides a levy-funded extension service in eleven of the twelve mill areas. This service involves on-farm visits and other personal contact by the local SASRI Extension Specialist providing one-on-one advice on specific aspects of sugarcane agronomy, as well as group-learning activities in the form of grower days, study groups and written media such as newsletters.

Visits and group events often involve SASRI Specialists enabling growers to better understand and implement new technologies. Valuable technical support is given to the many local grower structures operating in the industry, for example, Local Pest Disease and Variety Control Committees (LPD&VCCs), and local grower structures such as Mill Group Boards.

SMALL-SCALE GROWERS

Extension is delivered to small-scale growers through a joint venture with the KZN Department of Agriculture and Rural Development (DARD). Under this Extension Venture Agreement (EVA), five SASRI Extension Specialists support 30 DARD Agricultural Advisors ensuring they are trained and equipped with all new SASRI research outcomes thereby enabling them to assist small-scale growers to farm more effectively and profitably.

A joint Monitoring Committee comprising DARD and SASRI oversees the work programme of the EVA through quarterly meetings. DARD local managers are contacted regularly to ensure operational issues are addressed.

RESEARCH, DEVELOPMENT AND EXTENSION (RD&E) COMMITTEES

A key function performed by Extension Specialists is to identify and gather specific research needs in their respective areas. This is enabled through locally elected Research Development and Extension (RD&E) Committees in each Extension area. This link with the SASRI research programme provides a platform for growers to have their specific research issues addressed. In many instances, growers assist in this process by providing land to conduct trials.

Growers also provide important local context to the research, as well as advice on the practical implementation thereof. In addition, SASRI Extension Specialists are members of the project teams conducting research in their Extension areas and offer guidance in making these trials as relevant as possible.

Once new research outcomes are generated, RD&E Committees assist in facilitating the transfer of these technologies to growers, thereby completing the exchange of technology between grower and research.

THE 2022/2023 SEASON

The industry produced 17.9 million tons of cane and 1.93 million tons of sugar respectively during the 2022/2023 milling season, which was slightly higher than the previous season. The estimated industry average cane yield was 75.7 t/ha, also an increase from 73.1 t/ha, in 2021/2022. These yield increases were due to better rainfall, improved irrigation water supplies, and a mild winter. Average cane yields in the northern irrigated regions, Midlands, and South Coast areas improved compared to the previous season. However, the North Coast and Zululand regions recorded lower yields.

The approximate area harvested in 2022/2023 was 236 700 ha, which was similar to the 235 300 ha harvested in 2021/2022. However, as in previous seasons, deliveries and production were negatively affected by milling constraints at several mills in KZN, particularly in the Midlands region where up to 40% of the crop was carried over. Across the industry, there was an increase in the forced carry-over area, resulting in pest and quality problems which manifested in the early part of the 2023/2024 season.

In April 2022, heavy rainfall in parts of KZN resulted in severe flooding, with extensive damage to infrastructure. This led to massive disruptions to harvesting and milling operations, as growers could not access their fields. Mills in the affected areas were forced to stop operating for several days, with the Gledhow mill remaining shut for a month. The disruption to harvesting and milling operations caused by flooding, together with cane quality deterioration in excessively aged carry-over cane, resulted in a drop in the overall average estimated recoverable sugar. More heavy rains in May 2022 further damaged areas in the coastal belt, causing additional disruptions to harvest and deliveries.

In February 2023, very heavy rainfall in the Lowveld caused extensive damage to fields and infrastructure, and irrigation equipment. Parts of the lower Umfolozi Flats had been underwater since the heavy rains of early 2021 and access to cane in these farms and fields remained impossible well into the 2023/2024 season. Another major challenge to the irrigated regions was the onset of regular loadshedding at the end of 2022. This interference disrupted irrigation cycles and stressed the crop during the peak summer growth period.

In October 2022, Tongaat Hulett went into voluntary business rescue causing uncertainty among the affected grower communities and the industry at large. The Gledhow mill also followed suit, adding to the general uncertainty in the region.

The area under cane (AUC), declined to approximately 346 000 hectares in 2022/2023 from an average of 360 000 ha over the previous six seasons. This reduction has not resulted in a similar reduction in sugarcane production, the reason for this being the favourable climatic conditions and newer higher yielding SASRI varieties.

Despite the rainfed areas of the industry receiving below average rainfall from winter to early spring 2022, the crop status remained largely good due to well replenished soil water following good earlier rains. Unlike the previous years, there were no severe frost events in the Midlands to disrupt harvesting schedules. Extension was active in assisting growers with final decisions around carrying over cane into the 2023/2024 season.

The Umfolozi, Pongola, Komati and Malelane mill areas crushed their entire crops and there was no carry-over to the 2023/2024 season.

EXTENSION ACTIVITIES

There was a return to normal extension activities in 2022, following the restrictions of the pandemic. While some local grower committees continued to hold remote or hybrid meetings, in most areas, in-person meetings and other gatherings were once again the norm. The backbone of extension activities such as individual farm visits continued to assist growers in a wide range of agronomic aspects of sugarcane production. Approximately 2 500 such visits and contacts were made. In addition, communication via cellphone, email and WhatsApp has resulted in good contact being maintained with all sections of the grower community.

