

# Tuesday 18<sup>th</sup> July: Opening and Plenary Sessions

**09:00 – 11:00**

**Opening Session ..... 1**

The Contribution of Technology to the Economic Progress in South Africa  
Dr Adi Paterson ..... 2

Biofuel Options for RSA  
Mr Manny Singh..... 3

**11:30 – 13:00**

**Plenary Session One..... 4**

Eighty-First Annual Review of the Milling Season in Southern Africa (2005-2006)  
Davis S B and Achary M..... 5

Fuel Cells, Fuels and Future Energy  
Purchase B S..... 6

A Survey of Value Addition in the Sugar Industry  
Walford S N and Morel du Boil P G ..... 7

**14:00 – 15:40**

**Plenary Session Two: Joint Factory and Agriculture Session: Transport  
and Mechanisation I ..... 8**

CAPCONN, An Integrated Supply Chain Model Framework: Development  
and Demonstration  
Stutterheim P, Bezuidenhout C N and Lyne P W L ..... 9

The Complexities of Introducing the FREDD Vehicle Scheduling System into the  
Darnall Mill Area  
Giles R C, Dines G R, Lyne P W L and Bezuidenhout C N ..... 10

Incorporation of Sugarcane Harvesting and Transport Variables into a Sugarcane  
Harvest and Transport Scheduling Model  
Jorio R, Legendre B, Gautz L and Abdellaoui R ..... 11

Performance of Onboard Weighing Systems on Sugarcane Transport Vehicles  
Cole A K, Baier T and Lyne P W L ..... 12

**16:10 – 17:45**

**Plenary Session Three: Joint Factory and Agriculture Session: Transport  
and Mechanisation II..... 13**

Evaluation of the Illovo Mechanical Cane Cutter  
Langton M, Smithers J C, Bezuidenhout C N and Lyne P W L..... 14

Soil Compaction Decision Support  
Marx B J, Bezuidenhout C N, Lyne P W L and van Antwerpen R..... 15

An Approach towards the Derivation of a Reference Traffic Season for Sugarcane in  
South Africa to Manage Soil Compaction  
Bezuidenhout C N, Schulze R E, Marx B J, Maharaj M, Hull P J and Lyne P W L..... 16

Simulation Model to Reduce the Impact of Rain Stops and Breakdowns on Sugarcane  
Harvesting, Transport and Crushing System Performances  
Jorio R, Legendre B, Gautz L and Abdellaoui R ..... 17

# Wednesday 19<sup>th</sup> July: Agriculture Session

## 09:00 – 10:05

### **Agriculture Session 1: General Agriculture and Breeding ..... 18**

Selection and Management of Varieties through the Felixton Seedcane Scheme Fortmann R R, Brenchley P G and Mathew A K .....	19
The Impact of Trashing on Yield Response in the South African Sugar Industry: A Summary of Results from Several BT Trials van Antwerpen R, Meyer J H and Thompson G D .....	20
Preliminary Observations on Sugar Beet ( <i>Beta vulgaris saccharifera</i> ) Growing at Mumias, Kenya Mutonyi J, Chebosi P K and Maguge F .....	21

## 10:40 – 12:00

### **Agriculture Session 2: Crop Physiology and Modelling..... 22**

The Effect of Row Spacing on Inter-Row Competition in Sugarcane Smit M A and Singels A.....	23
An Investigation on the Utility of the Sunscan Ceptometer in Estimating the Leaf Area Index of a Sugarcane Canopy Chiroro D, Milford J and Makuvaro V.....	24
A Quantitative Study of Water Stress Effect on Sugarcane Photosynthesis Koonjah S S, Walker S, Singels A, van Antwerpen R and Nayamuth A R.....	25
Modelling Trash Management and its Impacts: Model Performance van den Berg M, Jones M and van Antwerpen R.....	26

