

# WEDNESDAY 25 August 2010

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## **GUEST SPEAKER – DR PETER JOHNSTON**

As a climatologist at the University of Cape Town, Peter's research focuses on the applications and impacts of climate variability and climate change on various user sectors. He specialises in agriculture and water related activities with special emphasis on vulnerability and adaptation options. He has worked closely with the Western Cape Government in developing a climate change vulnerability study and this was followed by a strategy and action plan. He is also involved in the African centre for cities looking at adaptation frameworks for both Cape Town and Johannesburg. His interests and involvements have taken him to many African countries to learn from and contribute to other water and agricultural adaptive practices to climate change and variability. Current research includes the application of models to determine the sustainable long term water use in the larger Berg river catchment area of the SW Cape Province of South Africa. Peter gives numerous presentations on the science and applications of climate change for southern Africa at various public and sector meetings.



### **Recent projects and involvements**

- Researcher and contributing author for Status Quo, Vulnerability and Adaptation Assessment of the Physical and Socio-Economic Effects of Climate Change in the Western Cape, commissioned by the W Cape Provincial Government 2005.
- Researcher and contributing author for The Western Cape Climate Change Strategy and Action Plan, in progress. Commissioned by the W Cape Provincial Government 2006.
- Researcher for the Regional Climate Change Programme, A DFID funded project for the SADC region DACST Seasonal forecasting downscaling project co-ordinator. U Cape Town 2000-4.
- Co-coordinator: Discussion forum for CLimate Applications and Impacts(CLAIM)
- Member of Climate Change Forum (CCF) at UCT.
- Participant: Adaptation and Vulnerability Assessment Techniques., Trieste, Italy 2004
- Co-ordinator: International workshop on African Climate Change 2003, on behalf of the ETCCDMI.
- WRC funded project: Climate for Water, which has analysed the uptake of weather and climate forecast information among water resource managers – ends 2008.
- WRC funded project: Applications of rainfall forecasts for agriculturally related decision-making in selected catchments. 2007-2009.
- IDRC funded project: Managing climate risk for agriculture and water resources development in South Africa: Quantifying the costs, benefits and risks associated with planning and management alternatives. 2007-2010.
- Principal investigator for WRC funded project: Adaptive interventions in agriculture to reduce vulnerability of different farming systems to climate change in South Africa. 2009-2013.

### **Recent Publications**

- An analysis of forecast performance for the 2001/2 rainfall season - from a users' point of view – presented at SASAS 2002 – Pretoria.
- Usman MT, Archer ERM, Johnston PA and Tadross M, 2005. A Conceptual Framework for Enhancing the Utility of Rainfall Hazard Forecasts for Agriculture in Marginal Environments, Natural Hazards, Volume 34, Issue 1, Jan 2005, Pages 111 – 129.
- Book Review: O'Brien K & C Vogel, 2005. Coping with Climate Variability: The Use of Seasonal Climate forecasts in SA, Bull of Amer Meteorol 86:1 104-105.
- Tailored Seasonal Climate Forecasts: Opportunities and Challenges for South African Maize; Paper presented at AAG conference March 2004, Philadelphia.
- Johnston PA, Archer ERM, Vogel CH, Bezuidenhout CN, Tennant WJ, Kuschke R, 2004. Review of seasonal forecasting in South Africa: producer to end-user. Climate Research 28(1) pp 67-82.
- Midgley GF, Chapman RA, Hewitson B, Johnston P, De Wit M, Ziervogel G, Mukheibir P, Van Niekerk L, Tadross M, Van Wilgen BW, Kgope B, Morant PD, Theron A, Scholes RJ, Forsyth GG. (2005): A Status Quo, Vulnerability and Adaptation Assessment of the Physical and Socio-Economic Effects of Climate Change in the Western Cape.
- Johnston PA, Ziervogel G and Matthew M, 2007. The Uptake and Usefulness of Weather and Climate Information among Water Resource Managers. Papers of the Applied Geography Conferences 30:380-389.

## **GUEST SPEAKER- DR PETER REIN**



Peter Rein studied chemical engineering at the Universities of Cape Town and Natal, and spent 31 years working for Tongaat-Hulett Sugar, in R & D, in Operations Research, in Production and in Technical Management. Dr. Rein was Technical Director at Tongaat-Hulett Sugar, and Head of the Technical Management Department from 1992 to 2000.

He has served as President of the South African Sugar Technologists' Association, Congress organizer and Executive Committee member for Sugar Industry Technologists Inc, and Chairman of the International Society of Sugar Cane Technologists (ISSCT).

He joined Audubon Sugar Institute, Louisiana State University, in February 2000 as a full professor and Head of the Institute. He retired in March 2007 from LSU and now lives in England and operates as a consultant to the sugar industry.

He won the Sugar Industry Technologists Crystal Award in 1997, he was the first recipient of the SPRI Technology Award in 1998, and received the South African Sugar Technologists Gold Medal in August 2000. He was made an Honorary Life Member of the International Society of Sugar Cane Technologists in February 2005.

He authored a new text on sugar processing entitled "Cane Sugar Engineering", published by Bartens, Berlin in February 2007.

**GUEST SPEAKER- DR VADIM KOCHERGIN**



Dr Vadim Kochergin is a Licensed Professional Engineer holding M.S. and Ph.D. in Chemical Engineering from Mendeleev Chemical Engineering University, Moscow, Russia.

For the last 20 years he has been working on various R&D projects in cane and beet sugar, sweetener and biorefining industries. Special expertise includes unit operations involved in all aspects of new process development and implementation of sugar technology, such as: membrane filtration, industrial chromatography, solvent extraction, ion exchange, distillation, filtration, crystallization, bulk solids handling. He has developed several new technologies applied commercially.

Dr Kochergin has over 80 publications and patents and multiple presentations in national and international meetings.

He presently works as a Professor at the Audubon Sugar Institute in Baton Rouge, Louisiana, USA. Currently, he is the principal investigator or collaborator in several grants (total of \$1.5 million) related to improvement of sugar cane mill operations and integration of biomass conversion technologies into existing cane sugar industry infrastructure.

# EIGHTY-FIFTH ANNUAL REVIEW OF THE MILLING SEASON IN SOUTHERN AFRICA (2009-2010)

SMITH G T, DAVIS S B and ACHARY M

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## Abstract

Performance, throughput and other relevant aspects of the sugar industries in southern Africa are presented and discussed. Data from sugar mills in South Africa, Malawi, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe are included. The 2009-2010 milling season in South Africa was slightly down on the 2008-2009 season in terms of cane quality and recoveries, and the tonnage of cane harvested was also lower, despite the same Length of Milling Season (LOMS) as the 2008-2009 season. Time efficiencies were also down, with higher No-cane, Foreign Matter and Scheduled Stops as well as Lost Time % Available (LTA). Extraction performance continued the substantial decline of the previous three seasons. Losses to molasses stopped the downward slope of the previous two seasons, although an increased Undetermined Loss resulted in a lower Boiling House Recovery (BHR) and Overall Recovery (OR). These were partly as a result of poorer cane quality, however, and this resulted in slight increases in Corrected BHR (CRB) and Value Recovery (VR).

Regarding the SMRI Affiliate member mills in neighbouring countries, those in Swaziland, Malawi and Zimbabwe experienced poorer recoveries than in the previous season, while the Nakambala mill in Zambia showed the most notable improvement over previous seasons, following a major capacity upgrade. The Nakambala mill also achieved sugar production of 315 043 tonnes, a record in the history of the SMRI Factory Performance reporting.

*Keywords:* sugarcane, sugar factories, cane quality, crop size, performance, recovery

### ***Biography: Gavin Smith***

*Gavin Smith is Industry Support Manager at the Sugar Milling Research Institute in Durban. He received his Chemical Engineering degree from the University of Natal in Durban in 1983. His work history includes the nuclear energy field, before moving into the sugar industry in 1987. He worked for Tongaat-Hulett Sugar and Illovo Sugar, including the downstream alcohols plant where he managed both the distillery and pharmaceutical plants. After a brief stint in project management, still mainly involved in the sugar industry, he moved to the SMRI to help manage the research programme. He now heads the Industry Support Division where he is responsible for training, consulting and the factory performance figures of the SMRI's Member and Affiliate Member mills. Gavin has been a member of SASTA since 1990, and has been on the SASTA Council for 3 years.*

## REVIEW OF SOUTH AFRICAN SUGARCANE PRODUCTION IN THE 2009-2010 SEASON FROM AN AGRICULTURAL PERSPECTIVE

SINGELS A<sup>1</sup>, MCFARLANE S<sup>1</sup>, WAY MJ<sup>1</sup>, FERRER S<sup>2</sup>, AND VAN DER LAAN M<sup>1</sup>

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### Abstract

The objectives of this paper were to characterise South African sugarcane production for the 2009/10 (denoted 2009) milling season from an agricultural perspective, in order to provide insight into successes and failures of recent production strategies and identify priorities for improved efficiency in producing high quality sugarcane in South Africa. Cane yield and quality were related to the main production factors, namely climate, irrigation water supply, pests and diseases, soil fertility and economic conditions.

Below average solar radiation and temperature, combined with below average or poorly distributed rainfall during the growing period, caused rainfed yield potential to decrease from 2008 to 2009 for most of the industry. Decreases from 2008 to 2009 in actual yields matched model-estimated decreases in most cases. Model estimates suggest that yields in fully irrigated areas should have increased slightly due to improved water availability (in Mpumalanga) and above average, well distributed rainfall. Actual yields, however, declined from 2008 to 2009 in these areas. Yields in Umfolozi increased significantly from 2008 to 2009 despite less favourable climatic conditions. This could possibly be ascribed to lower pest and disease pressures. Cane quality declined in some mill areas and improved in others. These changes were mostly driven by climatic factors.

Generally, pest survey information suggests that *Eldana saccharina* Walker (Lepidoptera: Pyralidae) (henceforth referred to as Eldana), was not a major factor influencing yield in 2009. Populations of *Fulmekiola serrata* (Kobus) (Thysanoptera: Thripidae) (henceforth referred to as thrips), in the Umfolozi region declined from 2007/08 to 2008/09; however, thrips numbers in the remainder of the industry are not clear due to a lack of empirical data. Smut levels declined in problem areas and it is unlikely that this disease had any significant effect on industry cane production in 2009.

The ratio of real input prices to real recoverable value (RV) price reached a high in 2008/09, exacerbating the negative economic returns experienced by large-scale growers since 2002/03. Lack of cash flow is likely to have constrained production inputs below optimal levels.

Generally, the changes in cane yield and quality from 2008 to 2009 were driven mainly by climate. Positive factors were the low diseases and pest levels and good irrigation water supplies. However, the poor economic situation of many cane growers is a limitation to optimal production input and crop management. Yield estimates from the Canesim model suggest that, although agronomic performance in 2008 and 2009 improved when compared with 2007, it could be further improved to achieve yields closer to potential.

*Keywords:* sugarcane, production, diseases, pests, modelling, review

***Biography: Abraham Singels***

*Dr. Abraham Singels is principal agronomist with the South African Sugarcane Research Institute. He has a Ph.D. in Agricultural Meteorology from the University of the Free State, where he also worked as lecturer. His fields of interest are the development and application of mathematical models and computer tools to support research and management of crops (sugarcane) and natural resources. He has been member of SASTA since for more than 10 years and has published numerous scientific papers (including 32 at SASTA). He holds honorary appointments with University of Pretoria and University of KwaZulu-Natal.*

# DOUBLE PROFITS WITH A CONTROLLED TRAFFIC ZERO-TILL IRRIGATION FARMING SYSTEM?

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## Abstract

Many guidelines and recommendations for sugarcane farming are aimed at achieving a large number of ratoon crops. One of the reasons for this is that the replanting costs can be considerable when a field is conventionally tilled and replanted. Thus, delaying re-establishment makes financial sense provided the cost savings are greater than any yield and revenue penalties. An alternative is to introduce a controlled traffic and zero-till farming system (CTF), thereby lowering re-establishment costs and potentially allowing for fewer ratoon crops and more frequent green manure or break crops. A rigorous yield, sucrose content, costing and cash-flow analysis, based on published research findings and detailed costing of representative machinery, showed that a CTF system with only three ratoon crops was far more profitable than a conventional farming system involving eight ratoon crops and more intensive tillage operations. A doubling in profitability was shown when the yield benefits reported with break crops and the yield decline rates reported under conventional farming systems were included in the analysis. Substantial gains in water use productivity were also shown, up to nearly 80% improvement over a conventional farming system. Adoption of a CTF system with only three ratoon crops is therefore highly recommended and should be taken very seriously by decision-makers in the sugarcane industry.

*Keywords:* irrigation, farming systems, controlled traffic, zero-till, economics, green manure

## ***Biography: Neil Lecler***

*Neil Lecler is an Agricultural Engineer by profession. He completed his Masters degree in 1989 and a part-time PhD in 2005. He has worked in the former Bophuthatswana with Agricor, an agricultural development corporation, as a Research Fellow/Lecturer at the University of KwaZulu-Natal (UKZN), as an Agricultural Engineer/Hydrologist with the sugarcane industry in Zimbabwe, and as a Senior Research Engineer with the South African Sugarcane Research Institute. He was appointed as an Honorary Associate Professor at the UKZN in 2007. He considers the supervision and mentoring of post- and under-graduate students a very rewarding and important aspect of his career to date. Although he has been involved with optimising the performance of tractors with computer control systems, most of his work, publications and professional involvement have been related to water resources assessment and management. He has served on numerous Water Research Commission reference groups, review panels and project teams, the Committee of the KwaZulu-Natal (KZN) branch of the South African Irrigation Institute, the Committee of the KZN branch of the South African Institute of Agricultural Engineers and on the South African National Committee on Irrigation and Drainage.*

## REVIEW OF SUGARCANE MATERIAL HANDLING FROM AN INTEGRATED SUPPLY CHAIN PERSPECTIVE

BEZUIDENHOUT C N

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### Abstract

Agricultural supply chains are complex. They require a mixture of lean and agile principles and, in the sugar industry, infrastructures are generally over-capitalised. In this short communication, four aspects that pertain to an improvement in material handling are discussed briefly: (i) capacity utilisation can be improved when volumes and qualities become more consistent, (ii) insufficient risk management may exist, (iii) stockpiles need to be managed and reflect the health of the system and (iv) cane deterioration needs to be carefully measured and managed. Finally, it is proposed that the sugarcane supply chain will function better where more than one mode of operation exists.