Grower days are an excellent tool to communicate SASRI's better management practices with growers. There were 175 such events during the year. Often centered on SASRI trials, these gatherings encourage a less formal environment for growers to interact with Extension and Specialist Researchers. Study groups with smaller numbers of growers, are a means for deeper engagement. Extension also regularly provides technical support to local grower committees and associations and a total of 386 such meetings were attended, and input and feedback provided to grower leadership as needed.

Extension also communicates with growers through newsletters and publications such as *The Link* and *Ingede*. The SASRI Knowledge Management Unit and extension also co-operate to ensure messages on new technology are delivered effectively. Extension Specialists also make significant contributions to the SASRI Senior and Junior Certificate courses.

In recent years, grower modular courses have proved popular. These courses are held over a ten-month period with one subject per month. It has also enabled growers who would otherwise be unable to attend the SASRI Senior Certificate Course full-time to get the benefit of a condensed version of the course. In 2022, courses were held in Eston and Umfolozi.

THE EXTENSION VENTURE AGREEMENT

SASRI and the Department of Agriculture and Rural Development (DARD) have an Extension Venture Agreement (EVA) that has been in place since 1996. Over the years, this agreement has proved an excellent example of a private-public sector partnership, delivering value to both partners. The EVA model is widely held, both nationally and internationally, as a practical and workable framework for delivering Extension to many recipient farmers. Currently, there are approximately 21 000 small-scale growers in the South African sugar industry making the delivery of individual Extension impractical. However, through group interactions, and with additional Extension staff accessed through the DARD, effective Extension is achieved.

Under EVA, SASRI employs five sugarcane Extension Specialists, jointly funded by SASRI and DARD, to provide support to DARD Extension staff working with small-scale and land reform sugarcane growers in KwaZulu-Natal. This support provides for assistance in planning of work programmes for sugarcane-related extension, regular updates on new technology and better management practices for sugarcane. Specialist advice is also given to DARD Extension staff and where necessary, SASRI subject specialists are engaged to help diagnose and remedy farm or area specific problems.

The EVA also delivers Extension to land reform grower beneficiaries. In this respect, regional levy-paid Extension also provides support under the broader SASRI umbrella. On the North Coast, a regional levy-funded Extension Specialist works specifically with land reform farmers and, in that region, extension is managed and deployed regionally as a unified team. In so doing, the EVA has access to a wide range of advice and support.

To deliver an effective and relevant Extension service, the EVA team relies heavily on demonstration plots and the farming calendar to guide the timing of field events. Learning events with growers are timed strategically to coincide with activities in the cropping cycle in

springtime (for example, crop estimating at the beginning of the season, and planting and weed control). Demonstration plots which function both as living field schools and sources of approved seedcane have been established across KwaZulu-Natal.

The EVA team also held a series of roadshows with contractors in all areas of the industry. These roadshows emphasised the impact contractors can have on cane quality of the cane they harvest and deliver; the success of operations such as ripener application depend largely on the efficiency of contractors.

The remarkable success stories of both the 2020/2021 and 2021/2022 seasons, particularly in terms of interactions with small-scale growers, revolved around the drone ripening project conducted on farms across the industry. The introduction of the concept took place through dedicated grower days, followed by subsequent sessions when the ripener was applied. Results from these fields were then processed and feedback provided. Significant quality benefits were demonstrated, and this method of application has the potential to contribute greatly to the economic sustainability of small-scale growers, if commercialised. An extension to this project will be a series of interactions with stakeholders to try to establish the practice amongst target communities.

Other on-going projects amongst small-scale growers were: a project aimed at extracting specific research needs from small-scale growers to inform the SASRI research programme; and another to improve knowledge of soils, their potential and management requirements.

An Extension Specialist was appointed to service small-scale growers in the Mpumalanga region in 2021. There has already been a significant impact on extension delivery in this region, following largely the same model and work programme employed in KwaZulu-Natal with the EVA team.

VARIETIES AND SEEDCANE

The promotion of new SASRI varieties remained a high priority with Extension. Being one of the most common questions from growers, choosing the correct varieties is becoming increasingly complex with a wider range of varieties available. The irrigated regions released N73 into further bulking; and the Midlands regions received the variety N78 into bulking for release in 2023.

In the coastal regions two short-cycle varieties, N76 and N77 were released to growers.

In addition, the variety N12 Zapyr, a product of mutagenic breeding with resistance to the herbicide active ingredient imazypr, was released to those areas where N12 was currently grown.

The variety disposition across the industry remains dominated by only a few varieties. According to delivery records over 50% of deliveries were comprised of just four varieties: N41, N36, N12 and N39. Whilst these are excellent all-round performers, there are ample choice of varieties available to growers to exploit specific conditions on the wide range of soils and growing conditions across the industry.

Growers are beginning to see the benefits of this choice and the newer varieties are contributing to maintaining industry production in the rainfed areas despite a significant reduction in area under cane. It should be noted that the large percentage of deliveries marked unknown or mixed is making it difficult to assess fully the level of adoption of the recently released varieties, but varieties such as N52, N53, N54, N55, N57 N58 and N59 are becoming more widely grown.

SASRI variety trials are used extensively by Extension and Researchers to promote the effective use of varieties. In addition to field days, the results of these trials are often publicised in extension newsletters and in other forums.