## 14:00 – 15:30

### **Agriculture Session 3: Water Management..... 27**

Australian Sugar Industry Response to Water Price Increases Danzi E .....	28
Estimates of Regional Scale Water Use for Sugarcane in South Africa Bezuidenhout C N, Lecler N L, Gers C and Lyne P W L .....	29
Application of a Catchment-Scale Irrigation Systems Model Lecler N L, Moulton N and Smithers J C.....	30
The Effect of Plant Residue Layers on Water Use and Growth of Irrigated Sugarcane Olivier F C and Singels A .....	31
Drying off Sugarcane on Soils with Low Water Holding Capacity Olivier F C, Donaldson R A and Singels A.....	32

**16:00 – 16:50**

<b>Agriculture Session 4: Poster Session.....</b>	<b>33</b>
A Successful Methodology for the Establishment of an Extension Programme in a Small Grower Area Gillespie W A and Mitchell F J .....	34
Modelling Trash Management and its Impacts: Methodology Jones M and van den Berg M .....	35
Use of Laptops and PDAs in the Field Collection of Survey Data on <i>Eldana saccharina</i> (Lepidoptera: Pyralidae) in Sugarcane Kuppen J P and Leslie G W .....	36
Attraction of <i>Eldana saccharina</i> (Lepidoptera: Pyralidea) to Certain <i>Fusarium</i> Isolates in Olfactory Choice Assays McFarlane S A and Rutherford R S.....	37
Incidence of <i>Fulmekiola serrata</i> (Thysanoptera: Thripidae) in South African Sugarcane Way M J, Leslie G W, Keeping M G and Govender A.....	38

# Wednesday 19<sup>th</sup> July: Factory Session

**08:45 – 10:15**

**Factory Session 1: Engineering: Diffusers..... 39**

A Review of Cane Diffusion at Sezela and Umzimkulu Sugar Factories  
Munsamy S S and Bachan L ..... 40

The Effect of Clay Type Soil in the Diffuser at Umfolozi Mill  
Rama S, Dehrmann R A, Zungu H and Sweet D G..... 41

First Impressions of ADI Chain Installed in the Amatikulu Diffuser  
Rein M, Smith L, Strachan B and Wirminghaus R ..... 42

**10:45 – 12:15**

**Factory Session 2: Energy and Electrical ..... 43**

Load Flow Study for Nchalo Mill  
Chakhwantha S G ..... 44

Power Factor Correction used to Release System Capacity for Co-Generation at  
Umzimkulu Mill  
Myeni Z S ..... 45

Why do we Continue to Burn so Much Coal?  
Reid M J ..... 46

**14:00 – 14:20**

**Factory Session 3: Factory Posters..... 47**

Evaluation of the Berthold Technologies Microwave Probe  
Mitchell G E and Springer H K ..... 48

Survey on the use of Starch Hydrolysing Enzymes in South Africa  
Schoonees B M..... 49

**14:20 – 15:35**

**Commercial Session ..... 50**

ZUKA - The New Range of Radically Improved Batch Centrifugals from Fives Cail  
Pilot G..... 51

Improved Factory Operation with Quality Management Information  
von Pannier C and King S ..... 52

Microwave Measurement Technology: New Applications in Sugar Production for the  
Measurement of Density, Total Solids and Concentration (e.g. Brix)  
Theisen K H..... 53

# Thursday 20<sup>th</sup> July: Agriculture Session

**08:30 – 10:15**

**Agriculture Session 5: Special Focus on Eldana ..... 54**

First Records of the Stem Borer Complex (Lepidoptera: Noctuidae; Crambidae; Pyralidae) in Commercial Sugarcane Estates of Ethiopia, their Host Plants and Natural Enemies Assefa Y, Conlong D E and Mitchell A .....	55
Impact on Yield Due to Early and Late Phase Infestation by <i>Eldana saccharina</i> (Lepidoptera: Pyralidae) Goebel F R and Way M J .....	56
Differences in Mitochondrial DNA and Fertility of Crosses between Populations of <i>Eldana saccharina</i> (Lepidoptera: Pyralidae) from Kenya and South Africa: Possible Evidence for Cryptic Species? Assefa Y, Conlong D E and Mitchell A .....	57
Habitat Management using <i>Melinis minutiflora</i> (Poaceae) to Decrease the Infestation of Sugarcane by <i>Eldana saccharina</i> (Lepidoptera: Pyralidae) Barker A L, Conlong D E and Byrne M J .....	58
Progress in the use of Aerially Applied Fastac <sup>®</sup> (Alpha-Cypermethrin) for the Control of the Sugarcane Borer <i>Eldana saccharina</i> (Lepidoptera: Pyralidae.), and an Assessment of its Commercial Impact Leslie G W, Stranack R A and de Haas O .....	59