*Keywords:* supply chain, sugarcane, risk, stockpiling, variability

### ***Biography: Carel Bezuidenhout***

*Carel Bezuidenhout is an Associate Professor and the SASRI research fellow in the School of Bioresources Engineering and Environmental Hydrology at the University of KwaZulu-Natal. Starting at SASRI, Carel has worked in a research capacity in the sugar industry since 1996. His research to date involved crop modelling, transport, supply chain systems, infrastructure design and harvesting systems optimization.*

# EXPERIENCE OF DIFFUSER PERFORMANCE AT VERY LOW IMBIBITION WATER RATES

VOIGT I

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## Abstract

The typical operation of sugarcane diffusers in South Africa involves the use of relatively high rates of imbibition water. Water addition is generally above 300% on fibre. At Usina Noroeste Paulista in Brazil, where the first Bosch Projects Chainless Diffuser was commissioned in 2008, imbibition water rates during the first season of operation were as low as 80% on fibre. This paper describes the experiences and operational results at these conditions.

*Keywords:* diffuser, imbibition rates

## ***Biography: Ivan Voigt***

*IVAN VOIGT (BSc Eng (Mech), GCC, MBA) is the Director: Sugar Equipment at Bosch Projects Pty (Ltd). He has managed all aspects of Bosch Projects Sugar Equipment business, including marketing, technology development and projects. Previous roles at Bosch Projects include being a project engineer on the Kagera rehabilitation project and Pongola conditioning silo project, Head of Mechanical Engineering and Engineering Manager. Noteworthy achievements include the commercialisation of the Bosch Projects Chainless Diffuser in Africa, South America and Asia, and involvement in the establishment of Bosch Projects to Brazil, of which he is also a director. Prior to his career at Bosch Projects he was a Project Engineer for Iscor (Newcastle), Plant Engineer and Engineering Manager at Royal Swazi Sugar Corporation (Simunye).*

# NOISES OFF: BANGING SOUNDS FROM PIPES AND VESSELS IN A SUGAR FACTORY – CAUSES AND CURES

LOVE D J

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## **Abstract**

Banging sounds from inside pipes and process vessels are clearly an undesirable situation, being indicators of large forces with the potential to damage equipment and become a safety hazard for people. The noises are usually caused by ‘water hammer’ or ‘steam hammer’ (more appropriately termed ‘steam/water hammer’ of which there are a number of distinct variations). Instances of these events that have occurred in sugar factories are described. The mechanisms involved are explained, to assist in understanding the factors that cause the events. Guidelines are given for preventing and eliminating both water hammer and steam/water hammer.

*Keywords:* steam hammer, water hammer, steam/water hammer, sound, bang, condensation

*Biography: David Love*

*Dr David Love is a Chemical Engineer who has worked in the sugar industry since 1977. His varied experience has included time working in research and development, process design, process equipment design, sugar factory operations, commissioning and technical support to factory operations. He has published numerous SASTA papers and a few ISSCT papers.*

# A JUICE CLARIFIER WITH TURBULENCE REDUCTION DEVICES: RESULTS OF FIRST INDUSTRIAL TRIALS

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## Abstract

Optimisation of juice clarifiers has been the subject of multiple studies that have led to the development of a number of efficient designs. Computer-aided simulations of the clarifiers using various CFD packages demonstrated that the presence of turbulent eddies were responsible for efficiency reduction. The clarification process is especially important for Louisiana sugar mills due to the climatic conditions and the type of soil that lead to elevated mud levels. With increased demand for higher quality sugar and continuous efforts to reduce inversion losses, the improvement in clarifier operation is timely. A new design of trayless juice clarifier has been tested in a Louisiana sugar mill. A simple juice distribution system comprises a number of feed pipes uniformly distributed over the cross-sectional area. The exit points of the pipes are supplied with turbulence reduction devices that dissipate the momentum of the feed juice, thus eliminating turbulence eddies. A 6 m diameter modified clarifier was operated in parallel with a 6 m diameter Graver clarifier and 10 m diameter Rapidorr. The modified clarifier initially performed at a 25% higher feed flowrate than a Graver clarifier and delivered juice with 20-25% lower turbidity. It also compared favorably with a Rapidorr clarifier that had twice the residence time. The new design is promising as it delivers a simple retrofitting option. Operating results and areas for optimisation are discussed.

*Keywords:* clarifier, juice, turbulence reduction, sucrose loss, CFD modelling

## **Biography: Vadim Kochergin**

*Vadim Kochergin is a Licensed Professional Engineer holding M.S. and Ph.D. in Chemical Engineering from Mendeleev Chemical Engineering University, Moscow, Russia. For last 20 years he has been working on various R&D projects in cane and beet sugar, sweetener and biorefining industries. Special expertise includes unit operations involved in all aspects of new process development and implementation of sugar technology, such as: membrane filtration, industrial chromatography, solvent extraction, ion exchange, distillation, filtration, crystallization, bulk solids handling. Developed several new technologies applied commercially. Has over 80 publications and patents and multiple presentations in the national and international meetings. Presently works as a Professor at the Audubon Sugar Institute in Baton Rouge, Louisiana, USA. Currently principal investigator or collaborator in several grants (total of \$1.5 million) related to improvement of sugar cane mill operations and integration of biomass conversion technologies into existing cane sugar industry infrastructure.*

# MEASURING THE QUANTITY OF INCONDENSABLE GAS REMOVED BY A LIQUID RING VACUUM PUMP

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## Abstract

Vessels operating under vacuum, such as vacuum pans and final effect evaporators, require a vacuum pump to remove incondensable gasses that accumulate within the vessel. The vacuum pumps need to be sized to remove incondensable gasses from four possible sources: those that enter with the feed into the vessel, direct leaks from the atmosphere into the vessel, dissolved and entrained gas that is released from injection water used in direct contact condensers, and gas that is contained in steam vented into the vessel body.

It is often necessary to discover why a process vessel is unable to maintain the design vacuum. If the condenser is capable of adequately cooling the gas stream entering the vacuum pump, an inability to maintain the design vacuum within the vessel is an indicator of either insufficient pump capacity or excessive quantity of incondensable gas. To diagnose the cause of the problem, pump performance can be checked by measuring the performance of the vacuum pump, off-line, using a simple test rig, whilst the possibility of excessive quantities of gas are normally investigated only by using a standard vacuum test on an empty vessel to estimate the quantity of the air leakage into the vessel.

As an alternative to off-line pump testing and the conventional vacuum test for leaks, a measurement of the quantity of incondensable gas being discharged from the vacuum pump during normal operation provides a very useful diagnostic test. The test provides a direct measure of the load (of incondensable gas) on the pump whilst also providing a single point on the pump curve and thus can give an instantaneous indication of the reason for the inability to maintain the design vacuum. A simple method of performing this measurement is described.

*Keywords:* vacuum pump, vessel, leak, air, incondensable gas

*Biography: David Love*

*Dr David Love is a Chemical Engineer who has worked in the sugar industry since 1977. His varied experience has included time working in research and development, process design, process equipment design, sugar factory operations, commissioning and technical support to factory operations. He has published numerous SASTA papers and a few ISSCT papers.*

## **SASTA Training Workshop**

At a training workshop held during the 2009 SASTA Congress it was confirmed that the southern African sugar industry is facing increasing difficulties in attracting and retaining suitably qualified technical personnel. Input was received from all of the milling companies in South Africa (at the time). This paper summarises the points that emerged at the workshop and looks forward to what may be done to address these issues in the southern African sugar industry.

### ***Biography: Gavin Smith***

*Gavin Smith is Industry Support Manager at the Sugar Milling Research Institute in Durban. He received his Chemical Engineering degree from the University of Natal in Durban in 1983. His work history includes the nuclear energy field, before moving into the sugar industry in 1987. He worked for Tongaat-Hulett Sugar and Illovo Sugar, including the downstream alcohols plant where he managed both the distillery and pharmaceutical plants. After a brief stint in project management, still mainly involved in the sugar industry, he moved to the SMRI to help manage the research programme. He now heads the Industry Support Division where he is responsible for training, consulting and the factory performance figures of the SMRI's Member and Affiliate Member mills.*

*Gavin has been a member of SASTA since 1990, and has been on the SASTA Council for 3 years.*

## FROM 'FARM TO FORK' SUGAR TRACEABILITY

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### Abstract

#### *The EU General Food Law*

For European authorities, companies and consumers, safety is the most important ingredient of their food. Crises in the past have undermined public confidence in the capacity of the food industry, and of public authorities to ensure that food is safe. The EU has identified food safety as one of its top priorities and is focused on ensuring a high level of protection of human health and consumers' interests in relation to food, taking into account diversity, including traditional products, whilst ensuring the effective functioning of the internal market.

#### *'Farm to Fork' technology*

This integrated 'farm to fork' approach is considered to be a general principle for EU food and feed safety policy and has been addressed by the Swaziland Sugar Association as arguably a *first* in Africa. Using information technology as a business enabler, the Swaziland Sugar Association has recently implemented an automated tracking system using RFID technology for the purpose of traceability and recall of export bagged sugar.

#### *RFID system*

Radio-frequency identification (RFID) is the use of an object (typically referred to as an RFID tag) applied to or incorporated into a product, animal or person for the purpose of identification and tracking using radio waves (Wikipedia). The physical RFID system was designed by a company called The RFID Institute, complemented by sugar-specialist software company Adapt IT (previously InfoWave) who designed and programmed the software required for business decisions.

Aside from the ability to track sugar bags, various other benefits of the technology have been identified and are being investigated for commercial viability. This presentation describes the process followed, additional benefits identified, the technology used, and the outcomes achieved for wider adoption in the sugar industry.

*Keywords:* RFID, tracking, traceability, information technology, food safety

#### *Biography: Stuart Jack*

*Stuart has been in the IT industry for 21 years and has obtained in-depth experience in the implementation of credit card, retail insurance, distribution and inventory systems whilst with Pref-Info (now part of the McCarthy Limited group). He was also involved in re-engineering systems methodology for the group. In June 1997, Stuart joined InfoWave (now called Adapt IT) as a Senior Consultant responsible for custom-built solutions and was promoted to Business Unit Manager in February 2002.*

*He has been involved in the development and upgrade of the SASA (South African Sugar Association) industry-wide IT systems since they were re-engineered by Adapt IT in 1997. In addition, Stuart led the development of the CaneLab product and has been involved in various SASRI (South African Sugar Research Institute) IT projects resulting in an excellent knowledge of the sugar industry. The SSA (Swaziland Sugar Association) warehouse management industry IT system was developed in 2002 and upgraded recently to the latest technology paving the way for the development of the 'track and trace' application as a natural extension to this product.*

*Stuart is passionate about developing IT systems that complement and improve business processes, and is constantly researching new ways to add value to Adapt IT's sugar customers across the world.*

## NOVEL DESIGN OF A CONTINUOUS CENTRIFUGE FOR LOW GRADE MASSECUITES

BARTELS B AND WESTENDARP H-H

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### Abstract

After many years the time had come to review the basic design of continuous centrifugal machines. The aim was to develop a completely new concept with superior properties. Based on proven, successful state-of-the-art machine concepts, new ideas have been introduced which deviated significantly from conventional design features. After a novel concept was found, design work started to build a trial machine which was tested under industrial conditions in Central America and in Europe. As a result, this new machine proved to be able to provide higher capacity at improved sugar quality and reduced power consumption. In addition, the centrifuge needs less space (smaller footprint) than its predecessors of comparable capacity. The machine offers high reliability and availability, is easy to operate and needs less maintenance. Highest safety standards are ensured by FEM calculations, tests during fabrication and safety devices incorporated into the design of the machine.

*Keywords:* centrifuge, continuous, intermediate/low grade massecuites

### ***Biography: Burkhard Bartels***

*Burkhard Bartels is a Sales Engineer with BMA. He holds a Master degree in Process Engineering from the Technical University of Magdeburg in Germany. Burkhard started his career with BMA in 1992 at the engineering department with special focus on fluidized bed drying technology. He worked there for 8 years before changing over to the sales department where he takes care of certain regions including Southern Africa and Latin America now. He is based in Braunschweig – Germany at BMA's head offices.*

## COMMERCIAL ABSTRACT

# THE SOLUTION TO SPENT WASH (VINASSE) AND EFFICIENCY AUGMENTATION THROUGH A HIGH-PRESSURE CO-GENERATION ROUTE

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### Abstract

In the future the sugar industry will require more revenue from the existing set-up and will need to minimise damage to the environment. The co-generation route will help deal with the former, and spent wash firing with the latter. The disposal of spent wash (vinasse) has always been a headache for the sugar industry. Now, with the latest technology, it is possible to generate power from incinerating the spent wash in a boiler. This helps to eliminate waste in a safe way and generates power as well.

Traditionally, boilers in the sugar industry have operated in the lower pressure range (less than 35 bar). However, as boiler technology advances with biomass-based fuels, the biomass operated boilers now operate in the higher pressure range. This paper presents the various aspects of co-generation in the higher-pressure range. The overall efficiency of the turbine increases with higher pressure, resulting in a reduction in specific steam consumption for the generation of power, which in turn results in overall higher plant efficiency. To achieve other advantages such as higher ROI and plant availability, the co-generation route is recommended. During the season the plant operates in co-generation mode, where the quantity of bagasse consumed reduces due to higher plant efficiency. During the off-season, the plant operates to generate power using saved bagasse and other support fuel, and the power is exported to the grid. The requirements for higher pressure are high quality of water, a supply of auxiliary fuel during the off-season, skilled operators, higher maintenance, and higher initial capital cost.

*Keywords:* co-generation, spent wash, vinasse, power generation, efficiency

***Biography: Prakash Karve***

No biography available at time of print.

COMMERCIAL ABSTRACT

## VARIATIONS IN COMPOSITION OF MOLASSES AND THEIR EFFECTS ON ETHANOL PRODUCTION

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### **Abstract**

Molasses and bagasse are the most important by-products of sugar production. While bagasse is used mostly as fuel and feed material for making paper, molasses finds its application in producing ethanol, citric acid, yeast, ephedrine and cattle-feed. Output of ethanol from molasses is greatly dependent on the composition of molasses, and the effects of variations in molasses composition are therefore important.

The components which vary are numerous and there are several parameters which they affect, thus making the effects of variations complex. This paper attempts to list and elaborate on these components, parameters and effects. The content of sugar in molasses decides the economics of production of ethanol. The presence of other components affects operation of the plant and equipment. This paper will deal with molasses and its application for production of ethanol by fermentation.