Ensuring adequate supplies of Certified and Approved seedcane continued to be a major challenge in many regions. Several regions made good efforts to comply with the 2023 deadline for all commercial fields to be planted using

either Certified or Approved seedcane. However, not all control areas were compliant by the appointed date and SASA Council agreed to extend the deadline by five years to 2028, conditional on LPD&VCCs providing regular reports of progress towards compliance.

An exciting recent development has been the establishment of commercial scale variety observation plots on a farm in the Pongola area. At these plots, variety performance is being assessed by planting large observation plots to enable accurate measurement of yield and quality from the plots. These trial in the irrigated Pongola region includes some rainfed varieties for comparison with varieties for irrigation.

SOIL HEALTH AND CROP NUTRITION

One of the main aims of Extension is to promote the use of the Fertiliser Advisory Service (FAS) thereby ensuring cost-effective and economically optimum fertiliser applications which are not damaging to the crop or the environment. A dramatic increase in fertiliser prices necessitated efforts to assist growers in deciding on the most cost-efficient ways to allocate their fertiliser budgets. Grower days around this subject were also held in all the major regions.

Special efforts were made in areas such as Pongola and the Mpumalanga Lowveld to promote the use of FAS, where the service has not been utilised to any great extent. Attention to soil health issues is also promoted at every opportunity. SASRI has several applications available for growers to use through extension to determine for optimum applications of fertiliser, lime and gypsum. Advice is also frequently provided on the use of organic manures and green manures. A project to identify the primary soil management units (SMUs) in Mpumalanga was launched in 2022. Motivated and managed by Extension, the outcomes of the project should enable growers to identify SMUs on their farms and link these to SASRI better management practices around a range of farming operations and other aspects such as crop nutrition and soil health.

PEST AND DISEASE CONTROL

In their support to LPD&VCCs, Extension Specialists assist committees in guiding general pest and disease strategies in their areas. SASRI Extension Specialists also carry out line management responsibilities in the management of Biosecurity staff.

Yellow sugarcane aphid (*Sipha flava*) has developed as a major biosecurity threat to the industry. The Lowveld regions, including Pongola continued to contain outbreaks although from early 2022 populations across the industry tended to decrease and remain low for most of the period from then into 2023. Growers have become more efficient in responding to outbreaks through regular scouting and preventative spraying.

Smut continued to be a major threat particularly in the Pongola area. The moratorium on the planting of the variety N41 imposed in 2020 had a positive effect on reducing the area under this variety although numerous roguing and eradication orders still had to be issued, mainly in fields of N41. The Pongola area now has a new seedcane scheme which generates an adequate supply of heat-treated Certified seedcane to growers in the region.

Further south in the industry, smut levels in two popular new varieties, N54 and N59 remain a concern. In the Felixton area, the variety NCo376 was removed from the list of varieties approved for the region due to its susceptibility to smut. A SASRI project was launched to promote the adoption of chemical roguing of smut as a cost-effective alternative to manual roguing.

Another project was completed to provide LPD&VCCs and seedcane co-operators with a calculator to determine the quantities and costs of producing Certified seedcane from the three recognised sources: hot-water treated whole stick seedcane; single-budded sett transplants; and NovaCane®. This will greatly assist in the different regions efforts to be compliant with the 2023 seedcane deadline. Extension participated actively in this project which was managed by a SASRI Specialist.

In an ongoing effort to contain an outbreak of the longhorn beetle (*Cacosceles newmannii*), SASRI Extension continued to be closely

involved in monitoring the Entumeni area where the outbreak first occurred. Fortunately, during the report period ending March 2023 there were no larvae or adult beetles found in the containment area.

SUSFARMS® AND CONSERVATION

Growers in the Noodsberg, UCL and Eston mill supply areas continued their participation in the SUSFARMS® 2018 Collaboration. Growers delivering to the Illovo Sugar Sezela mill on the South Coast have also, for the past three seasons been submitting SUSFARMS® Progress Trackers. Extension has provided active support to the development and implementation of SUSFARMS® and the associated Progress Tracker as an environmental sustainability management tool. Growers on the South Coast submitted SUSFARMS® Progress Trackers during 2021 as part of their recent commitment to participation in this environmental management system.

Extension continued to provide support to growers in soil conservation and land use planning. Although not offering a planning service, SASRI Extension assisted growers in implementing new field layouts and conservation structures. Whilst this work is often done in the context of a full Land Use Plan (LUP), significant ad hoc advice on field layout is given at individual field level. Extension also delivers the farm planning module on the Senior Certificate Course, training students in the essentials of field layout and design of conservation structures. This area of expertise rests almost entirely within Extension at SASRI.

Renewed focus on the management of wetlands and watercourses was initiated during the year, as part of the Memorandum of Agreement between SASA and the Department of Water and Sanitation (DWS). A Joint Implementation Committee (JIC) between DWS and SASA was formed and SASRI Specialists and Extension are represented along with representatives of the growing and milling sections. As part of this engagement with DWS, a field visit was arranged to familiarise DWS representatives with the current state of wetland and watercourse management in the sugar industry.