**10:45 – 12:30**

**Agriculture Session 6: Sugarcane Pests and Nematodes ..... 60**

A New Association: <i>Trichogramma bournieri</i> Pintureau and Babault (Hymenoptera: Trichogrammatidae) and <i>Chilo sacchariphagus</i> Bojer (Lepidoptera: Crambidae) in Sugarcane in Mozambique Conlong D E and Goebel F R .....	61
Response of <i>Goniozus indicus</i> (Hymenoptera: Bethyridae) to Sugarcane and <i>Cyperus papyrus</i> Volatiles Smith J M, Conlong D E, Byrne M and Frerot B .....	62
Recent Developments in the Control of <i>Idaecamenta eugeniae</i> (Coleoptera: Scarabaeidae: Melolonthinae) at Kinyara Sugar Works Ltd, Uganda Mugalula A, Tibakanya G and Conlong D E .....	63
Molecular Identification of South African Sugarcane White Grubs (Coleoptera: Scarabaeidae) Dittrich G, Conlong D E and Mitchell A .....	64
Green Manure Crops: Agronomic Characteristics and Effect on Nematodes Berry S and Rhodes R .....	65
Effect of Variety Combinations on Yield of Sugarcane Spaull V W, Cadet P and Berry S .....	66

**13:30 – 14:30**

**Agriculture Session 7: Special Focus on Silicon..... 67**

Silicon use for Pest Control in Agriculture: A Review

Laing M D, Gatarayiha M C and Adandonon A ..... 68

An Assessment of Soil Extraction Methods for Predicting the Silicon Requirement of Sugarcane

Kanamugire A, Meyer J H, Haynes R J, Naidoo G and Keeping M G ..... 69

Silicon and Water Stress Synergy in Resistance of Sugarcane Cultivars to the Stalk Borer, *Eldana saccharina* (Lepidoptera: Pyralidae)

Kvedaras O L, Keeping M G, Goebel F R and Byrne M J..... 70

**15:00 – 16:00**

**Agriculture Session 8: Diseases of Sugarcane ..... 71**

Fungicide Trials to Determine the Effect of Brown Rust on the Yield of Sugarcane

Variety N29

McFarlane K, McFarlane S A, Moodley D and Rutherford R S ..... 72

Fungicide Sprays to Control Brown Rust (*Puccinia melanocephala*) gave Variable Cane and Sugar Yield Responses in the South-East Lowveld of Zimbabwe

Zvoutete P ..... 73

Evaluating the Inhibitory Activity of Synthetic Anti-Microbial Peptides against *Ustilago scitaminea*, *Fusarium verticillioides* and *Eldana saccharina*

Ramgareeb S and Rutherford R S ..... 74

# Thursday 20<sup>th</sup> July: Factory Session

## 08:30 – 10:30

### Factory Session 4: Processing : Raw House Operations ..... 75

Applications of Capillary Viscometry in Cane Sugar Factories Lionnet G R E and Pillay M .....	76
Numerical Study of the Flow in Air Flotation Syrup Clarifiers Echeverri L F and Rein P W .....	77
Experiences of Massecuite Pipeline Explosions Caused by the High Temperature Decomposition of Molasses Getaz M, Archibald R D and Love D J .....	78

## 10:30 – 12:30

### Factory Session 5: Processing : Crystallisation and Centrifugation ..... 79

Automatic Measurement of Crystal Size Distribution using Image Processing Argaw G A, Alport M J and Malinga S B .....	80
Testing of Wash Water Equipment in A-Centrifugals at Felixton Mill Jaganath S H .....	81
Centrifugal Control with Automatic Colour Measurement Nielsen B C .....	82
Some Comments on the Elongation Ratio of Crystals in C-Massecuities Lionnet G R E .....	83