*Keywords:* Sugarcane, molasses, ethanol, cattle-feed, yeast, fermentation

### ***Biography: Abhay Chaudhari***

*Abhay Chaudhari is a Mechanical Engineer from the Leading Engineering College in India. Mr. Chaudhari is the Executive Vice President of PRAJ INDUSTRIES LIMITED, world's leading Alcohol technology company. He has over 25 years of experience in ethanol and brewery plant engineering. He has provided end-to-end solutions encompassing range of technologies and systems for Fermentation, Distillation, Dehydration, Evaporation, Effluent Treatment. As Executive Vice President, Abhay Chaudhari heads the Strategic Business Unit for India and Sub-Saharan Africa. He has presented many papers in seminars in India and abroad on varied subjects. He has been closely associated with the sugar and distillery industry.*

# ANALYSIS OF FACTORY PERFORMANCE FIGURES AS AN AID TO IDENTIFYING SOURCES OF UNDETERMINED LOSS

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## Abstract

The South African sugar industry possesses arguably the best technical information systems in the global sugar industry. All factories in the country (as well as a number of affiliate member factories external to South Africa) provide accurate cross-checked figures on a weekly and monthly basis to the Sugar Milling Research Institute (SMRI), who collate the data and produce consolidated performance reports. This extensive database is of great value for benchmarking and evaluating performance and is already a useful resource for technologists. However, the potential exists to further increase the usefulness of the collected data by means of detailed analysis, as an aid to troubleshooting and for the ongoing monitoring of factory performance.

The estimated undetermined loss for a factory is a key performance measurement and an important guide for production management. Due to inherent problems in the measurement of undetermined loss, making effective use of these measurements normally requires a high degree of processing knowledge, experience and judgement. Although a range of secondary measurements can be used to help identify sources of undetermined loss, these usually require extra flow measurements, sampling and specialist analyses. A new approach to trying to identify possible sources of undetermined loss is proposed. This involves comparing available process measurements with the predictions of a boiling house mass balance. Assumed loss streams are introduced into the boiling house mass balance and their magnitudes are adjusted to match the mass balance to factory performance figures. Details of this approach are presented.

*Keywords:* performance figures, analysis, troubleshooting, monitoring, modelling

## ***Biography: David Love***

*Dr David Love is a Chemical Engineer who has worked in the sugar industry since 1977. His varied experience has included time working in research and development, process design, process equipment design, sugar factory operations, commissioning and technical support to factory operations. He has published numerous SASTA papers and a few ISSCT papers.*

# MAIDSTONE MILL FACTORY OPTIMISATION: USE IT OR LOSE IT

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## Abstract

Maidstone mill cane estimates have reduced drastically over the past few years from a design capacity of 2.4 million tons cane crushed to below 1 million tons cane crushed in 2009. This has resulted in changes in both mindset and in operation of the factory. In this regard, the mill has taken into consideration its existing capacity and has downsized to compensate for the reduction in throughputs.

The changes have reduced residence time and improved exhaustions in the raw house. In addition, more focus has been placed on attention to detail with respect to optimisation of operations throughout the factory. The evaporation and crystallisation stations were re-configured to cater for the lower throughputs, and this has decreased undetermined losses, improved exhaustions and increased productivity.

This paper outlines the changes made and evaluates the effects it has had on performance criteria in the factory. It further highlights the need for flexibility in a modern sugar factory.

*Keywords:* cane estimates, optimisation of operations, residence time, capacity, exhaustions, performance criteria

### ***Biography: Omashni Moodley***

*Omashni Moodley was employed as Engineer-in- Training at Tongaat Hulett Sugar in December 2002. She completed her training at Darnall Sugar Mill in 2005 and was appointed as a Process Engineer for the Back-End.*

*Omashni transferred to Maidstone Mill in August 2007 as Process Engineer for the Extraction Department. In 2009 her responsibilities shifted to the Raw House and Effluent at Maidstone.*

*She is currently studying towards her BCom degree specialising in Management at Unisa and holds a BTech in Chemical Engineering.*

# ENVIRONMENTAL CHALLENGES FACING THE SUGAR MANUFACTURING INDUSTRY

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## Abstract

The sugar manufacturing industry in South African is facing many challenges due to the rapid changes in environmental legislation over the past decade. The industry is also experiencing increasing pressure from community groups, as housing developments around some of the industries are on the increase. The requirement for responsible environment management is also becoming crucial when obtaining custom from industrial users of sugar. The environmental impacts of the sugar manufacturing processes and the cost implications of maintaining environmental compliance are listed. The experiences and environmental strategies implemented at Hulets Refinery, an industry situated in a pollution 'hot spot' and in close proximity to the community, are discussed.

*Keywords:* sugar manufacturing, environment, impacts, sustainability, natural resources

## ***Biography: Natisha Padayachee***

*Natisha Padayachee, Technical Manager –Tongaat Hulett Sugar - Refinery. As a qualified Chemical Engineer she is responsible for all aspects related to the quality and environmental management at the Sugar Refinery. In this role, Natisha is responsible for maintaining the legal and regulatory compliance of the business. She also provides technical support to the marketplace and deals with communications with all relevant authorities and public forums with respect to environmental issues. Natisha is a member of the leadership team at THS Refinery. As April 2010 she has been appointed as EQ : Manager for THS SA.*

# A SEASONAL EVALUATION OF THE FILTERKWIK RAW SUGAR FILTERABILITY TEST

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## Abstract

The filtering characteristics of raw sugar destined for refining have been the topic of much research. Investigations in South Africa on the impact of various components of raw sugar on the filterability characteristics of raw sugars started as far back as 1954.

Worldwide, there is still no uniform method to determine the filterability of raw sugars for use in export agreements. To address this, the Sugar Milling Research Institute developed a method, called FilterKwik, specifically to predict the behaviour of raw sugar during the first stages of refining. The aim was for the method to be representative of general South African refinery conditions so that it could be used to rapidly assess the suitability of a raw sugar for refining, be it local or abroad, bearing in mind that different refinery processes may be sensitive to different raw sugar quality requirements.

The FilterKwik method was earmarked to replace the SA Sugar Terminal method, in recognition of the value that this would add to the South African Sugar Association marketing strategy, pending a seasonal comparison study. This study was completed during the 2009/10 season when just under 400 raw sugar samples were subjected to duplicate analyses using the FilterKwik method as well as a range of other sugar quality tests typically performed by the Sugar Terminal laboratory. This paper reports on the seasonal evaluation.

*Keywords:* raw sugar, filterability, refining, export, SA Sugar Terminal

## ***Biography: Barbara Muir***

*Dr Barbara Muir is a Senior Research Officer at the Sugar Milling Research Institute (SMRI). She has a Doctoral Degree in Chemistry and has been working in the SA sugar industry for the last eight years. Her current work includes the development of a new method for slurry preparation, and the screening of chemicals and other additives for the removal of non-sucrose (for example colour or starch) from cane sugar processing streams.*

*Barbara has authored, co-authored or presented several SASTA papers and posters and has been a member of the SASTA Council since 2004.*

# USING NEAR INFRA RED SPECTROSCOPY FOR RAPID QUANTIFICATION OF INTERMEDIATE SUGAR FACTORY PRODUCTS

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## Abstract

The Sugar Milling Research Institute analytical laboratory has been exploring the feasibility of using NIR spectroscopy as a processing tool for intermediate products, following the successful implementation of this novel application for the analysis of C-molasses for both factory control and as part of cane payment during the 2009/2010 South African crushing season. NIRS is an attractive method for process engineers, as rapid multi-component analysis of intermediate products may be possible. Sample sets of approximately 300 clear juices, syrups, A-, B- and C-masseccutes and A- and B-molasses have been analysed by standard reference methodologies for sucrose, fructose, glucose, pol and Brix, and the results used to develop NIRS calibrations for rapid multi-component analysis. The correlation coefficients achieved for most of the intermediate products for most analytes were greater than 0.9. The data prove that NIRS is capable of providing an analytical prediction tool suitable for process control. The method, compared with conventional analysis, would allow for a larger number of analyses to be conducted within a relatively short period of time, thereby enabling faster process control decision-making.

*Keywords:* NIRS, molasses, masseccutes, syrup, clear juice, calibration

## ***Biography: Lola Naidoo***

*Yumesperi (Lola) Naidoo holds a National Higher Diploma in Microbiology and has been employed at the SMRI for 16 years. She currently holds the position of Analytical Instrument Specialist. Prior to this she administered the SMRI laboratory accreditation system. One of her core duties is to maintain a high standard of quality laboratory service to the southern African sugar industry.*

# AN INTRODUCTION TO GAS CHROMATOGRAPHY MASS SPECTROSCOPY FOR THE STRUCTURAL ELUCIDATION OF POLYSACCHARIDES FROM SUGAR PROCESSING STREAMS

DU CLOU H<sup>1,2</sup> AND WALFORD S N<sup>2</sup>

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## Abstract

The gas chromatograph (GC) coupled with a mass spectrometer (GC-MS) has become a highly versatile tool in determining the structure of compounds such as sugars; including the constituents of oligosaccharides and polysaccharides. For higher saccharides a GC-MS can be used to determine its constituent monosaccharides, the linkage position between these monosaccharides, the general position in the chain (terminal/reducing end, branch point, or intra-chain) as well as the ring size of each sugar (being either a five-membered furanose or six-membered pyranose). The success of such analyses relies on a method of sample preparation which involves a permethylation step, followed by methanolysis and silylation of the individual residues. These residues are separated in the GC, and their structure is determined through the specific, reproducible fragmentation patterns generated from an electron impact process. The resultant ions are separated in the mass spectrometer and the mass spectra are compiled into a database which is used as a reference library. This library is used as an aid in the identification of similarly prepared monosaccharide residues with respect to their type, configuration, and general position within an oligo- or polysaccharide chain. This paper reports the development of a mass spectral library from model compounds in order to qualify the fine structure within complex sugars and uses cane starch (found in sugar factory processing streams) to illustrate the methods used.

*Keywords:* GC-MS, monosaccharides, polysaccharides, structure, elucidation, library

## ***Biography: Heidi du Clou***

*Heidi du Clou is an Assistant Researcher at the Sugar Milling Research Institute (SMRI) and a Master of Science (MSc) student in the School of Chemistry at the University of KwaZulu-Natal (UKZN) (Westville Campus) in Durban. She completed her Bachelor of Science (BSc) in Chemistry Cum Laude and BSc Honours degrees at the same university, and received recognition as being the Best Student in the School of Chemistry in 2007 and 2008. It is through the collaboration between SMRI and UKZN that she was able to complete her final Honours project and undertake her current MSc research.*

# ARE MANNITOL AND LACTIC ACID INDICATORS OF SUGARCANE DETERIORATION IN A SOUTH AFRICAN CONTEXT?

WALFORD S N AND NEL S

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## Abstract

Deteriorated sugarcane can lead to processing difficulties in the factory and to high levels of unwanted compounds in the raw sugar, with some extending to refined sugar. A high level of dextran is one of the more serious processing problems in a sugar factory that is associated with deteriorated cane. The development of a rapid test to measure an indicator of the 'amount of deterioration' could be useful to determine whether a load of cane can be processed economically or not. Ethanol has been used as an indicator in the South African industry for many years. Indicators used in other sugarcane industries include dextran itself (monoclonal antibody method) and mannitol. This study describes an investigation of the possible use of mannitol or lactic acid as indicators of cane deterioration as measured by dextran. It further investigates the use of a rapid enzymatic method for mannitol analysis as an indicator of cane deterioration for use at individual mills.

*Keywords:* sugarcane, deterioration, mannitol, dextran, lactic acid

## ***Biography: Stephen Walford***

*Stephen has been employed for a total of over 19 years at the SMRI and is currently the Head of the Chemical Division. He has an MSc in Chemistry, has an interest in separation sciences and the development of renewable products. He has published numerous papers at SASTA and presented at a number of international conferences.*

# BACKEND CORROSION IN BAGASSE – COAL FIRED BOILERS WITH PARTICULAR REFERENCE TO CO-GENERATION

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## Abstract

Low temperature corrosion is experienced in an operating boiler when metal temperatures drop below the acid dew point (ADP) of the flue gas.  $H_2SO_4$  and HCl are the acids which contribute most aggressively to corrosion. Both these acids can be produced when burning bagasse and trash. The  $H_2SO_4$  ADP is largely dependent on the sulphur content of the fuel which mostly oxidises to  $SO_2$  during the combustion process and on the proportion of  $SO_2$  that converts to  $SO_3$ .  $SO_3$  in turn converts to  $H_2SO_4$  as the gas cools from about  $400^\circ C$  down to about  $175^\circ C$ .

Chlorine in the fuel converts to HCl during the combustion process. The dew point of HCl is lower than that of  $H_2SO_4$ . Although bagasse does not normally contain sufficient Cl for HCl to become a major contributor to corrosion, recent studies in Denmark and Sweden show that even small quantities of chlorine can be aggressive at higher temperatures if zinc and calcium are present with high water vapour contents. Trash, when burned as a side stream, can provide sufficient quantities of these salts to cause a problem.

The  $H_2SO_4$  and HCl ADPs are dependent on the partial pressures of the water vapour,  $SO_3$  and HCl in the flue gas. Graphs are provided to enable the boiler operator to determine the concentrations by volume of these gasses and hence their partial pressures. Formulae based on the partial pressures are provided to determine dew points when burning bagasse and other wet biomass fuels, such as wet woodwaste as well as coal.

Burning coal with bagasse aggravates the backend corrosion problem. Coal normally has a much higher sulphur content than bagasse but a lower moisture content. If burned on its own it may have a lower  $H_2SO_4$  ADP than bagasse because of its lower moisture content. When coal is combined with bagasse the ADP is elevated, largely due to the much higher moisture content of the combined flue gases. This can have serious long term corrosion implications for the back end. The paper describes how to determine the ADP when dual firing.

With co-generation boilers, as pressure rises, a single pass air heater placed upstream of a multi-bank extended surface carbon steel economiser provides the best security from a corrosion point of view. At higher pressures the case for a steam heated air heater in place of a gas/air air heater becomes stronger. Graphs are provided to show how efficiency can be improved with the addition of extra economiser heating surface and by lowering the feed water temperature. Feed water heaters should be used to preheat water fed to economisers. Air bypasses should, when necessary, be used around air heaters to reduce the air's cooling effect. By being aware of the ADP of the fuels being burned the operator can adjust the feed water temperature and/or the air heater bypass to maximise plant efficiency without the risk of corrosion.

An abstract from a Swedish publication on high temperature corrosion is included in Appendix 4 to make the corrosion picture more complete.