Rowan Stranack
Extension and Biorisk Manager

The SASRI Biosecurity inspectorate comprises 24 field inspection teams with attendant officers and technicians. The inspectorate operates in all regions of the industry but is managed centrally together with SASRI Extension providing management and technical support. The industry biosecurity function is driven by twelve Local Pest Disease and Variety Control Committees (LPD&VCCs) situated across the industry having representation from both the milling and the two grower associations, with SASRI staff providing technical and administrative support to the committees.

COMMITTEE OPERATION AND ACTIVITIES

Representation on LPD&VCCs includes members from the South African Farmers Development Association (SAFDA), SA Canegrowers Association (SACGA) and the South African Sugar Millers Association (SASMA).

SASRI Extension and Biosecurity staff are ex-officio members of LPD&VCCs and provide an administrative and technical advisory service to LPD&VCCs, as well as managing the field survey programme. Wherever possible, representation from the various geographic areas or wards within the control area is also sought. Other stakeholders are co-opted as committee members, seedcane cooperators and managers.

Where necessary, LPD&VCCs liaise with other grower structures and industry bodies such as Mill Group Boards to fulfil their responsibilities. LPD&VCCs report to the Sugarcane Research and Sustainable Agriculture Committee (SRASA) who, in turn, report to the Council of the South African Sugar Association.

The SRASA Committee has a Pest and Disease Working Group who meet to discuss and approve various issues such as changes to LPD&VCC rules and standards and any other pressing matters relating to pest, disease, and variety control. This Working Group then provides recommendations to the SRASA Committee who then act upon the advice given to provide recommendations to SASA Council.

PEST OCCURRENCES IN 2022/23

Yellow sugarcane aphid (*Sipha flava*)

Yellow sugarcane aphid (YSA) *Sipha flava* was first recorded in the South African sugar industry in 2013, when it was found infesting cane growing on the Umfolozi Flats. The pest was very soon found in all areas in the industry where it caused damage to cane to varying degrees in the years following.

Severe outbreaks of YSA occurred in the summer of 2020, mainly in the Komati area and these persisted throughout until late 2021 and early 2022 when they lessened somewhat. Noticeable effects on yields were reported and the pest continued to attack the crop as it matured. The varieties N57 and N23 were particularly badly affected. In consultation with SASRI Specialists, a strategic approach to control was initiated. Active scouting and spraying of insecticide were implemented. This met with some success although it was found that the conventional treatments had a relatively short-lived effect.

A severe outbreak occurred in the North Coast in early 2022. Outbreaks also occurred in the Umfolozi region. However, following the heavy rains and onset of autumn, populations subsided slightly.

Biosecurity teams record observations of YSA during their routine surveys for eldana and diseases in commercial cane. SASRI variety trials are being regularly inspected to determine the relative susceptibility of varieties to this pest. Data from these inspections was collated and analysed and is slowly building a picture of varietal reaction to the pest.

For the remainder of 2022 and the first half of 2023, YSA remained elusive with only a few isolated serious outbreaks occurring.

Longhorn Beetle

(Cacosceles newmannii)

No emergence of adult beetles in the containment area was reported during the summer and autumn months of 2020/2021, 2021/2022 and 2022/2023.

The Biosecurity Inspectorate continues to monitor fields regularly in the containment area for signs of the pest having spread.

Eldana

The SASRI Biosecurity Inspectorate undertakes eldana surveys with three primary objectives in mind: monitoring the overall threat posed by the pest to the LPD&VCC control area; assisting growers with decisions relating to fields to carry-over; and linked to that, determining the need for and success of spraying operations. During the 2022 and 2023 survey season a total of 96 269 hectares was surveyed for eldana of which 4 149 hectares (4.3%) were above the local hazard level requiring remedial action, either harvesting or the spraying of insecticide. The total area surveyed was significantly more than the minimum required, emphasising the importance of this threat. The area surveyed which was above the hazard level also increased significantly compared with the previous season, indicative of the current presence of a large area of older cane.

Apart from the off-crop, it is important to prioritise fields for harvest at the start of the season; eldana surveys in the rest of the season are now focused on cane for harvest in the following year as this cane has potentially the highest risk of losses caused by eldana damage.

Effectively managing eldana is complex, involving several factors, some of which, such as the weather, are beyond the control of growers. SASRI Extension Specialists and Biosecurity Officers play an important role in assisting with advice to LPD&VCCs and individual growers, balancing the influence of the weather, soils, the local environment, varietal susceptibility and the biology and ecology of the pest on management decisions.

As planting infested seedcane has been shown not only to affect germination but also to help spread the pest, it has been necessary to introduce hazard levels for seedcane at a threshold which does not affect the overall availability of seedcane.

The area of hazard cane expressed as a percentage of the area surveyed showed a significant increase this year with areas such as Felixton, Midlands North and Sezela all recording significant increases in the area above the local hazard compared with the previous season. This was mainly due to the presence of old cane with milling issues forcing increased areas of carry-over cane.

Where fields are found to have eldana above the hazard level, remedial action in the form of either harvesting or the application of insecticide is required.

With the additional unplanned carry-over cane from 2022, it could be anticipated that eldana levels might have increased significantly which they did, despite the good rainfall generally across the industry. A dry start to 2023 increased eldana levels and despite good rainfall after that, the crop suffered a build-up of the pest which has persisted well into 2023.

Unfortunately, some of the old cane was unmillable and some Midlands growers took the decision to destroy the cane by mulching it to maintain their farms in cycle and to ensure that the best possible cane was sent to the mill, even if it was younger.