## 13:30 – 15:00

### Factory Session 6: Processing : Maximising Sucrose Recovery ..... 84

The Effect of some Impurities on the Target Purity Formula Davis S B and Schoonees B M .....	85
Practical Steps taken at Tongaat-Hulett Sugar Factories to Achieve Low Target Purity Differences Ninela M and Rajoo N .....	86
Crystal Recovery Efficiency: Three Years on Peacock S D and Schorn P M .....	87

## 15:30 – 17:00

### Factory Session 7: Colloquium on Crystallisation ..... 88

# LIST OF SPONSORS AND EXHIBITORS 2006

ABB South Africa  
Applied Vacuum cc  
Bartens Verlag  
Bearing Man (Pty) Ltd  
Bell Equipment  
BNC Projects (Pty) Ltd  
Bosch Projects (Pty) Ltd  
Buckman Laboratories (Pty) Ltd  
Donaldson Filtration Systems  
Elgin Engineering  
Fletcher Smith Ltd  
Illovo Sugar Limited  
Infowave (Pty) Ltd  
Kirton Mechanical Equipment cc  
Lakeside Equipment cc  
Land Resources International  
Lasec SA (Pty) Ltd  
Mecosa (Pty) Ltd  
Novozymes SA (Pty) Ltd  
Neltec  
Omnia Fertilisers (Pty) Ltd  
Peter Brotherhood Southern Africa (Pty) Ltd  
PGBI Engineers and Constructors (Pty) Ltd  
Praj Industries Ltd  
Pro-M-Tec Theisen GmbH  
SQR Software cc  
Sucrotech (Pty) Ltd  
Techserve cc  
Thomas Broadbent & Sons  
Tongaat-Hulett Sugar Limited  
Turbo Machines Field Services (Pty) Ltd  
Unitrans Sugar & Agriculture



**TUESDAY 18<sup>TH</sup> JULY**  
**OPENING AND PLENARY SESSIONS**  
**09:00 – 11:00**

**OPENING SESSION**

Chair: Roger Bailey

## THE CONTRIBUTION OF TECHNOLOGY TO THE ECONOMIC PROGRESS IN SOUTH AFRICA

DR ADI PATERSON

*Group Executive, Science and Technology Expert Services,  
Department of Science and Technology*



### Abstract

Not available at time of print

### BIOGRAPHY

*Adrian Paterson was born in Durban, South Africa on the 17th May, 1956. He is a graduate of the University of Cape Town with a B.Sc. in Chemistry and a Ph.D (Engineering). Following a period of research on ceramic materials, including a Post Doctoral year at the University of Leeds in the UK, he became Director of the Division of Materials Science and Technology at the CSIR in 1990. In 1995 he accepted an Acting position on the Executive of the CSIR and became an Executive Vice-President: Technology and Policy in 1996. He has (at different times) been responsible for Human Resources, Policy, Technology, and became the Chief Information Officer of the CSIR in April 1999. During 2000 and 2001 he was jointly the CIO of the CSIR and the University of Pretoria and served on the Executive of both institutions.*

*In October 2001 he was seconded to the Department of Arts, Culture, Science and Technology, (now the Department of Science and Technology as of 1 August 2002), as the Branch Manager (DDG) of the Science and Technology Branch. He currently fills the position of Deputy Director-General: Science and Technology Expert Services in the Department.*

*He was a member of the task team that drafted the South African Green Paper on Science and Technology in 1995. From 1998 – 2003 he served on the National Advisory Council for Innovation (NACI).*

*He has a keen interest in institutional development and has been involved in strategy and implementation of a number of significant South African institutions and initiatives. Among these, are the National Manufacturing Advisory Centre, the Innovation Hub (an initiative of the Gauteng Provincial Government) and the Innovation Fund – as the Chair of the Board of Trustees.*

*He has lectured and conducted workshops on IT strategy and the impact of the information revolution on organizations. He has been involved in the strategic management of intellectual capital, innovation and intellectual property. He has been involved in technology assessments in the UK, Europe, the United States and South Africa, and has served on numerous advisory boards.*