*Keywords:* boilers, bagasse, corrosion, dew point, heat recovery, co-generation

### ***Biography: Norman Magasiner***

*Norman Magasiner graduated BSc (Mech. Eng.) (Wits) in 1955 after qualifying as a tool and die maker. In 1956 he designed and erected a graphite refining plant on the Limpopo River for Dowson & Dobson and then joined the R & D department of London based W.S Atkins where his work included carrying overhead travelling cranes on pneumatic tyres. In 1957 he joined John Thompson, UK who later sent him to South Africa to establish a boiler design and contracting department. As Project Engineer, Technical Director and then Managing Director of John Thompson Africa (JTA) he was intimately involved in the development and commercialization of many new technologies. These included new girt supported watertube boiler designs for burning biomass and fossil fuels and a new range of high efficiency coal and oil fired shell boilers. He also led JTA's team responsible for the design and construction of a number of turnkey co-generation industrial and condensing municipal power stations. Norman Magasiner founded Thermal Energy Systems (TES) in 1988 to service the biomass energy market using JTA licenced design procedures and data which he helped develop. During TES's early years he designed a range of fuel feeders, spreaders and Continuous Ash Discharge stokers. TES is licenced to market these technologies. His work with TES included overseeing the design of the 225 t/h bagasse/gas fired boiler installed at US Sugar's Clewiston plant, consulting to Charbonnages de France on the 60 MW Bois Rouge, Reunion bagasse/coal fired co-generation power station and consulting to Florida Crystals, USA on their 75 MW Okeelanta bagasse/woodwaste co-generation power station. He retired from active participation in TES in 2005. He has developed a method of estimating unburned carbon losses in spreader stoker coal fired boilers based on the fuel's maceral analysis. In 2007 he wrote the chapter on boilers for Peter Rein's Cane Sugar Engineering handbook. He consults on an ad hoc basis.*

# PREPEX – A HAMMERLESS SHREDDING TECHNOLOGY

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## Abstract

The Sugar Milling Research Institute (SMRI) has investigated an innovation which could take the sugarcane processing industry into the future: cane preparation without knives and shredders. The technology is a complete break from the past, with knives and shredders being replaced by water, bringing advantages centred on reductions in maintenance and downtime, as there will be no more wearing faces.

Outside of the sugar industry, the use of very high and ultra high pressure water for cutting and surface preparation has increased rapidly in recent years. A demonstration of the use of water jets for preparation of surfaces for rust prevention coatings stimulated the idea of shredding sugarcane using water jets. Trials at the SMRI showed that the technology can be used successfully for shredding sugarcane. International patents for the process have now been lodged.

This paper details the trials conducted as well as some of the challenges faced as a result of this new area of research. The parameters pressure, flow rate and power, formed the basis of many discussions, and the terms ‘nozzle attack tip’ and ‘stand-off distance’ became new buzz phrases at the Institute.

One of the major challenges is to determine ways to minimise overall energy consumption, such as reducing evaporator loading by using juice instead of clean water for shredding. This has proven to be a substantial hurdle since manufacturers of very high pressure pumps are unwilling to certify their pumps for this fluid and conventional high pressure pumps cannot provide the pressure required for this process.

*Keywords:* shredder, high pressure jet, costs, extraction, nozzle assembly, wear

## ***Biography: Richard C Loubser***

*Dr Richard Loubser left the transport industry and joined the Sugar Milling Research Institute in 2000. He has worked in various areas of research in the area of mechanical engineering within the SMRI. He is now a Chief Research Officer in the Process Engineering division with the main focus on reducing the cost of producing sugar. During his membership of SASTA he has authored and co-authored several papers.*

# EVALUATION OF THE SMRI JUICE COLOUR ANALYSIS METHODS AND LABORATORY CLARIFICATION TESTS

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## **Abstract**

Raw sugar colour is an increasing sugar quality concern, not because of a decline in the quality of South African very high pol raws but rather due to rapid improvements in the raw house colours in the rest of the world. Technically, raw sugar with lower colour has direct implications for the refiner's effort and cost of processing that sugar. Enormous benefits could be derived if colourants could either be prevented from entering the factory or be removed early in the process, e.g. during clarification where insoluble impurities are already being settled out.

The method for analysing juice colours in South Africa is based on the ICUMSA methods for sugar and molasses colours. This method was evaluated on both mixed juice and clear juice. Once repeatability limits were established, the SMRI laboratory clarification settling test could be evaluated for reproducibility in terms of colour changes. It was also ascertained that the effect of freezing of the mixed juice on the analysis and on the clarification procedure was negligible for at least six weeks of freezing.

*Keywords:* colourants, ICUMSA colour, analysis, mixed juice, clear juice, clarification

## ***Biography: Barbara Muir***

*Dr Barbara Muir is a Senior Research Officer at the Sugar Milling Research Institute (SMRI). She has a Doctoral Degree in Chemistry and has been working in the SA sugar industry for the last eight years. Her current work includes the development of a new method for slurry preparation, and the screening of chemicals and other additives for the removal of non-sucrose (for example colour or starch) from cane sugar processing streams.*

*Barbara has authored, co-authored or presented several SASTA papers and posters and has been a member of the SASTA Council since 2004.*

# EVALUATION OF A BMA k2300r CONTINUOUS CENTRIFUGAL AT UBOMBO MILL, SWAZILAND

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## **Abstract**

A high grade continuous centrifugal was commissioned at Ubombo sugar factory in Swaziland in 2007. The performance of the machine was evaluated and compared against the design specification. Results of experiments and the operational experiences are reviewed.

Continuous centrifugation for A-massecuite producing refinery melt is a relatively new concept which has not been widely implemented in sugar processing. It was thus imperative to explore this concept by evaluating its performance. The continuous centrifugal BMA k2300r also has A-molasses classification as designed by the manufacturer. This paper shows how the centrifugal was evaluated and the success of the installation.

*Keywords:* continuous centrifugal, refinery melt, A-massecuite, classification

## ***Biography: Samkeliso Ngozo***

*Samkeliso Ngozo is an Engineer in training at Illovo, at the Ubombo Mill in Swaziland. He received his B Tech of Chemical Engineering from the Durban University of Technology in 2007. He started his first employment within the trainee Programme with the Engen Refinery Limited in 2004. In the succession of the trainee programme he was then engaged with General Electric (with BEE partner Tsutsuma Petrochem) as a Site Engineer in 2005. He then joined Illovo Pty Ltd as an Engineer in Training from 2008 to date.*

# CARBONATATION – PILOT PLANT EVALUATION OF SINGLE STAGE MEMBRANE FILTER PRESS IN A CARBONATATION REFINERY

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## Abstract

*The carbonatation process at the Hulett refinery (Hulref) consists of adding a slurry of calcium hydroxide in water to the raw melt solution, to a desired pH. Carbon dioxide gas is then bubbled into the sugar solution, in saturators, under controlled conditions of alkalinity and temperature. Separation of the clear liquor and the calcium carbonate is done by filtration. The filter station at the refinery consists of 13 rotary leaf filters and four plate and frame filters. The performance of these filters has been deteriorating due to age and lack of maintenance. As a result there is a carryover of impurities which adversely affects the performance of the resin plant and also refined sugar quality. Options were considered regarding the way forward with the filter station. The installation of new filters was considered. Currently fully automated membrane filter presses are available that carry out both the filtration and de-sweetening of the calcium carbonate cake in one filtration step. This has major advantages in terms of operating personnel, liquor quality and quality of the filter cake. The new filters would reduce the moisture of the filter cake from 52% to less than 30%. The loss of sugar in the cake would also be reduced.*

This paper describes the pilot plant tests that were done. The results from these tests were used to scale up for the full-scale installation.

*Keywords:* filtration, carbonatation, refining, clarification, membrane filter presses, filter cake

## **Biography – Mano Moodley**

*Mano is currently factory manager at Tongaat Hulett refinery. He has 21 years of sugar technology experience. He has worked at the SMRI, TSB and is now with Hulett. He has published many technical papers both at SASTA and SIT.*

# EVALUATION OF HYDROGEN PEROXIDE AT HULETTS REFINERY: PRELIMINARY RESULTS

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## Abstract

Hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) has been tested in the past as a colour removal agent in the sugar refining process. The high costs and the very high reactivity of this chemical are negative factors that have prevented its full-scale application in sugar factories. Work was done in the USA to reduce the quantity of H<sub>2</sub>O<sub>2</sub> required by dosing as wash water in raw sugar centrifugals. Based on the promising results, trials were done in the Technology and Engineering Group of Tongaat Hulett laboratory on raw sugar and WSM sugar. Full-scale tests were carried out at the Hulett refinery (Hulref) centrifugals on the fourth white boiling at varying concentrations of between 30-1000 ppm on refined sugar in 2009 and 2010. The effect of H<sub>2</sub>O<sub>2</sub> on colour removal and on pH of both sugar and jet were investigated.

Regardless of the H<sub>2</sub>O<sub>2</sub> concentration, 11-15% colour removal in sugar was achieved, with insignificant reduction in pH. Contrary to sugar, jets showed an increasing trend in colour removal with an increase in H<sub>2</sub>O<sub>2</sub> concentration. The optimum H<sub>2</sub>O<sub>2</sub> application appears to be at a concentration of 300 ppm. The amount of H<sub>2</sub>O<sub>2</sub> consumed per ton of refined sugar produced shows that the use of this chemical may be an alternative for colour removal.

*Keywords:* hydrogen peroxide, centrifugals, colour, concentration, shelf life, pH

## ***Biography – Cebisile Mbanjwa***

*Ms Cebisile Mbanjwa is a process engineer at Tongaat Hulett refinery. She holds a Bachelor of Technology degree in Chemical Engineering from Mangosuthu Technikon (now Mangosuthu University of Technology). She started her career at Mondi paper and proceeded to Hulett Aluminium before joining Tongaat Hulett as an Engineer in Training in 2007. This is her first SASTA paper.*

## REFINERY CARBONATATION: A PRACTICAL APPROACH

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### Abstract

*Tongaat Hulett Refinery employs carbonatation as its clarification and decolourisation step in processing very high pol sugar. During the past few years attempts have been made to optimise the carbonatation process with regard to impurity removal and filterability. This paper covers in detail the equipment employed to facilitate carbonatation, together with the control philosophy surrounding the gassing of milk of lime, lime dosing rates into melt liquor and filtration throughputs. Practical insights and challenges concerning the management of the saturator equipment, auto-filter station and operations are discussed.*

*Keywords:* carbonatation, filtration, filterability

### ***Biography: Zyven Rambakus***

*Zyven Rambakus graduated with a B-tech degree in chemical engineering at the Durban University of Technology in 2004. He joined Toyota Manufacturing Plant as an engineering trainee in the Paint Plant where production management skills such as Toyota Production System, Kaizen, Quality circles were developed. Zyven joined Tongaat Hulett in 2006 as a Chemical Engineering trainee and is currently working as a Process Engineer at the Hulett Refinery.*

### ***Biography – Mano Moodley***

*Mano is currently factory manager at Tongaat Hulett refinery. He has 21 years of sugar technology experience. He has worked at the SMRI, TSB and is now with Hulett. He has published many technical papers both at SASTA and SIT.*

# PERFORMANCE EVALUATION OF SASRI VARIETIES N19 AND N25 IN TANZANIA

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## Abstract

SASRI varieties N14, N19, N25 and N30 were introduced in Tanzania in 2000 and tested for adaptability in the local environment from 2002 to 2009, compared to standard commercial variety NCo376.

A total of 16 replicated trials were conducted in both irrigated and rainfed environments. Data collected included; cane yield, brix, pol, purity, fiber, sucrose and reaction to pests; sugarcane smut (*Ustilago scitaminea*), stem borers (*Eldana saccharina*) and white scale (*Aulacaspis tegalensis*).

Under rainfed conditions, N19 and N25 did not show consistent performance. However, under irrigated conditions, these varieties out-performed variety NCo376 in terms of Pol %, and cane and sugar yields. Variety N19 had relatively higher Pol % when compared to variety N25; however, N25 had higher cane yields. Both varieties had similar sugar yields.

Varieties N19 and N25 showed good levels of resistance to smut under both the inoculation technique and natural field conditions. The varieties also have good cane and sugar yields, reasonable levels of resistance to sugarcane smut and good ratooning ability, and are therefore recommended for commercial cultivation in Tanzania under irrigated cultivation.

*Keywords:* sugarcane, variety, smut, yield, sugar

## ***Biography: Denis William Isa***

*Denis William Isa is a Research Scientist working with the Sugarcane Research Institute in Tanzania. He received his PhD in Biological Sciences from the University of Gent in Belgium (2004), masters in Crop Physiology from Reading University in United Kingdom (1994) and a bachelor's in Agriculture from Sokoine University in Tanzania (1987). After completion of his PhD studies, he has been involved in research with small scale sugarcane farmers in Tanzania to address issues limiting improved productivity such as fertilizer and weed management which have led to improved recommendations. Currently he is member and Vice President of Tanzania Society of sugar and cane Technologists.*

# DEVELOPMENT OF A VARIETY SELECTION DECISION SUPPORT SYSTEM: GENOTYPE X ENVIRONMENT ANALYSES AND SYSTEM VALIDATION

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## Abstract

The objective of this study was to develop a basic variety selection decision support system (DSS) for the South African sugar industry. The approach adopted considered legal aspects, cutting cycle, and structured genotype-by-environment (GxE) analyses. Data extracted from SASRI's variety trial database were categorised into different regions, harvest ages (12, 18, 24 months) and harvest seasons (early, mid, late). Restricted maximum likelihood (REML) analyses were conducted within regions to determine varietal adaptability to different harvest ages and seasons. Varietal adaptability to different yield potential conditions was determined using the site regression technique, and was interpreted from the slope of the regression curves. Highly significant variety x harvest age and variety x season interactions allowed for the appropriate categorisation of varieties. The analysed data were used to create simple 'yes/no' matrices, which were housed within a relational database. A web interface linked to the database allows users to specify characteristics of their production environment. The V-Choice™ system then selects appropriate varieties that conform to specified criteria and eliminates non-compliers in a stepwise approach. The system was subsequently validated against expert extension specialist opinion, where the number of choices made by experts was compared to corresponding selections made by the DSS. The results showed acceptable performance (84% success rate) by the DSS. The system is currently implemented as a web-based application and is planned to form the framework of a more comprehensive system that will include environmental factors and actual yield data to assist with variety selection.