Growers increasingly adopted spray programmes, which in areas such as the South Coast, are regionally co-ordinated and so take place under some level of monitoring and supervision.



DISEASE OCCURRENCES IN 2022/23

Smut and Mosaic

These diseases continue to remain generally at low levels across the industry. The total area of commercial fields surveyed was 69% of that required to obtain a fully representative sample. Although, in the regions where diseases, specifically smut, are a major threat, these committees exceeded their targets. A total of 40 278 hectares of commercial fields was surveyed for diseases across the industry. Of these, 806 hectares (2%) were above the local hazard level. Most of these problem fields were infected with smut and were either in the Pongola region and in KZN north of the Tugela River. Roguing, and where necessary, eradication orders were issued.

Mosaic was mainly confined to the southern and high-altitude regions of the industry and, on average, only at trace levels on a relatively small area of cane. High levels of off-types remained a problem in some commercial fields indicating ineffective crop eradication and volunteer control.

Ratoon Stunt (RSD)

All LPD&VCC areas are required to submit a quota of samples to be tested for RSD, based proportionately on the area under cane in each control area. Of the 5 333 commercial fields tested for RSD during the 2022/2023 season, 5.4 % were found to be infected. This was slightly above the 5-year average. Of all the regions, Pongola, Mkuze Makhathini and Umfolozi regions recorded the highest levels of infection in commercial fields tested. Of the 1 037 RSD samples extracted from seedcane fields, only 2 of these fields were found to be positive. Compulsory testing of all seedcane fields has largely prevented any infected seedcane from being planted out and this requirement should contribute to an overall reduction in RSD as seedcane sources are improved over time.

Other Pests and Diseases

Orange rust (*Puccinea kuehni*) was positively identified on sugarcane in the South African sugar industry for the first time in January 2022. Orange rust spores had been detected on a spore trap in the Mpumalanga Lowveld periodically from as early as 2016, but this was the first time the disease was positively identified on sugarcane in the field. First identified on three varieties (N41, N75 and N76) on a farm near Shakaskraal on the North Coast,

the disease has subsequently been identified at Mount Edgecombe, on the Umfolozi Flats and Sezela. More varieties were found to be infected, including N23, N36, N49, N60 and N77.

In accordance with the emergency response plan, the SASRI Biosecurity Inspectorate undertook a survey across the industry to determine the prevalence and severity of the incursion. The disease was not identified in either the Midlands or Lowveld regions during 2022, but early in 2023 the disease was identified in both regions.

To date, outbreaks experienced have been less severe than initially anticipated and growers are fortunate in having a wide range of varieties available should one or more varieties prove to be unacceptably susceptible to orange rust.

Registered fungicides were applied successfully to outbreaks of the disease. Orange rust is gazetted as a hazardous disease and should control measures be required to limit the spread of the disease, then these can be implemented.

Both brown and tawny rusts were recorded during the report period with orange rust being a recent addition, as mentioned earlier. The Biosecurity Inspectorate now routinely records the presence and severity of the three rusts, as well as damage caused by thrips and YSA. Extension Specialists receive a rust alert from SASRI when conditions are favourable for the development of the disease.

Across the entire reporting period, sour rot was frequently reported by Biosecurity teams during routine eldana surveys in the Midlands regions. Typically associated with older cane which has undergone some stress, these conditions were common across the Midlands and in some parts of the coast where there were large areas of unplanned carry-over cane.

In the Midlands North a survey for white grub was completed. There was an outbreak of *Heteronychus arata* in N54 cane near Seven Oaks, adjacent to old maize lands.

Sugarcane thrips infestations were recorded across the industry in early 2023, anecdotally worse than in previous years and with the customary peak in January along the coast and slightly later in the midlands regions.

Monitoring Exotic Pests and Diseases

Monitoring for the stem borer (*Chilo sacchariphagus*) continues to be carried out under contract by Crop Watch Africa who maintain a series of pheromone traps along the KZN and Mpumalanga borders with Mozambique. To date, no positive specimens have been identified. Any suspicious interceptions are sent to SASRI for identification and if necessary, DNA from the sample is analysed.

Also, in the interests of regional biosecurity, SASRI, annually collects information on biosecurity threats found on sugarcane on estates in the SADC region. This information is shared amongst all interested parties with estates rating their threats and providing information on control measures being implemented.

SEEDCANE

Certified and Approved Seedcane

All LPD&VCCs have been challenged in terms of the requirements of the industry LPD&VCC Rules, to have in place adequate supplies of Certified and Approved seedcane before March 2023. Unfortunately, the March deadline was not met across the industry and SASA Council approved an extension of the deadline until 2028. Most LPD&VCCs are now actively investigating the establishment of seedcane schemes to benefit all growers. In a few areas, mainly those where long-standing seedcane schemes are in place, the objective has been achieved, but there remain other regions where schemes are either non-existent or only starting up. To promote the principle of using certified and approved seedcane, seedcane committees have been formed in all LPD&VCC control areas. The provision of sufficient good quality seedcane therefore remains one of the most important challenges facing grower communities.