*He was involved in the South African delegation to the World Summit on Sustainable Development, the G77 High-Level Forum on Science and Technology and the EU-ACP Science and Technology initiatives, among others.*

*He was elected to the Academy of Science of South Africa in 1994 and to the South African Academy of Engineering in 2002.*

# BIOFUEL OPTIONS FOR RSA

MR MANNY SINGH

*General Manager, Energy Development Corporation,  
Division of the Central Energy Fund*

[mannys@cef.org.za](mailto:mannys@cef.org.za)



## Abstract

Global overview: status check

RSA Government Policy

Legal Framework

Strategic Imperatives

Economic Fundamentals

    Macroeconomic perspectives

    Stakeholder Implications

CEF Perspectives

## BIOGRAPHY

*Ramchunder (Manny) Singh is currently the General Manager of the Energy Development Corporation at the Central Energy Fund (the CEF) also forming part of executive management. His responsibilities include implementing government strategy on alternate energy into the South African economy, assisting with the establishment of SANERI and EEA (South African National Energy Research Institute and Energy Efficiency Agency), manage overseas donor funded projects, direct and manage equity investments and lead implementation plans of government for bio-fuels introduction.*

*Previously he held the position of Director: Petroleum Policy at the Department of Minerals and Energy, where he focused on Black Economic empowerment, Policy research and Analysis and Environmental Policy.*

## EDUCATION

- *Submitted completed thesis: Doctor of Business Administration, (University of Kwa Zulu Natal – Durban)*
- *Masters of Business Administration MBA Buckinghamshire (United Kingdom)*
- *B. Com (Accounting), (University of South Africa)*

## Certification & Professional Memberships

- *Certificate in Managerial Finance*
- *Certificate in Marketing Services*
- *Certificate in Petroleum Policy*

**TUESDAY 18<sup>TH</sup> JULY**  
**OPENING AND PLENARY SESSIONS**  
**11:30 – 13:00**

**PLENARY SESSION ONE**

Chair: Janice Dewar

# EIGHTY-FIRST ANNUAL REVIEW OF THE MILLING SEASON IN SOUTHERN AFRICA (2005-2006)

DAVIS S B AND ACHARY M

*Sugar Milling Research Institute, University of KwaZulu-Natal, Durban, 4041, South Africa*

[sdavis@smri.org](mailto:sdavis@smri.org)

## **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, Swaziland, Zimbabwe, Malawi, Zambia and Tanzania are included. The 2005-2006 season showed some improvement over the 2004-2005 season in terms of cane quality and cane supply. South African mill performances generally improved over 2004-2005, with better time efficiencies and lower undetermined losses. The cane crop in South Africa was slightly over 21 million tons and 2.514 million tons of sugar was made at a cane-to-sugar ratio of 8.37, an improvement over the 2004-2005 value of 8.42.

## **Biography**

*Steve Davis is the Head of the Processing Division at the Sugar Milling Research Institute. A Professional Chemical Engineer, he studied for his BSc and MSc in Engineering at the University of Natal in Durban.*

*He is currently a member of SASTA Council and the SASTA Congress Organising Committee, serving as joint Factory Programme Editor. He is also currently Chairman of the Factory Control Advisory Committee, which advises the industry on matters relating to factory calculations and performance parameters.*

*His research interests include clarification processes, colour removal from sugar juices and syrups (raw house and refinery), separation technologies and tracer testing. He has presented the Annual Review of the Milling Season in Southern Africa at the annual SASTA Congress since 2002.*

## FUEL CELLS, FUELS AND FUTURE ENERGY

PURCHASE B S

*School of Chemical Engineering, University of KwaZulu-Natal, South Africa*

[purchase@ukzn.ac.za](mailto:purchase@ukzn.ac.za)

### Abstract

The possible use of alcohols as direct fuels for fuel cells conjures up images of instantly recharging cellphones and digital cameras from hip flasks, and of alcohol-based electricity generation plants for remote villages, and perhaps, more efficient use of alcohols as motor fuels. The reality of such images is assessed and some recent developments in fuel cells are outlined. Perspectives on the future potential of a range of non-fossil energy sources are presented and related to broad energy flow scenarios in the sugar industry.