*Keywords:* sugarcane, variety, decision support system, genotype-by-environment

## ***Biography: Sanesh Ramburan***

*Sanesh Ramburan currently holds the position of Scientist (Varieties) at the South African Sugarcane Research Institute. His research focuses on variety evaluation by conducting multi-environment trials throughout the sugar industry to characterise varietal responses to environmental conditions and management practices. He was previously employed as a Researcher by the Agricultural Research Council – Small Grain Institute, where his work focused on cultivar evaluation and plant growth regulator responses. He is the author of several peer-reviewed scientific articles and popular publications, and holds an MSc. from the University of Kwa-Zulu Natal. His current research interest includes the interpretation of genotype x environment interactions in sugarcane.*

# MULTIVARIATE REPEATED MEASURES: A STATISTICAL APPROACH FOR ANALYSING DATA DERIVED FROM SUGARCANE BREEDING VARIETY TRIALS

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## Abstract

Data from plots in sugarcane breeding variety trials are collected for several variables over several sequential crop cycles, creating a multivariate repeated measures (MRM) data structure. The MRM analysis accounts for correlations between variables (multivariate) and correlations between crop-years (repeated measures) when computing experimental errors. Currently, univariate analysis (split-plot in time) is used to analyse the data. This approach ignores the correlation between variables and the correlation between crop-years, assuming independence between variables and between crop-years. The assumption of independence could produce incorrect estimates of experimental errors and that could lead to incorrect interpretations. The objectives of this study were to demonstrate the use of MRM analysis on sugarcane breeding variety trial data by determining multivariate effects, covariance structure for crop-years, and comparing univariate to MRM analysis. Data for yield (cane and stalk dry matter), quality (ERC % cane and fibre % cane) and agronomic (stalk height and diameter) traits were collected from 16 genotypes planted in four blocks at Mkwesine location and five blocks at Triangle location, and harvested over eight crop-years. The UN@CS covariance structure was chosen because it used fewer parameters than UN@UN and produced lower Akaike information Criterion (AIC) and Bayesian Information Criterion (BIC) than UN@AR(1). The MRM produced better model fit than univariate analysis for yield traits and height leading to greater statistical efficiency. The MRM analysis produced greater discrimination of the differences between experimental genotypes and the control cultivar than univariate analysis for yield traits. The univariate method was adequate for quality traits.

*Keywords:* sugarcane, varieties, multivariate repeated measures, univariate, mixed model, model fitness

## ***Biography: Marvellous Zhou***

*Dr Marvellous Zhou is a Senior Plant Breeder and Plant Breeding Project Manager at SASRI. Before joining SASRI, he was a Plant Breeder at the Zimbabwe Sugar Association Experiment Station and later PhD Research Fellow in the Sugarcane Genetics Laboratory at Louisiana State University. He graduated from the University of Zimbabwe with a BSc Agriculture Honours, MSc Agriculture from the University of Natal, Masters of Applied Statistics and PhD (Plant Breeding and Genetics) from Louisiana State University.*

# INTEGRATING AGRONOMIC AND ECONOMIC PRINCIPLES THROUGH APPLICATIONS OF VARIETY TRIAL DATA: THE ILLOVO CASE STUDY

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## Abstract

Variety recommendations are conventionally based on agronomic principles, while the economic implications of such variety replacements are often overlooked. This case study describes the methodology and outcomes of an integrated agronomic and economic variety recommendation study in the South African sugar industry. The variety disposition of four miller-cum-planter estates belonging to Illovo Sugar Limited was evaluated, with the aim of limiting any single variety to a maximum of 30% of an estate's total area under cane. Field records describing topography, soil characteristics, and variety disposition were provided for each estate. A variety trial database at SASRI was restructured and aligned to field record spreadsheets from the estates (soil group, harvest age, region), and the RV yields of the existing varieties under specific conditions were estimated from trial data. Estate managers and Extension Specialists developed an alternate variety disposition based on individual field characteristics, agronomic suitability of varieties, and the 30% limitation. For each field, the economic implications (R/ha) of switching between existing and recommended varieties were calculated based on average RV yields from SASRI trials. Examples of differential varietal responses under different scenarios are illustrated and discussed. The results showed that conforming to the 30% limitation resulted in isolated economic losses associated with changing dispositions on some estates. Alternatively, when varieties producing only positive economic gains were chosen as replacements, the 30% limitation was exceeded on most estates. Also, new varieties gave greater economic returns in terms of average RV yields per hectare compared to existing commercial varieties. The practical implications of rapid variety shifts are outlined and discussed in the context of pest and disease risks and limited information on new varieties. The principles demonstrated in the study will be applied to other studies involving variety performance and recommendations.

*Keywords:* sugarcane, yields, variety, trial data, economic evaluation

### ***Biography: Sanesh Ramburan***

*Sanesh Ramburan currently holds the position of Scientist (Varieties) at the South African Sugarcane Research Institute. His research focuses on variety evaluation by conducting multi-environment trials throughout the sugar industry to characterise varietal responses to environmental conditions and management practices. He was previously employed as a Researcher by the Agricultural Research Council – Small Grain Institute, where his work focused on cultivar evaluation and plant growth regulator responses. He is the author of several peer-reviewed scientific articles and popular publications, and holds an MSc. from the University of Kwa-Zulu Natal. His current research interest includes the interpretation of genotype x environment interactions in sugarcane.*

## **NOVACANE<sup>®</sup> AS A TOOL FOR RAPID PROPAGATION OF MATERIAL FOR THE SASRI PLANT BREEDING PROGRAMME**

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### **Abstract**

The South African Sugarcane Research Institute (SASRI) Plant Breeding Programme evaluates new sugarcane germplasm for pest and disease resistance and performance in a range of environmental conditions. The time taken for selection and release of a commercial cultivar is 11-16 years. One of the bottlenecks in the breeding process is the length of time required to produce sufficient material for both evaluation (selection) and final-stage propagation (bulking) as a result of the propagation ratio (eight plants from a single sugarcane stalk). NovaCane<sup>®</sup> is a technique for the rapid multiplication of sugarcane via *in vitro* culture. In this study, plantlet production after five months varied between 800 and 2,400 per apical meristem depending on the genotype, representing an average propagation ratio of 1:1,600. NovaCane<sup>®</sup> is currently being used to eliminate Sugarcane Yellow Leaf Virus enabling transfer of high potential genotypes from northern to southern regions of the South African sugar industry. This technique also has the potential to (i) reduce the propagation stages of the plant breeding selection programme, (ii) reduce time-frames for generation of regional information on pre-release genotypes, (iii) eliminate disease and simultaneously multiply imported sugarcane in the quarantine facility and (iv) supply larger volumes of material for either mill area bulking plots or for export to countries with which SASRI has cultivar agreements.

*Keywords:* sugarcane, propagation, plant breeding, NovaCane<sup>®</sup>, *in vitro* culture

### **Biography: Gwethlyn Meyer**

*Gwethlyn Meyer obtained her MSc from the University of KwaZulu Natal, Durban and has been part of the Tissue Culture team within Biotechnology, CBRC at SASRI for the past 15 years. Her core interests are genetic modification and in vitro micropropagation of sugarcane. She has been a member of SASTA since 1994 and has published 3 short communications in previous SASTA Proceedings*

# ENHANCING SMALL-SCALE GROWER SUSTAINABILITY THROUGH INSTITUTIONAL CHANGE

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## Abstract

Growers operate in a commodity market where survival is dependent on high volume, low cost production. In this environment, small-scale growers are potentially the most severely affected, due to small farm sizes and market failures. In Mpumalanga, small-scale sugarcane growers farm on communal land. It is difficult for growers to increase scale due to the communal property rights regime, and land area is limited by soil type and water rights. Growers therefore have declining incomes from a fixed area, which impacts on their ability to invest and undermines their incentive to farm. The result is that yields and net farm incomes have declined to the point where grower sustainability is threatened. This issue has been exacerbated by growers operating in groups where they depend on one another for on-going investment and maintenance of common irrigation infrastructure. Group schemes are often plagued by high transaction costs and ‘free riding’ which makes compliance and sanction difficult.

A grower-miller initiative was launched to address the sustainability challenges facing small-scale cane growers in Mpumalanga. The project aims at improving grower sustainability by introducing predictable institutional changes that are supported by growers at irrigation project level. Institutional changes identified include growers consolidating into co-operatives, facilitation of land rental transactions and management agreements. Governance is a key factor, and irrigation projects are being reconstituted to ensure greater accountability and transparency at project level. This paper describes institutional changes and methodologies used to date. Lessons learnt from this process have implications for all small-scale growers.

*Keywords:* small-scale growers, tenure reform, sugarcane, sustainability, institutional change

## ***Biography: David Thomson***

*Dr David Thomson is manager of Tsb Sugar’s Land Reform Unit. He graduated with a PhD in Agricultural Economics from the University of KwaZulu-Natal in 1996. Since graduating he has worked extensively in the cane growing and land reform sectors. Prior to taking up his position at Tsb Sugar, he was General Manager of Inkezo Land Company. Key projects at Tsb Sugar include project management of the Small-Scale Grower Sustainability Project and ensuring sustainable land reform in Tsb cane supply areas.*

# ANALYSIS OF SMALL-SCALE GROWER RETURNS IN MPUMALANGA: TENANT FARMERS OR SUSTAINABLE PRODUCERS?

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## Abstract

Small-scale grower (SSG) production in Mpumalanga province of South Africa has declined dramatically since the 2000/01 season. Tsb Sugar Ltd provided 811 consolidated remittance advice slips from the 2003/04 to 2006/07 seasons for analysis to obtain an insight into SSG financial returns. The results are indicative of the growers' annual cash trading account, and are expressed per unit of gross production to enable comparison. Results indicate that the sustainability of the sector is questionable, with 30% of growers reliant on industry financial grants to generate a remuneration surplus. Scale economies do exist in the sector and a direct positive relationship exists between yield and unit returns. A grower's choice of financial institution's terms of trade has a significant impact on unit returns. Results show that declining yields may be a product of a reduced incentive to invest, brought about by continued poor terms of trade. Specific policy recommendations include improving performance by consolidating areas to take advantage of scale economies and increasing yields, and increasing the institutional savings to enable growers to ratoon their crops. Returns can be further improved, and sustainability enhanced, by restructuring current debt levels through lobbying financial institutions for debt restructuring.

*Keywords:* small-scale growers, unit returns, scale economies, incentive

## ***Biography: Justin Murray***

*Justin Murray is the Grower Affairs Manager for the Mpumalanga Cane Growers Association and is based in Malelane, Mpumalanga. He completed his undergraduate studies at Rhodes University and completed his MComm (economics) at the University of Cape Town in 2006. Although Justin has a particular interest in labour market issues he has an interest in broader development issues and intends exploring opportunities for social entrepreneurship in the Sugar Industry. This is Justin's third congress.*

## FINANCIAL MANAGEMENT OF FARMERS' ASSOCIATIONS FOR SMALL-SCALE GROWERS: LESSONS FROM THE MALELANE MILL CANE COMMITTEE

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### Abstract

There has recently been a lack of participation in projects aimed at small-scale farmers in the Malelane Mill Area. The authors believe that this problem is being experienced throughout the sugar industry. Investigations conducted by the Canegrowers Grower Support Officer indicated that a lack of institutional capacity at project level, to successfully and sustainably manage financial affairs, has contributed to the collapse of the small-scale projects. The ineffective management of communal accounts was a cause for concern, as 'free riding' was evident. Some growers were subsidising others.

To strengthen and tighten financial control, it was imperative to provide technical and material support to the project leadership. This was achieved by facilitating compulsory induction training on institutional governance and basic financial management to the project clerks and chairpersons. This was aimed at capacitating the leadership and promoting accountability.

Clerks were provided with a template to capture monthly expenditure and balance against bank statements. The Mill Cane Committee (MCC) administrator captures the individual project templates and supervises this process monthly, and the MCC retains copies for record purposes.

The implementation of these measures had a positive impact, as it immediately exposed growers who defaulted in paying their association charges. The project chairpersons are now able to present the consolidated financial report at the grower meetings and at the annual general meeting (AGM). The improved accountability by the leadership has minimised delays in routine maintenance and conducting emergency repairs.

*Keywords:* sugarcane, small-scale farming, agricultural projects, institutional capacity, financial management, leadership

### ***Biography: Vincent Qwabe***

*Vincent Qwabe is a Grower Support Officer for South African Cane Growers Association, and is based in Malelane Mpumalanga. He is a small scale sugar cane grower and has been a chairman of Malelane MCC. He has interest in empowering small scale growers to become financial independent. This is Vincent's first congress.*

## ECONOMIC CONTROL OF CYNODON: A THEORETICAL STRATEGY FOR EMERGING SUGARCANE FARMERS

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### Abstract

This paper focuses on the economics of reclaiming weed-infested sugarcane and offers a step-wise strategy to increase the area of well-managed sugarcane for emerging farmers. It uses a worst-case weed infestation scenario, where fields have been infested with *Cynodon dactylon* (L.) Pers. (cynodon). Information on input costs and returns calculated from several trials have been used to show that, although a slow process, progress with cynodon control and subsequent yield improvements can be made. Emerging growers often cannot afford to replant a full hectare in one season; two replanting strategies are therefore proposed. Firstly, by scaling down operations so that systematic weed control and replanting one hectare is accomplished in 0.1 ha units. Secondly, by subsequently scaling up control and replanting operations, with a gradual expansion from one hectare to approximately 15 hectares. This is considered by some to be a more viable area for small scale sugarcane production. Planting a dry bean cash crop during the enforced fallow period, and, later, subsidised seedcane were effective in offsetting sugarcane replanting costs. It is concluded that effective cynodon control can be achieved by emerging farmers, without the financial burden of replanting their entire farm in one season.

*Keywords: Cynodon dactylon, sugarcane, dry beans, emerging farmers*

### **Biography: Peta Campbell**

*Dr Peta Campbell is a senior researcher at the South African Sugarcane Research Institute (SASRI). She received her PhD from the University of KwaZulu-Natal, Pietermaritzburg in 1991, after studying the reproductive potential of a major forestry weed. Prior to this appointment, she worked for 20 years at the Plant Protection search Institute (Agricultural Research Council) as an agricultural researcher and project leader. Current research focus involves developing integrated control strategies for creeping grasses and improving minimum tillage recommendations. She is the author of 20 peer-reviewed publications, around 55 popular publications, and is a fellow of the South African Weed Science Society.*

## **ELECTRICITY TARIFF INCREASES: THE IMPACT ON IRRIGATORS?**

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### **Abstract**

Until recently the cost of electricity in South Africa was arguably rated amongst the cheapest in the world. However, there have been recent tariff increases, including 14.2% effective from 01 April 2008, 34.4% effective from 01 July 2008 and a further 33.6% increase on 01 July 2009. In addition, a 25% increase each year over the next three years starting on 01 April 2010 was approved subsequent to this study. The hypothesis investigated in this communication was that the increase in electricity tariffs has impacted substantially on the profitability of farmers and poses a serious threat to irrigators. The *Irriecon V2* decision support tool was used to quantify the impact of the electricity tariff increases. A semi-permanent sprinkler irrigation system, capable of delivering 48 mm on a 10 day cycle, was designed for a 60 ha block. Heatonville weather data for the 1998/99 cropping season were used in the *ZIMsched 2.0* model to generate a soil water balance with realistic irrigation applications. The cost of electricity for the simulated irrigation applications was then determined for the past three electricity tariff increases for the Landrate, Ruraflex and Nightsave Rural options. The electricity bill for the 60 ha field would have increased from R74,889 to R134,971 on the Landrate option. Similar increases were obtained for the Ruraflex and Nightsave Rural options.