During 2022/2023, a total of 570 hectares of Certified seedcane was approved for use, this being just short of the minimum 590 hectares the industry requires. Unfortunately, the distribution of this seedcane was not uniform across the industry, and as already stated, some areas have little or no Certified seedcane available for use. There were only 2 197 hectares of Approved seedcane available for use out of 6 620 hectares that is required,

being less than 33% of the total industry requirement. This indicates that there is a significant area of Certified seedcane not being used to plant approved nurseries and, instead, being sent to the mill. Of greater concern is that more than 60 percent of the material used to plant commercial fields in the industry does not meet the standards for Approved seedcane. This places the industry at considerable risk and, as this situation has prevailed for many years, the industry is vulnerable to any new incursions.

Status of Seedcane Schemes

There were several regional initiatives aimed at starting formal seedcane schemes. At Sezela, it was decided to implement a compulsory scheme, supporting both the transplant nursery and private co-operators, and at Pongola, Certified seedcane nurseries were established. In Mpumalanga, the Komati Cane Growers Association established a heat treatment plant on the SASRI Research Station.

Also, in Mpumalanga the RCL mother-blocks continue to generate Certified seedcane for growers. The Felixton, Amatikulu and Entumeni areas still operate their long-standing seedcane schemes providing Certified seedcane to plant approved nurseries. On the North Coast, producers of Certified seedcane and heat treatment facilities are limited but refurbishment of strategic tanks is being undertaken. In the Midlands North, Certified seedcane for the area is produced on a farm at Harden Heights but efforts are being made to develop satellite schemes as the area is extensive.

The Umfolozi area has had a heat-treatment facility for many years and Certified seedcane is produced, however, the area lacks any formal seedcane scheme. The areas of most concern are the Mkhuze/Makhathini, uMzimkhulu and Midlands South regions where there are no schemes and only limited heat-treatment facilities available to start up a scheme.

INSPECTORATE

Employees of the Inspectorate are employed by SASRI and work on behalf of the LPD&VCCs providing them with data which are used to make decisions regarding the control of various biosecurity threats.

Regular training of employees is undertaken. This is carried out both on-the-job and by SASRI Specialists. Special attention this year was necessary to train teams in the identification of the new orange rust threat.

Training in other areas such as supervision, health and safety and discipline management are also undertaken. A key area requiring on-going attention is driver training and evaluation. This is undertaken by an external party who specialises in driver training, both conventional and 4X4 off-road training. It was also possible to train certain so-called stand-by drivers who can assist when the regular driver is not available. In this way, the inspectorate is slowly increasing its pool of drivers.

Several Biosecurity staff attended courses at SASRI including the Senior and Junior Certificate Courses.

Biosecurity field teams regularly assist researchers in assessing trials. This year, the Midlands North Biosecurity teams P&D teams also assisted with releases of sterile moths at Bishopstowe near Pietermaritzburg twice a week as part of the Sterile Insect Technique (SIT) project.

A project to introduce electronic data capture in the field has progressed well enough to start a roll out to the wider group. An application, Survey 123, has been field tested to record all routine surveys and, in time, will enable near real time processing of survey data, aimed at reducing the feedback time to growers. In addition to this, a separate mobile application was developed to distribute to growers for them to record outbreaks of YSA and enable them to monitor outbreaks in the vicinity of their farms.

There were promotions and transfers amongst the teams: temporary staff to permanent positions; and inspector to supervisor. This is a healthy situation highlighting career paths available to entrants to the inspectorate.



ADVISORY AND Support Services

SPECIALIST ADVISORY SERVICES

SASRI researchers and specialists provide essential sugarcane agriculture services and support to the local sugarcane industry, as well as to several external customers (local and international). This expertise is offered as specialist advisory services to external clients in exchange for a consultancy fee when specialist capacity is available.

The income generated from the delivery of these services is used to offset operational expenses. These requests include specialist advice, technical support and training to Southern African Development Community (SADC) partners, SA agrochemical companies and other external clients. Specialist advice includes, but is not limited to, variety choice and evaluation, data analyses, crop nutrition, irrigation advice, pest and disease identification, control and management, crop forecasting, ripener advice and decision-making, soils management and crop performance and management.

The number of Specialist Advisory Requests (SARs) received during 2022/2023 was higher than the previous year, with 34 requests received. Following a successful online soil nutrition course provided to Compañia Agricola Industrial Santa Ana, S.A. in May 2021, SASRI conducted another online training course for twelve Unitrans Africa staff members. Approximately eleven SASRI staff members participated in the event during July 2022.

EXTENSION REQUESTS FOR ADVICE

SASRI received 10 requests for advice from Extension Specialists during 2022/2023. These services were provided to growers as part of the ongoing service provision, to the SA sugar industry. Most related to soil classification and soil sampling.

FERTILISER ADVISORY SERVICE

The Fertiliser Advisory Service (FAS) is a user-pays entity that uses state-of-the-art laboratory instrumentation and methods to provide growers with unbiased, customised advice based on their farm management practices and attainable yields. The FAS is SABS ISO 9001:2015 certified and provides accurate, sugarcane-specific fertiliser advice to ensure growers achieve sustainable and cost-effective returns from their input costs. FAS uses a Laboratory Information Management System to improve efficiencies in the delivery of accurate and reliable results and recommendations to customers.