*Keywords:* fuel cells, ethanol, climate change, renewable energy, electricity, fuels

### Biography

*Dr Brian Purchase is retired but holds a part-time position in the School of Chemical Engineering at the University of Natal. His primary training was in agriculture (BSc Agric, Natal). He completed a PhD (London) in soil bacteriology, a certificate in fermentation technology (Imperial College) and a diploma in chemical engineering. His introduction to the sugar industry was on the agricultural side when he worked at SASRI on nitrogen fixation associated with cane roots. He subsequently spent 25 years at the SMRI, initially working on ethanol production from bagasse and later being Director of the Institute for 16 years.*

# A SURVEY OF VALUE ADDITION IN THE SUGAR INDUSTRY

WALFORD S N AND MOREL DU BOIL P G

*Sugar Milling Research Institute, c/o University of KwaZulu-Natal,  
Howard College Campus, Durban, 4041, South Africa*

[swalford@smri.org](mailto:swalford@smri.org) [pduboil@smri.org](mailto:pduboil@smri.org)

## Abstract

A review of the global status of value addition (other than fuel ethanol and co-generation) in the sugar industry shows that several value-added commodity chemicals are currently produced from sugar feedstocks. These include sucrose acetate isobutyrate (primarily food applications), surfactants (food and cosmetic sector), organic acids such as citric and gluconic acid (mainly food applications), lactic acid (mainly food applications but increasingly biodegradable polymer applications) and polyols (food and pharmaceutical applications). A number of products are produced on a smaller scale due to the cost of production limiting the potential market. These include polysaccharides (e.g. xanthan gum and pullulan), oligosaccharides (e.g. fructose oligosaccharides – FOS) and industrial chemicals (e.g. itaconic acid). Development of the biorefinery concept has resulted in lignocellulose feedstocks such as bagasse being targeted to produce strategic platform chemicals that have been identified as replacements for petrochemical products.

*Keywords:* value addition, biorefinery, lignocellulose feedstocks, review, platform chemicals

## Biography

*Stephen Walford is responsible for New Product development at the SMRI and is currently Acting Head of the Chemical Division. He has an MSc in Physical Organic Chemistry and is currently registered for a Ph.D. studying novel applications related to the isolation and subsequent reactions of non-sugars from sugar processing streams. Most of his recent work has been involved with chromatographic analysis and chemical reactions with particular reference to aconitic acid. He has authored and co-authored more than sixteen SASTA papers, presented at international chromatography conferences and published in journals such as the Journal of Chromatography A and International Sugar Journal.*

**TUESDAY 18<sup>TH</sup> JULY**  
**OPENING AND PLENARY SESSIONS**  
**14:00 – 15:40**

**PLENARY SESSION TWO:**  
**JOINT FACTORY AND AGRICULTURE**  
**SESSION: TRANSPORT AND**  
**MECHANISATION I**

Chair: Peter Lyne



SHORT COMMUNICATION

## CAPCONN, AN INTEGRATED SUPPLY CHAIN MODEL FRAMEWORK: DEVELOPMENT AND DEMONSTRATION

STUTTERHEIM P<sup>1</sup>, BEZUIDENHOUT C N<sup>1</sup> AND LYNE P W L<sup>2</sup>

<sup>1</sup>*School of Bioresources Engineering & Environmental Hydrology,  
University of KwaZulu-Natal, Private Bag X01, Scottsville, 3209, South Africa*

<sup>2</sup>*South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 3400, South Africa*

[200269928@ukzn.ac.za](mailto:200269928@ukzn.ac.za) [bezuidenhoutc@ukzn.ac.za](mailto:bezuidenhoutc@ukzn.ac.za) [Peter.Lyne@sugar.org.za](mailto:Peter.Lyne@sugar.org.za)

### Abstract

Sugarcane supply chain stakeholders can benefit substantially where operations are successfully orchestrated. Computer models have been used to improve supply chains, especially in forestry, and are expected to play an increasingly important role in future planning and management. Management of sugar supply chains has previously focused on generating competitive individual supply chain components. Inter-component optimisation generally disregards many important intra-component interactions, hence efficiency improvements may be significantly limited. Integrated supply chain modelling provides a suitable approach for supply chain management and planning. The aim of this paper is to demonstrate an integrated sugar supply chain model framework stretching from field to mill back-end. The research involved two primary objectives. Firstly, to develop an integrated sugar supply chain analytical framework, named CAPCONN, and secondly, to demonstrate CAPCONN during a mechanisation case study.