*Keywords:* irrigation, electricity tariffs, irrigation operating expenses

### ***Biography: Ashiel Jumman***

*Ashiel Jumman is currently employed by the South African Sugarcane Research Institute (SASRI) as a Researcher: Agricultural Engineer. Ashiel obtained his MSc. Engineering degree from the University of KwaZulu-Natal under the supervision of Dr. Neil Lecler and Dr. Aiden Senzanje. The title of Ashiel's MSc. dissertation was "A framework to improve irrigation design and operating strategies in the South African sugarcane industry". During the course of his MSc. studies, Ashiel authored/co-authored 5 papers at the SASTA (2008 & 2009), SANCID (2008) and SABI (2009) conferences. Ashiel also served as an Agriculture Engineer with the KwaZulu-Natal Provincial Department of Agriculture and Environmental Affairs (DAEA) for 2 years prior to registering for his MSc. degree. Ashiel is a very passionate and energetic young man who thoroughly enjoys working in the field of irrigated crop production.*

**Poster SUMMARY**

**THE REVAMPED SASRI WEATHER DATA SERVICE**

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**Abstract**

Weather plays a key role in determining sugarcane crop growth and water use. High quality weather data is essential for effective sugarcane research and production management. This poster reports on the revamping of the South African Sugarcane Research Institute (SASRI) weather data service.

A survey was conducted to determine user perceptions regarding current products and preferences for future products. This assisted in the design of improved data collection, transfer and processing procedures, in the development of new products and in repackaging existing products.

Currently, the SASRI weather station network consists of 41 automatic stations (AWS) and eight manual stations (MWS) that record daily rainfall, solar radiation or sunshine duration, temperature, wind speed and air humidity. Daily rainfall is also recorded at an additional 106 rainfall stations. AWSs are owned by various role-players and operated and maintained either by SASRI (25) or by the Agricultural Research Council Institute of Soil, Climate and Water (ARC-ISCW) (16). Data from AWSs are downloaded daily, while data from other stations are obtained monthly via post or email, or are uploaded through the new website. Data are automatically screened and corrected for inconsistencies and gaps, before they are stored in an Oracle database. Weather driven crop parameters such as reference evapotranspiration, soil water content and stalk growth rate are calculated and stored.

Products are now delivered mainly through a new website (Oracle Portal) directly from the database. Users can view or download maps, reports and data files in standard or user-specified formats. The poster describes these products in more detail and highlights the advantages of the new service.

*Keywords:* weather data, weather station, evapotranspiration, rainfall, website

***Biography: Abraham Singels***

*Dr. Abraham Singels is principal agronomist with the South African Sugarcane Research Institute. He has a Ph.D. in Agricultural Meteorology from the University of the Free State, where he also worked as lecturer. His fields of interest are the development and application of mathematical models and computer tools to support research and management of crops (sugarcane) and natural resources. He has been member of SASTA since for more than 10 years and has published numerous scientific papers (including 32 at SASTA). He holds honorary appointments with University of Pretoria and University of KwaZulu-Natal.*

# DEFICIT IRRIGATION: A STRATEGY TO COUNTERACT ESCALATING ELECTRICITY TARIFFS AND WATER SHORTAGES

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## Abstract

In the context of water shortages, rapidly escalating electricity tariffs and increasing strain on farmers to remain profitable, deficit irrigation strategies have become increasingly more attractive. Deficit irrigation strategies aim at reducing water applications in order to reduce water and electricity costs. The hypothesis is that reductions in costs and gains in irrigation efficiency would offset the loss in revenue from yield penalties due to water stress. In addition, water savings could potentially be used to increase the area under irrigation and further increase the benefit. In this study, a computer-based decision support framework was used to assess a number of deficit irrigation strategies for the Heatonville area in KwaZulu-Natal. It was assumed that a semi-permanent sprinkler irrigation system, capable of applying 48 mm in a 10-day cycle was in use. Hence, to simulate a realistic and implementable scenario, deficit strategies that made use of the 'existing hardware' were developed, simulated and assessed. Strategies included 'fixed cycle' irrigation versus optimally scheduled irrigation versus altering stand times to reduce and keep irrigation applications outside of costly electricity peak periods. The results indicate that the cost of yield loss was too great to be offset by cost savings from water and electricity tariffs. Deficit irrigation proved beneficial when water savings were used to increase the irrigated cane area, where additional land was available. Substantial increases in relative profits were realised when the irrigated cane area was increased. Potential to increase profits while using scarce resources conservatively was an encouraging outcome.

*Keywords:* deficit irrigation, sugarcane, water use efficiency, off-peak pumping, profit optimisation

## **Biography: Ashiel Jumman**

*Ashiel Jumman is currently employed by the South African Sugarcane Research Institute (SASRI) as a Researcher: Agricultural Engineer. Ashiel obtained his MSc. Engineering degree from the University of KwaZulu-Natal under the supervision of Dr. Neil Lecler and Dr. Aiden Senzanje. The title of Ashiel's MSc. dissertation was "A framework to improve irrigation design and operating strategies in the South African sugarcane industry". During the course of his MSc. studies, Ashiel authored/co-authored 5 papers at the SASTA (2008 & 2009), SANCID (2008) and SABI (2009) conferences. Ashiel also served as an Agriculture Engineer with the KwaZulu-Natal Provincial Department of Agriculture and Environmental Affairs (DAEA) for 2 years prior to registering for his MSc. degree. Ashiel is a very passionate and energetic young man who thoroughly enjoys working in the field of irrigated crop production.*

SHORT COMMUNICATION

**OPTIMISING IRRIGATION SCHEDULING OF PORTABLE OVERHEAD SYSTEMS: A SIMULATION STUDY**

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**Abstract**

Irrigation scheduling aims to minimise yield loss and water wastage. Scheduling decisions for portable overhead (dragline) systems are complex because one irrigation cycle lasts several days and soil water content (SWC) can vary considerably within a field. The MyCanesim irrigation scheduling system accounts for this by comparing simulated SWC of different positions in the field with depletion thresholds that are determined from soil water holding capacity and the expected evapotranspiration during the current irrigation cycle. The aim was to investigate the impact of different depletion thresholds on simulated irrigation, water wastage, cane yield and profitability under dragline irrigation.

Results suggest that higher economic margins, and less irrigation and water wastage can be obtained on shallow soils in a humid climate by reducing depletion thresholds. It is recommended that depletion thresholds be automatically adjusted in the MyCanesim system by taking into account soil water holding capacity, drainage properties and long-term mean rainfall-evapotranspiration differences.

*Keywords:* irrigation scheduling, crop model, evapotranspiration, soil water depletion, drainage, cane yield

***Biography: Aresti Paraskevopoulos***

*Aresti Paraskevopoulos is a scientific programmer at SASRI. He received his BscHons in applied Mathematics with Computer Science at the University of KwaZulu Natal in 2002, and a teaching degree from UNISA in 2004. He worked for a short while as a programmer-consultant doing simulation studies for various industries through ITE-C in Durban. More recently he moved to SASRI where he works on the My Canesim model and irrigation advice system, as well as their Crop Forecasting system. This is his third year at SASRI.*

# INFLUENCE OF CLIMATE DATA QUALITY ON THE ACCURACY OF SOUTH AFRICAN SUGARCANE YIELD ESTIMATES

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## Abstract

The Canesim model uses climate data to estimate sugarcane production at homogeneous climate zone (HCZ), mill and industry levels in the South African sugarcane belt. This is important for scheduling harvest and mill operations and for marketing purposes. The objective of this study was to investigate the link between the quality of climate data input and the accuracy of yield estimates from two versions of the model, namely a simple version driven primarily by evapotranspiration (ET) and a more sophisticated version driven primarily by solar radiation (Srad). A second objective was to test whether improvements in the estimation of solar radiation from sunshine duration would improve the accuracy of yield estimates.

The quality of Srad and ET data for the period 1980 to 2002 was quantified based on whether it was measured or estimated, and on the proximity of recording site to application site. Two types of Srad estimates were evaluated, namely a previously calibrated industry standard and a method calibrated for cloudiness and site. The accuracy of yield estimates was determined by comparing estimates to detrended actual yield data at mill and industry levels for the period 1980 to 2002.

The study found that the accuracy of ET-based yield estimates was better than that of pre-recalibration Srad-based estimates (industry error of 4.6% compared with 5.6%), corresponding to the differences in quality between ET and Srad data. However, it could not be demonstrated that the quality of climate data influenced the accuracy of yield estimates. The recalibration of Srad estimates reduced the error of Srad-based industry yield estimates by 0.9%. It is recommended that the recalibrated Srad estimations and the two versions of the model be used in combination to improve the accuracy of the Canesim sugarcane production forecasts for the South African sugar industry.

*Keywords:* yield estimate, climate data, quality, accuracy, solar radiation, evapotranspiration

## ***Biography: Pillemon Sithole***

*Pillemon is an Agrometeorologist with the South African Sugarcane Research Institute (SASRI). He completed his MSc in Agrometeorology with the University of Zimbabwe in 2005 and worked briefly with the Zimbabwe Sugar Association before joining SASRI in 2007. He is currently studying towards his PhD in Agrometeorology with the University of Free State (UFS) under the supervision of Dr. Abraham Singels of SASRI and Prof Sue Walker of UFS. His study involves the evaluation and development of solar radiation estimation methods with a view to improve water use and yield forecasts in the South African sugar industry.*

# NUTRITION OF THE SOUTH AFRICAN SUGAR CROP: CURRENT STATUS AND LONG-TERM TRENDS

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## Abstract

The sugarcane crop has a high demand for nutrients due to its rapid growth rates, high biomass production and the appreciable nutrient removals in harvested material. Information contained in leaf and soil analytical databases of SASRI's Fertiliser Advisory Service (FAS) was used to assess fertility trends in the South African sugar industry. Leaf data suggest that nitrogen (N) deficiency is a widespread growth limitation, with ~36% of samples submitted from the various extension regions being deficient in N. Soil test data indicate that phosphorus (P) supply is adequate in the majority of soils; indeed, many of the soils are classified as containing high P levels, which raises concerns in terms of the potential for ground and surface water pollution. Exchangeable potassium (K) reserves in many of the topsoils in the dryland areas are low in terms of crop requirements, possibly making it necessary for the crop to scavenge below the plough layer to meet K requirements. As noted in earlier nutrient surveys of the industry, low pH and associated calcium (Ca) and magnesium (Mg) deficiencies are pervasive problems in the dryland areas. Large differences in leaf silicon (Si) levels were noted between irrigated and dryland production areas, and a need for an effective strategy to address the widespread Si deficiency in dryland areas is emphasised.

*Keywords:* FAS database, soil acidity, nitrogen, phosphorus, potassium, silicon

## ***Biography: Michael van der Laan***

*Michael van der Laan is the Systems Modeller at the South African Sugarcane Research Institute. He received his BSc(Agric) Agronomy in 2003 and his MSc(Agric) Agronomy in 2006 from the University of Pretoria. In 2009 he completed his PhD thesis titled 'Development, testing and application of a crop nitrogen and phosphorus model to investigate leaching losses at the local scale'. His research focussed on leaching of nitrogen and phosphorus from the root zone of agronomic cropping systems and developing predictive capability to further address and mitigate such losses. Since 2006, Michael has worked on several Water Research Commission projects involving the technology transfer of an irrigation scheduling computer model, non-point source pollution from agriculture, the use of wetting front detectors to improve irrigation and fertilization management practices, and sustainable biosolid land application and co-disposal strategies. He is currently involved in several projects at SASRI which entail the use of measurement and modelling to improve our understanding of sugarcane production systems.*

# CHALLENGES AND OPPORTUNITIES IN LEAF NUTRIENT DATA INTERPRETATION

MILES N

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## Abstract

Leaf analysis is an important diagnostic tool in the management of the nutrition of sugarcane. The Critical Nutrient Concentration (CNC) and Diagnosis and Recommendation Integrated System (DRIS) are the most commonly used methods of interpreting leaf nutrient data. Principles upon which these interpretive approaches are based are briefly considered. Attention is drawn to the impacts of variety, crop age and moisture stress on leaf nutrient concentrations, and the potential for incorrect interpretations where these factors are not taken into account. Data from field trials are presented to demonstrate potential pitfalls in the interpretation of leaf analyses where more than one nutrient is limiting. Restricted growth arising from a severe deficiency of one particular nutrient may result in deficiencies of other nutrients being masked in the leaf concentration data.

Interactions between nutrients in terms of their uptake by plants may markedly impact on the diagnostic process. In the case of sugarcane, N x K and N x S interactions are of particular significance, with seasonal variations in K uptake adding to the difficulties associated with the interpretation of leaf K data. The pivotal role of N in yield optimisation and its importance in the leaf-analysis diagnostic process imply an urgent need for a more rigorous approach to establishing N critical levels in sugarcane. In particular, there is a requirement to take into account decreases in the critical N% with increasing biomass (crop age), as has been done successfully for a range of other crops.

*Keywords:* leaf analysis, DRIS, critical nutrient concentrations, nutrient ratios, multiple deficiencies, nutrient interactions

## ***Biography: Neil Miles***

*Dr Neil Miles is currently a senior scientist with the South African Sugarcane Research Institute. Prior to his position with SASRI, he spent 28 years with the KZN Department of Agriculture, as a research scientist and research manager. He has sixteen papers as senior author in refereed scientific journals and one book chapter. His particular interests are crop nutrition and soil health.*

## NITROGEN RESPONSES AND NITROGEN USE EFFICIENCY OF FOUR SUGARCANE VARIETIES IN MPUMALANGA

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### Abstract

Nitrogen recommendations for sugarcane are currently based largely on responses of variety NCo376 in the various bioclimatic regions of the industry, together with an estimate of the nitrogen (N) mineralisation potential of the soil. However, previous studies suggest that commercial varieties differ in their N use efficiency, thus indicating a need for variety-specific N recommendations (Meyer *et al.*, 2007). A nitrogen response trial using varieties N19 and N32 was conducted at the Komati Research Station in Mpumalanga during the period 2001 to 2007. In 2007, a similar trial was established on the Komati farm using varieties N25 and N36. Nitrogen was applied at three rates: zero N, 50% and 100% of the Fertiliser Advisory Service (FAS) recommendation.