Unfortunately, the decline in FAS samples continued into 2022/23 with 29 818 soil, leaf, fertiliser and water samples being received. This is lower than the 2021/2022 season which saw 30 979 being received. A breakdown in sample numbers for 2022/2023 is provided in Table A:

Table A: Sample numbers for 2022/2023

2022/2023					2021/2022
	SA Growers	SASRI Research	Outside SA	Total	Total
Soil	19 062	1 418	4 034	24 514	26 044
Leaf	1 782	345	1 341	3 468	3 812
Fertiliser	1 233	12	43	1 288	1 047
Water	52	0	189	241	76
All	22 129	1 775	5 607	29 511	30 979

The continuing decline in leaf sample numbers remains a cause for concern due to the importance of growers being able to identify and adjust their management practices where necessary to prevent harmful soil conditions (e.g. acidity, salinity and nutrient imbalances) from developing. Soil testing forms an essential part of sustainable farming practice.

Table B: Sample numbers for the past five seasons.

	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023
SA Growers	20 288	19 603	22 249	20 217	19 062
SASRI Research	741	2 175	929	1 215	1 418
Outside SA	3 948	5 490	3 818	4 612	4 034
Total	24 977	27 268	26 996	26 044	24 514

There was an overall decrease in the number of soil samples received from both South African growers and Estates during 2022/2023.

FAS attracted 576 new customers during 2022/2023. These new customers included small-scale farmers, existing clients with new farms and customers outside of the sugarcane industry.

During 2022/2023, FAS improved the validations of Plant and Fertiliser methods of analysis as per South African National Accreditation System (SANAS) requirements.

FAS continued to investigate the implementation of SANAS (ISO17025) for leaf and fertiliser analysis, as this accreditation is a requirement for many agricultural crops/products that are exported.

DISEASE DIAGNOSTICS

SASRI provides a disease diagnostics service for local and SADC growers to assist in mitigating risk and preventing yield loss associated with a range of diseases. The focus areas of the disease diagnostic services are Ratoon Stunt Disease (RSD) and Yellow Leaf Virus (YLS). During 2022/2023, a total of 9 829 RSD samples were analysed with 8428 of these samples coming from SA growers and 1401 from other countries. All RSD diagnostics for SA cane growers are conducted through the Biosecurity Inspectorate. RSD Training also occurred in Zambia and Eswatini.



Figure 1: Number of RSD samples analysed for South African growers and growers from outside of South Africa from 2014/2015 to 2022/2023.

QUARANTINE

SASRI has a Department of Agriculture, Land Reform and Rural Development (DALRRD) - approved, world-class quarantine facility located at Mount Edgecombe for all sugarcane varieties imported into and exported from South Africa. Sugarcane varieties from foreign countries are imported into South Africa to broaden the genetic base of the parental breeding material. Imported varieties are also evaluated as potential commercial varieties. Through Variety Evaluation and Licence Agreements, SASRI controls the distribution of N varieties into Africa to protect SASRI's Plant Breeders' Rights. SASRI is responsible for obtaining phytosanitary certificates from the Plant Health division of DALRRD for the export of any sugarcane from South Africa.

During 2022/2023, SASRI exported disease-free varieties to Brazil, Tanzania, Mozambique, Zambia, and the Democratic Republic of Congo. Du Roi Laboratory and Dube Agrilab supplied acclimated NovaCane® N varieties to countries where there are Variety Licence Agreements in place. Sugarcane fuzz was exported to Pakistan.

SASRI also imported foreign sugarcane as fuzz from Barbados for breeding.

MILLROOM

SASRI provides a cost-effective near infrared (NIR) based cane-testing service mainly to the plant breeding project, but also for all SASRI field trials.

SASRI operates two millrooms: one based at Mount Edgecombe for all Midlands, Coastal and Hinterland research trials and the other is located on the Pongola research station for all Pongola and Mpumalanga research trials.

SASRI processed 44 953 millroom samples in 2022/23.

NOVACANE®

SASRI uses a proprietary NovaCane® (tissue culture) technology to propagate superior sugarcane genotypes in the final stage of the Plant Breeding programme to ensure that sufficient planting material is available for bulking upon variety release. This provides cane growers with true-to-type, disease free planting material of all new varieties.

SASRI also provides commercial laboratories with source material of all commercial varieties, as well as audits on the laboratories and hardening off facilities operated by external third parties (e.g. Dube Agrilab, Du Roi and Plant Protection Hub) who use the SASRI NovaCane® sugarcane micropropagation method. The audits ensure that sugarcane plant product integrity and quality is being maintained throughout the production process.

NovaCane® technology is also used by Quarantine for all imported varieties.

During this reporting period, SASRI delivered 100 300 hardened off NovaCane® plants of varieties N69 and N78.

GENETIC ANALYSIS

SASRI provides a genetic analysis service to SASRI researchers for research projects, Quarantine, Biosecurity and to external clients as a specialist advisory request (SAR) service. This genetic analysis service includes DNA sequencing and DNA fragment analysis. During 2022/2023, 3 055 samples were analysed, including the fingerprinting of 116 genotypes.

It is standard procedure for all pre-release varieties being considered for bulking to be fingerprinted by DNA fragment analysis. All South African commercial varieties have been fingerprinted. DNA sequence analysis is used to identify pathogens infecting sugarcane, as well as insects collected from sugarcane fields. The genetic analysis service is regularly used by researchers, Quarantine and Biosecurity for the accurate identification of varieties, pests, and diseases.