In the first experiment, N19 was found to be less responsive to N than N32, with there being a relatively diminished response in the case of N19 from the second to the highest N level. In contrast, in most trial years, N32 responded continuously to N up to the highest application level. These patterns of response were supported by data from N balance measurements: N32 required more N to achieve maximum sucrose yield, whereas for N19, N losses increased markedly at the highest N rate. Preliminary data from the second experiment (plant and 1st ratoon crops) suggest that N36 is more responsive to N than N25.

In these trials, yields from the zero N treatments were remarkably high, ranging from 80 to 145 tons cane/ha), and indications are that this was attributable to high N amounts mineralised from the former virgin soil and, to some extent, to high N levels in the irrigation water. Both these effects would account for the generally low responses to N fertilisation in the trials, and demonstrate the importance of accounting for all possible N sources as part of the N balance.

*Keywords:* nitrogen, fertiliser, varieties, responses to N, N losses, N sources, N mineralisation

### ***Biography: Annett Weigel***

*Dr Annett Weigel is a German soil scientist who is working at present in SASRI's crop nutrition and soils department. She made her PhD in agronomy at the Martin-Luther University in Halle, former East Germany, in 1992. After her graduation she worked for the Environmental Research Centre Leipzig-Halle, dealing with Soil Organic Matter, its role for soil fertility and its interaction with the nitrogen cycle. From 1998 to 2006 she was engaged with the Saxony-Anhalt Environmental Protection Agency in the Department Soil protection and waste management with the objective of implementing the German soil protection act. During her time at SASRI she is again involved in projects dealing with Carbon and Nitrogen dynamics of soils with major focus on soil sustainability and improvement of Nitrogen use efficiency.*

## THE USE OF TWINN (NITROGEN FIXING BACTERIA FOR NON LEGUMES) AS AN ALTERNATIVE SOURCE OF NITROGEN FOR SUGARCANE PRODUCTION

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### Abstract

Inorganic fertilizers are the most widely used sources of nitrogen (N) in Sugarcane production. However these sources are not very efficient as they are prone to such losses as volatisation and leaching, besides causing soil acidity. This short communication reports on the preliminary results obtained from field trials setup at Nakambala Sugar Estate in Zambia to establish whether TwinN, a freeze dried N fixing microbial inoculants (Endophytes bacteria), could be used as an alternative and efficient source of N that could lead to a cut back on inorganic N usage. The trial design was a 3 x 3 Randomised Complete Block Design (RCBD) and was repeated at three sites, each with a different soil type. Combinations of double applications of TwinN plus 50% and 35% cut backs on standard N (standard N = 140kgN/ha ) were compared with a no TwinN and no N cut back (standard fertilizer regime) treatment. The preliminary results obtained so far show that at 95% confidence level there is no statistical difference in the stalk elongation and thickness of three treatments. The field trials at the time of reporting had not been harvested to analyse yield parameters. However, by random sampling, preliminary yield trend obtained indicate higher yield for treatments with a combination of TwinN and inorganic fertilizer, in comparison with 100% Inorganic fertilizer with no TwinN.

*Keywords:* Endophytes, Nakambala, Nitrogen, Sugarcane, TwinN.

### *Biography: Emmanuel Simwinga*

*Emmanuel Simwinga is a Field Technical Manager – Head of Agronomy section with Zambia Sugar Plc, an Illovo group subsidiary based in Mazabuka – Zambia. He started with Zambia Sugar as a management trainee in 2001, and then later appointed to be an Agronomist, a position he held until his current 2007. He holds a Bachelor of Science degree in Agricultural Sciences from the University of Zambia, obtained in 2000. He did the senior certificate course in Sugarcane Agriculture in 2003 from South Africa Research Institute (SASRI) – Durban. This is his first SASTA presentation.*

SHORT COMMUNICATION

## THE EFFECT OF A TRASH BLANKET ON THE ENERGY BALANCE OF A SUGARCANE CROP: PRELIMINARY RESULTS

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### Abstract

Although crop responses to plant residue layers (trash blanket) are well documented, mechanisms are poorly understood. The partitioning of the available energy at the crop surface is important, as it affects the microclimate and drives processes such as crop water use and growth. This communication gives preliminary results of attempts to quantify the impact of a trash blanket on the energy balance and its effects on crop microclimate, water use and growth.

*Keywords:* residue layer, soil temperature, surface renewal, eddy covariance, irrigation

### ***Biography: Francois Olivier***

*Francois Olivier is an Irrigation Scientist employed by the South African Sugarcane Research Institute and is based at the Mpumalanga Research Station situated close to the town of Komatipoort. He received his Masters degree from the University of Pretoria in 1997 and is currently registered for a PhD at the University of KwaZulu-Natal. He specialises in soil-plant-atmosphere relationships and has a keen interest in instrumentation and crop modelling.*

## CHARACTERISING THE FACTORS THAT AFFECT GERMINATION AND EMERGENCE IN SUGARCANE

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### Abstract

Good germination is a basic requirement for successful sugarcane production. To predict crop emergence and manage early crop development it is necessary to understand the factors that affect germination and early growth. The minimum temperature for bud germination used in the CANEGRO and APSIM crop models is 10°C, based on leaf emergence studies. As the base temperature for emergence for South African cultivars has not been documented previously, a study was initiated to examine the effect of temperature, soil moisture, soil fertility and seed lot on the emergence of cultivars NCo376, N16, N27 and non-fertilised N27. Carefully selected setts were planted in trays filled with soil of 0, 7 and 21% clay content, in glasshouse cubicles which were set at 30°C, 25°C, 20°C and 15°C respectively. A set of planted trays was kept dry while the rest was irrigated according to evaporative demand.

Bud emergence from a 60 mm planting depth peaked at 14, 22 and 56 days in the 30, 25 and 20°C cubicles, respectively. Germination in the 15°C environment was very poor and could not be used to determine base temperatures. Using linear extrapolation of the response to temperature, the results indicated that emergence did not take place below 18.1°C for NCo376, 17.8°C for N16 and 16.8°C for N27. Seedcane of unfertilised origin germinated significantly more poorly than that of fertilised origin and sets planted in fertilised soil demonstrated significantly higher emergence counts ( $p=0.05$ ) compared to unfertilised soil. Setts planted in sun-dried soil did not grow roots or show signs of bud swelling and differentiation.

Results from this study may help explain the poor emergence under cool winter conditions or poor ratoonability experienced under trash. Results also indicated differences in cultivar sensitivity, and the methodology could be used to screen for better adaptation to the cooler Midlands or southern production areas.

*Keywords:* sugarcane, base temperature, cultivars, soil type, seed lot, soil moisture

### ***Biography: Michiel Adriaan Smit***

*Dr Michiel Smit did his undergraduate studies at the University of the Free State and received a PhD in Crop physiology from Purdue University, USA in 1986. He has been with the South African Sugarcane Research Institute since 2001. His research focuses on crop physiological and phenotypical response to climate, soil and crop management practices.*

## AN APPLIED APPROACH TO SUGARCANE HARVEST SCHEDULING DECISION SUPPORT

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### Abstract

The authors present an approach to applied decision support research and development for the sugar industry. The approach consists of a series of steps designed to ensure the accuracy, user-friendliness and usefulness of a decision support system for harvest scheduling while keeping development resource demands at a minimum. Brief mention is made of a case used to verify the soundness of the approach, involving actual tactical sugarcane harvest scheduling. The main decision support aim of the study – from a development methodology perspective – is achieving the end-user requirement of complete sensitivity towards multiple complex factors such as the effects of various stalk borers and other pests, lodging, varying degrees of frost, accidental fires and partial harvesting. The stages of the approach are information gathering and initial modelling, first validation and reformulation under end-user cooperation terms, final modelling stage and a final validation stage.

*Keywords:* sugarcane, harvest scheduling, research approach, decision support systems

### ***Biography: Carel Bezuidenhout***

*Carel Bezuidenhout is an Associate Professor and the SASRI research fellow in the School of Bioresources Engineering and Environmental Hydrology at the University of KwaZulu-Natal. Starting at SASRI, Carel has worked in a research capacity in the sugar industry since 1996. His research to date involved crop modelling, transport, supply chain systems, infrastructure design and harvesting systems optimisation.*

## ADSORPTION OF ATRAZINE AND HEXAZINONE IN A SUGARCANE SOIL AMENDED WITH COAL FLYASH

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### Abstract

The sugar cane industry in Mauritius uses 400 000 tonnes of coal for cogeneration during the intercrop season to optimize the viability of the enterprise. In so doing, 20 000 t/annum of coal ash are produced and have to be judiciously disposed of, with minimal risk to the environment. Agricultural recycling of these wastes is deemed to be the most sensible option for its disposal. However, when 100 t/ha of coal flyash were applied to sugarcane soil, a higher proliferation of weeds was observed than when only NPK fertilizers were used. This therefore suggests that herbicides were being effectively adsorbed by the flyash, thereby reducing significantly their potency in soil. For this reason, the adsorption of atrazine and hexazinone (concentration of solutions equivalent to their recommended rates), on a mixture of soil and coal flyash added to reflect application rates of 100 t/ha was studied using batch equilibrium. The results showed that coal flyash, because of its higher surface area, adsorbed more herbicides than the soil. It also had a higher affinity for atrazine and hexazinone with sorption coefficients ( $K_L$ ) of 3.13 for atrazine and 7.69 for hexazinone as opposed to 0.09 for atrazine and 0.13 for hexazinone, with soil only. These results imply that coal flyash reduces the transfer of herbicides to groundwater; however, to control weeds more frequent applications or three times the recommended dose of hexazinone (1.2 kg a.i/ha) and 10 times the recommended dose of atrazine (2.4 ka a.i/ha) will have to be used.

*Keywords:* herbicide, sorption, weed control, waste recycling, crop production, isotherm

### ***Biography:*** Aneeza Soobadar

*Dr Aneeza Soobadar is a graduate in Biology and Environmental Sciences from the University of Mauritius and has an MSc in Molecular Biology and Genetic Manipulation from the University of Sussex, UK. She joined the Mauritius Sugar Industry Research Institute in 1997 and since then she has been participating actively in the research alternatives to mineral fertilizers in sugarcane production. For the research on the re-use of coal/bagasse ash and vinasse in sugarcane, she received a doctorate degree from the University of Avignon in France. The communication she is presenting today is part of that research she did for the doctorate degree.*

## A RUNNING GRASS CONTROL STRATEGY THAT IS WORKING

SUTHERLAND D B

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### Introduction

Situated in the mistbelt of KZN inland from Stanger is Langespruit Estate, owned by Crookes Brothers Ltd since 1978. Prior to sugarcane being established, sections of the estate were planted to pastures for a dairy herd and other areas were planted to coffee. These were later converted to sugarcane lands, and it was in these areas where what was initially a friendly pasture grass soon developed into an enemy of epic proportions as it staked its claim on what was now very productive cane land. The enemy is a running grass with the reputation of being able to make a grown farmer cry, and was identified with the help of many specialists in the field as *Digitaria abyssinica*. The grass started in small patches where it had not been eradicated completely, and rapidly spread throughout the fields. By 2006, the area that had been reclaimed by the grass amounted to 160 ha of the 808 ha estate. Thus almost 20% of highly productive land was out of production due to this grass. This obviously had severe implications on the profitability of the farm and something had to be done.



**Figure 1. The enemy: *Digitaria abyssinica*.**

### Infestation levels

As can be seen in Figure 2, large portions of the fields became totally invaded by the running grass with no sugarcane able to grow at all.



**Figure 2. Digitaria Infestation levels in the fields.**

### **Initial control**

Initial control consisted of hand weeding and trusting that, as the cane canopy developed, it would restrict growth. This, however, was not effective at all and the grass continued to spread. In 2003 a decision was taken to reduce the harvest cycle from 18 months to an annual cut cycle. This resulted in an even more rapid spread of the grass, as it was more frequently exposed to sunlight and fertiliser. From then on, hand weeding stopped and the grass was treated with glyphosate, albeit only once per season. This was also not effective and the grass continued to spread rapidly, with runners being able to grow to a length of one metre in a few weeks. Soon patches appeared where the cane was totally overgrown by the grass (see Figure 2, left hand photo).

From 2004 the intensity of treatment was increased, and the patches were marked with flags and resprayed several times during a season. The result of this was that more and more cane was being sprayed out with the grass, and patches with no cane were increasing in size (see Figure 2, right hand photo). This resulted in the 160 ha previously mentioned being out of production.

It was found that it was taking up to three seasons of repeated spraying with glyphosate during the warmer months to get the grass under control, but even then it was not eradicated completely. By then fields such as Field 1 were more than 50% covered by running grasses. Another approach was required.

### **Fallowing and green manures**

In 2006 the first experiment was introduced with fallowing fields that were more than 40% covered by running grasses. This was brought in under the guidance of the then General Manager, Mr Gavin James, and the Farm Manager, Garth Cunningham. The first field to be treated in this way was Field 1 on Sprinz section. The field at that stage had more than 50% running grasses (Figure 3).



**Figure 3. Running grass in Field 1.**

The field was taken out of production in 2006 and after repeated glyphosate sprays was planted to various summer green manure crops, namely sunn hemp, sorghum and velvet beans (Figure 4). Sunn hemp proved to be the best and has become the summer crop of choice.



**Figure 4 Summer green manure crops in Field 1.**

The summer crops were followed by a winter crop of black oats, which was chosen as it forms a thick canopy and has an allelopathic effect on other grasses (Figure 5).



**Figure 5. Black oats in Field 1.**

The field was then replanted to sugarcane in August 2007 and was harvested in December 2008. The results were fantastic, with Field 1 yielding 93.3t/ha in 2008 at 14.9 months and 91t/ha at 11.2 months in 2009 (Figure 6).



**Figure 6. The results in Field 1.**

All old ratoons and fields that have more than 30% running grass are now treated in the same way as Field 1.

The young ratoons and fields where the grass was present but not yet severe were the next challenge, as it was found that waiting for the cane to grow enough to spray glyphosate was not working. As can be seen in Figure 2, the grass soon becomes taller than the cane. This results in more cane being killed and the grass still spreading rapidly. Various trials were done with other products but nothing gave the required solution. Finally hand weeding after harvest was tried to ensure that the grass did not grow too high to be sprayed. The idea was to keep the grass short

until the cane grew tall enough. The problem was that this required weeding every two to three weeks and required too many units. An experiment was tried using gramoxone after the grass had been weeded and as soon as it started to shoot again. This proved to be successful and added the final element to the strategy.