MECHANISATION AND ADVISORY SERVICE AND MACHINERY DEVELOPMENT

When requested, SASRI provides advice and recommendations on mechanisation alternatives, as well as on costings and system optimisation. Annually, SASRI prepares two Mechanisation cost reports for the industry. The first report provides the costing of different equipment and machinery systems, and the second report provides the costings of a range of system scenarios including land preparation, planting and ratoon management. These reports are available on the SASRI website.

Many stakeholders make use of these mechanisation reports. Growers use these reports for annual budget preparation, while SA Canegrowers and in full (SAFDA) economists use the reports for updating the industry cane salvage rates and industry budgets. SASRI Specialists use these reports for the sugarcane certificate courses and for updating various Decision Support Tools.

When necessary, SASRI investigates the need for machinery development and, where appropriate, initiates and collaborates in the development of new machinery.

POLICY DEVELOPMENT AND IMPLEMENTATION

SASRI offers specialist advice on policy development and implementation. In addition, SASRI provides specialist technical advice on specific requests pertaining to irrigation, transport, mechanisation and energy-related issues and industry initiatives. Examples include:

- monitoring and providing comments on the development and implementation of the national government's water policy on behalf of the sugar industry;
- monitoring and providing comment on the development, amendment, and implementation of transport-related legislation such as: Haulage tractor; Consignee/consignor, etc; and
- energy tariff changes and impacts thereof.

WEATHER INFORMATION

SASRI collects, collates, and processes meteorological data continuously from a grid of automatic and manual weather stations distributed across the industry. This also involves the maintenance and calibration of the automatic weather station network and data processing system and the provision of summaries of meteorological data for comparative purposes. These data and related weather applications can be accessed via SASRI's WeatherWeb (www.sasri.org.za).

Users can view current weather information on the WeatherWeb from a range of weather stations and they can also download all information in the form of maps, graphs or reports. Rainfall and temperature figures are updated every five minutes, and the site also provides evapotranspiration values and a fire danger index. Real-time weather information is useful for decision-making regarding irrigation, chemical application and harvesting operations.

SASRI offers an Automatic Weather Station (AWS) installation and maintenance service both within and outside the borders of South Africa. SASRI provides support to Mondi for the installation and maintenance of 29 AWS weather stations. During 2022/2023 this AWS service was also provided to customers in Eswatini, Malawi, Mozambique, and Tanzania.

All installations are conducted according to established standards and include programming of data loggers to suit user needs and setting up automated data collection. All data from the AWS is processed to ensure integrity.

Maintenance routines include regular on-site calibration of sensors and equipment, any repairs or replacements required and general site maintenance. Calibration reports and certificates of compliance are issued with each visit.

CROP FORECASTING

SASRI provides the industry with operational forecasts of the sugarcane crop, monthly from October of the preceding year to August of the current year, on a mill and industry level. Specialists make use of weather and irrigation water supply data, climate forecasts and the Canesim® crop model for these forecasts. Detailed cane yield forecast information is made available to registered users, while industry estimates of cane production are shared widely within the industry.

Information from Canesim® crop forecasts is also used by the SASA RV Forecast Committee to guide Mill Group Boards providing monthly forecasts (from April onwards) of seasonal average RV content of cane for each mill area. These estimates are used to calculate growers' remuneration for cane deliveries.



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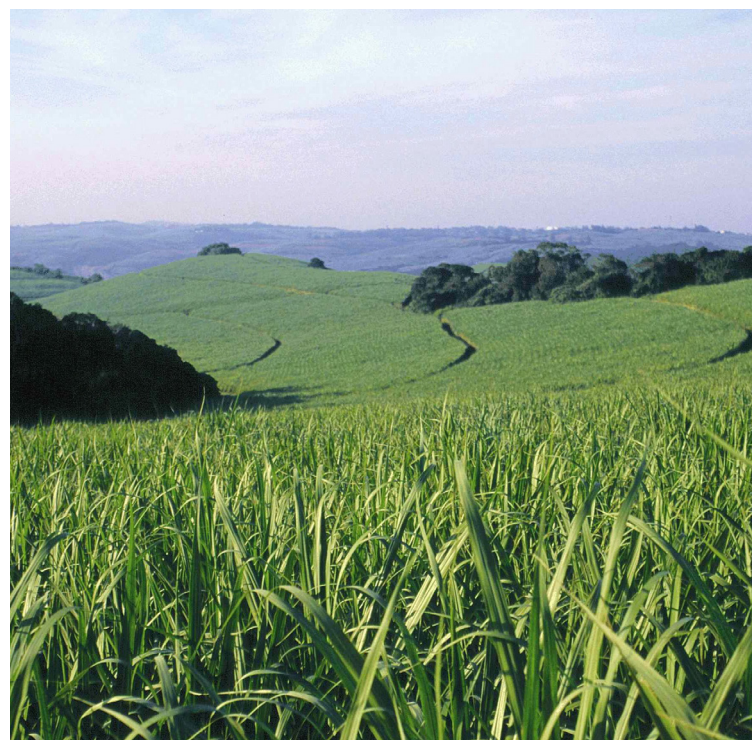
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1 April 2022 – March 2023

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PROGRESS REPORT



SASA 

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