### **Conclusion**

The two-fold strategy being implemented is as follows:

- 1) Young ratoons
  - a) Grass is hand weeded after harvest.
  - b) All grass patches are marked with flags so they can be seen once the cane is up.
  - c) Grass is sprayed repeatedly with gramoxone as soon as new growth occurs (can be every three weeks)
  - d) When the cane is tall enough and the lower leaves have dried after the gramoxone sprays, glyphosate is then sprayed.
  - e) Glyphosate is repeatedly sprayed on any grass regrowth.
  - f) All field edges, roads and breaks are sprayed with glyphosate to ensure no encroachment from outside the field.
  - g) At replant, strategy 2) is utilised.
  
- 2) Old ratoons
  - a) Fallowed, with sunn hemp planted in summer and black oats in winter.
  - b) Running grasses sprayed repeatedly with glyphosate in the field, edges and breaks.
  - c) Sugarcane re-established.
  - d) Follow-up operations are meticulous and any running grass is weeded out with vine hoes and removed in bags. This is done in the plant crop and ratoons.

An extremely important factor in this strategy is never to allow the grass the opportunity to grow, but to continually keep it under pressure using hand weeding or spraying.

So finally after much pain, suffering, blood, sweat and tears a strategy has been put together that is so far proving to be successful in the fight against this species of running grass. We remain hopeful that a 'wonder product' will be developed that will eradicate the problem grass with one spray and without harming the cane but, until such time, we will continue to fight valiantly. As Winston Churchill so aptly put it, "*We shall fight in the fields and in the streets (cane breaks), we shall fight in the hills; we shall never surrender.*"

### ***Biography: David Sutherland***

*David Sutherland is currently employed by Crookes Brothers Limited as the General Manager of their Coastal operations. He obtained a BSc Honours in Agricultural Production from the University of Kwazulu Natal, Pietermaritzburg in 1990. Since then he has been involved in various farming operations where he has gained experience in agricultural management well as in the field of Agronomy.*

# IMPACT OF SUGARCANE THRIPS, *FULMEKIOLA SERRATA* (KOBUS) (THYSANOPTERA: THIRIPIDAE) ON SUGARCANE YIELD IN FIELD TRIALS

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## Abstract

Two field trials were conducted on the South African Sugarcane Research Institute (SASRI) research farm at Gingindlovu to study the effect of sugarcane thrips, *Fulmekiola serrata* (Kobus) (Thysanoptera: Thripidae) on various parameters relating to sugarcane yield. Stalk yield components measured were: cane (grams/stalk); sucrose (grams/stalk); Brix % dry matter; purity %; dry matter % cane; fibre % cane; Brix % cane; Pol % cane; ERC % cane. Stalk characteristics measured were: mean stalk length (cm); number of stalks per plot; and stalk diameter. Final yields were assessed as tons cane/ha and tons sucrose/ha. The experiment design allowed comparison between *F. serrata* numbers in untreated sugarcane and sugarcane treated with the insecticide, imidacloprid. *F. serrata* numbers were significantly lower in treated sugarcane. Yield reductions attributable to *F. serrata* infestations of between 18.0 and 26.8% (tons cane/ha) and between 16.2 and 24.0% (tons sucrose/ha), were measured in these trials.

*Keywords:* sugarcane thrips, *Fulmekiola serrata*, Thysanoptera, stalk characteristics, yield, imidacloprid

## **Biography: Mike Way**

*Mike Way is an Entomologist at SASRI involved with researching various aspects of sugarcane pests of sugarcane. His main focus is monitoring and ecology of arthropod communities and understanding their role in sugarcane crops and surrounds as a means towards the development of sustainable area-wide integrated pest management (AW-IPM) strategies for the key sugar pests.*

**THE PRESENCE OF *WOLBACHIA* IN *ELDANA SACCHARINA* WALKER  
(LEPIDOPTERA: PYRALIDAE):  
IMPLICATIONS FOR BIOLOGICAL CONTROL**

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**Abstract**

*Wolbachia* is a maternally-inherited endoparasitic bacterium infecting many different insect species. It causes phenotypic changes resulting in mating disruptions in its host insect populations. There is thus much interest in the potential of *Wolbachia* as a biological control agent. *Eldana saccharina* (eldana) is well known for its damaging effects on South African sugarcane. It has been sampled from various African countries (Tanzania, Uganda, Kenya, Ethiopia, Benin, Mozambique) and different locations within South Africa (KZN Midlands, Transkei, Limpopo, Richards Bay, Mount Edgecombe). At its putative centre of origin in Central/East Africa and in south-eastern Africa, eldana has not reached pest status in its natural host plant species. The presence or absence of *Wolbachia* in these different eldana populations has been established by PCR amplification of *Wolbachia*-specific DNA sequences. *Wolbachia* was found to be present in eldana from Uganda, Tanzania and Kenya only. Eldana colonies from Tanzania and Kenya have been established at SASRI. Test matings conducted between *Wolbachia*-positive males from Tanzania and *Wolbachia*-negative females (SASRI lab colony) revealed that the fertility of the mating was almost half that of *Wolbachia*-positive females (Tanzania) and *Wolbachia*-negative males (SASRI lab culture). These preliminary results suggest that *Wolbachia* causes cytoplasmic incompatibility in infected males, thereby reducing the number of viable progeny produced. DNA sequence analysis of *Wolbachia*-positive individuals established that all eldana populations tested were infected with the same *Wolbachia* genotype, supergroup A.

*Keywords:* *Wolbachia*, *Eldana saccharina*, biocontrol, PCR, cytoplasmic incompatibility

**Biography: Lauren Martin**

*Lauren Martin is a Microbiologist at SASRI. She joined the research institute in 2006 as a Masters student investigating the biochemical and microbiological changes in sugarcane stalks during a simulated harvest-to-crush delay. In March 2008 she was employed in her current position as Assistant research officer in Pathology. She is involved in a broad range of projects ranging from the molecular detection and investigation of insect endoparasites, to investigations into sugarcane rust diversity.*

## IDENTIFICATION OF HERBIVORE INDUCED PLANT VOLATILES FROM PUSH-PULL PLANTS AND *FUSARIUM* SPECIES: AIDS FOR THE MANAGEMENT OF *ELDANA SACCHARINA* WALKER (LEPIDOPTERA: PYRALIDAE) IN SUGARCANE?

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### Abstract

The stalk borer *Eldana saccharina* continues to be the most serious pest in the sugarcane industry and research into integrative pest management strategies is ongoing. This study investigates the impact of plant and fungal derived volatiles on the behaviour of *E. saccharina* in sugarcane. The push plants chosen for this study were the grasses *Melinis minutiflora* and *Brachiaria humidicola*. Plant entrainment studies and analyses of compounds released have shown that the volatiles 4,8-dimethyl-1,3,7-nonatriene (DMNT), hexenyl acetate,  $\beta$ -caryophyllene, methyl salicylate and 4,8,12-trimethyl-1,3,7,11 tridecatetraene (TMTT) are common to both grasses. These volatiles are well recognised plant stress signals, which are usually released by a plant as a consequence of insect herbivory. However, *M. minutiflora* and *B. humidicola* are emitting volatiles without incurring any insect damage. In addition to plant volatiles, it appears that endophytic fungal volatiles are also effective repellents and attractants of *E. saccharina*. In previous behavioural experiments, first instar larvae have found *Fusarium sacchari* to be repulsive and *Fusarium pseudonygamai* attractive. Both *Fusarium* species emit the volatiles 4-heptanone; 1,2,3-trimethylbenzene; 2-pentyl furan; t-butyl isobutyl ketone; 4-ethyl-3-methyl phenol; 6-methyl-3,5-heptadiene-2-one; 4-ethyl-1,2-dimethoxy benzene; spiro[4.5]dec-7-ene; 1H-3a,7-methanoazulene. In addition to these volatiles, *F. pseudonygamai* produces 3-nonanone and *F. sacchari* emits styrene.

**Keywords:** push-pull plants, endophytic fungi, volatiles, insect chemical ecology, *Eldana saccharina*

### **Biography: Dr Sumita Ramgareeb**

*Sumita has recently been appointed to the position of resource manager for the Plant Breeding and Field Unit. She was awarded her doctorate at the University of KwaZulu-Natal in the field of applied plant biotechnology in 2005. Sumita has initiated, managed and participated in various research projects in the Variety Improvement and Crop Protection programmes since joining SASRI in 2004. She was awarded the Rothamsted International fellowship in 2009. The fellowship enabled Sumita to hone her skills in the field of insect chemical ecology and to engage with international collaborators on this project. The work in this presentation was initiated during the course of the fellowship while she was based at the Natural Resources Institute, University of Greenwich, Kent.*

***FUSARIUM* SPECIES CAUSING POKKAH BOENG AND  
THEIR EFFECT ON *ELDANA SACCHARINA* WALKER  
(LEPIDOPTERA: PYRALIDAE)**

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**Abstract**

Pokkah boeng is a fungal disease that can cause serious yield losses in susceptible varieties. Pokkah boeng is caused by *Fusarium*, but there is some debate regarding the species involved. Previous research has revealed that some *Fusarium* species isolated from sugarcane could benefit the development of the stalk borer, *Eldana saccharina*, a serious pest of sugarcane in South Africa. The aim of this research was to isolate and identify the causal organism of pokkah boeng and to determine the effect of the isolates on the development of *E. saccharina*. Eight representative isolates were inoculated into pokkah boeng susceptible varieties N34 and N41. Typical pokkah boeng symptoms were evident after three weeks. Isolates inoculated into the pot trial and the isolates obtained from inoculated, symptomatic plants were identified as *F. sacchari*, *F. proliferatum* and *F. andiyazi*. The isolates were included in *E. saccharina* diet and olfactory choice assays. When compared to controls in the dietary inclusion assays, three isolates were considered to be antagonistic (two identified as *F. andiyazi* and one as *F. proliferatum*) to *E. saccharina*, with the mean mass of surviving larvae being significantly lower than the controls. In this study, no isolates resulted in significantly greater larval mass than the controls. Results from the olfactory choice assays suggested that all isolates were attractive to *E. saccharina*, with significantly more larvae feeding on inoculated maize kernels than the uninoculated controls.

*Keywords:* sugarcane disease, stalk borer, disease control, pokkah boeng, *Eldana saccharina*

***Biography: Pavithra Govender***

*Pavithra Govender is a Quarantine and Disease Diagnostic Technician in the Pathology department at the South African Sugarcane Research Institute (SASRI). She started working at SASRI 5 years ago during which time she has obtained a Bachelor of Technology in Biotechnology from the Durban University of Technology. Her current area of work involves the use of Microbiological and Molecular techniques to diagnose various viral, fungal and bacterial pathogens that are present in sugarcane.*

**EFFECTS OF SILICON AND PLANT DEFENCE INDUCERS ON SUGARCANE YIELD PARAMETERS, *ELDANA SACCHARINA* WALKER (LEPIDOPTERA: PYRALIDAE) AND *FULMEKIOLA SERRATA* KOBUS (THYSANOPTERA: THIRIPIDAE)**

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**Abstract**

Substantial evidence now exists for the beneficial effects of silicon (Si) fertilisation on sugarcane yield and in suppressing stalk borer infestation. Pot trials were used to examine the interactive effects of soil supplied Si and foliar sprays of the plant defence inducers, *cis*-jasmonate (JA) and Bion® (a synthetic analogue of salicylic acid) on plant resistance to the borer *Eldana saccharina* Walker (Lepidoptera: Pyralidae) and thrips, *Fulmekiola serrata* Kobus (Thysanoptera: Thripidae), as well as on yield and cane quality components. Silicon reduced borer survival and damage, but had no effect on thrips numbers. Jasmonic acid and Bion had no consistent effects on *E. saccharina* or thrips, either alone or in combination. Silicon treatment increased cane biomass, which translated into higher sucrose g/stalk. Factors contributing to increased biomass were greater internode length (and therefore stalk height), stalk width and tillering. In the plant and ratoon crop of trial ESI 2 the combined JA+Bion/Si- treatment produced lower cane and sucrose g/stalk than the JA+Bion/Si+ treatment. Notwithstanding the greater biomass of Si+ cane, infection of the plant crop of trial FSI 1 with sour rot resulted in significantly lower ERC% cane in Si+ cane compared with Si- cane, and consequently no gain in terms of sucrose g/stalk. There was evidence that Bion decreased yield. The interaction between Si+ and JA+Bion suggests that soluble, rather than amorphous Si, played a physiological role in increasing yield.

*Keywords:* induced resistance, silicon, sucrose yield, biomass, stalk borer, thrips

***Biography: Malcolm Keeping***

*Dr Malcolm Keeping is a senior entomologist at SASRI, having moved across from academia to SASRI in 1994, and has since been engaged in research on plant resistance to pests and more lately in the role of silicon in increasing plant resistance and yield.*

## INTEGRATED WEED MANAGEMENT FOR SUGARCANE FIELD VERGES: *MELINIS MINUTIFLORA* AND *CYNODON DACTYLON* ENCROACHMENT

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### Abstract

Creeping grasses are considered the most costly weeds in the South African sugar industry, drastically reducing yields and, in extreme cases, even killing the sugarcane crop. *Cynodon dactylon* commonly encroaches into fields from surrounding areas, e.g. cane breaks and roadsides, requiring frequent and costly encroachment control. Measures for controlling the weed involve mechanical mowing and/or repeated chemical treatment with glyphosate, paraquat plus diuron, and imazapyr. An innovative solution may involve planting of a non-invasive, strongly aromatic tufted grass, *Melinis minutiflora*. In previous work in habitat management field trials against *Eldana saccharina*, a potential added benefit of this grass was the observed strongly competitive interaction between it and *C. dactylon*, especially where a *M. minutiflora* ‘barrier hedge’ was planted on field margins. Following this, more detailed work involved comparing biomass of these two grass species where they occurred together. In trials at Port Shepstone and Mount Edgecombe, results indicated that biomass of *C. dactylon* was severely or completely suppressed under *M. minutiflora*, which had formed an effective barrier against this weed and prevented encroachment into the field. *M. minutiflora*, in return, did not encroach into the adjacent sugarcane. Recommendations are being formulated to include using *M. minutiflora* as part of an integrated strategy to better manage *C. dactylon*.

**Keywords:** sugarcane, *Cynodon dactylon*, *Melinis minutiflora*, weed control, grass weeds

### **Biography: Des Conlong**

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