*Keywords:* supply chain, CAPCONN, integrated model, mechanisation

### Biography

*Peter Stutterheim is an Agricultural Engineering Graduate from the School of Bioresources Engineering and environmental Hydrology at the University of KwaZulu Natal. He is currently completing his masters degree, part of which is presented in this paper. The project serves to evaluate whether an integrated supply chain model would be of benefit to the South African sugar industry.*

## THE COMPLEXITIES OF INTRODUCING THE FREDD VEHICLE SCHEDULING SYSTEM INTO THE DARNALL MILL AREA

GILES R C<sup>1</sup>, DINES G R<sup>2</sup>, LYNE P W L<sup>3</sup> AND BEZUIDENHOUT C N<sup>4</sup>

<sup>1</sup>*Crickmay and Associates, PO Box 1165, Pietermaritzburg, 3200, South Africa*

<sup>2</sup>*New South Wales Sugar Milling Co-operative, Condong Sugar Mill, McLeod Street, Condong NSW, 2484, Australia*

<sup>3</sup>*South African Sugarcane Research Institute, Private Bag X02, Mount Edgecombe, 4300, South Africa*

<sup>4</sup>*School of Bioresources Engineering and Environmental Hydrology, University of KwaZulu-Natal, Private Bag X01, Scottsville, South Africa*

[ryan@crickmay.co.za](mailto:ryan@crickmay.co.za)

### Abstract

Compared with leading producers of good quality, low cost sugar, the South African sugarcane supply chain is still inefficient. Innovative solutions are needed if the SA sugar industry is to remain competitive and sustainable in a global environment. FREDD, which is a vehicle dispatching/scheduling programme designed in Australia, was introduced as a pilot project at the Darnall mill in late 2005. The project's objectives were to (i) customise FREDD to a South African mill, (ii) reduce vehicle cycle times, thereby reducing the number of vehicles in the fleet and maximising vehicle utilisation and (iii) synchronise the vehicle arrival rate with the mill's crush rate. During implementation, many lessons were learnt about the complexities of the supply chain and their effects on the system's efficiency. Issues that were highlighted included cane stock levels on farms, the large number of vehicle configurations, the number of grower groups, communication and communication infrastructure, real-time system monitoring and information feedback. The project showed that vehicle dispatching/scheduling can operate successfully under South African conditions, but this demands co-ordinating the supply chain from a central location. In addition, the need for buy-in and co-operation from all parties is vital in realising the significant cost savings that are possible.

*Keywords:* harvesting, vehicle scheduling, Sugar Logistics Improvement Programme, SLIP, FREDD, supply chain, transport

### Biography

*Ryan Giles has a BSc Engineering (BioResources) from The University of Natal and is currently registered for an MSc at UKZN for vehicle scheduling in the sugar industry.*

*I presently work for Crickmay and Associates Pty LTD in PMB as an engineer and Logistics consultant. I manage the Sugar Logistics Improvement Program (SLIP) providing strategic and management information to 9 of the South African and Swaziland sugar mills with the aim of increasing their efficiencies and increasing their international competitiveness.*

*I also manage the FREDD vehicle scheduling project in SA, involved in marketing and negotiations, technical aspects such as software customisation, support and maintenance, vehicle onboard computer integration and scheduling system implementation. We are presently implementing the FREDD system at two SA sugar mills, Malelane and Darnall, which is going particularly well and aim to reduce the fleets by 30% by the end of 2008.*

# INCORPORATION OF SUGARCANE HARVESTING AND TRANSPORT VARIABLES INTO A SUGARCANE HARVEST AND TRANSPORT SCHEDULING MODEL

JORIO R<sup>1</sup>, LEGENDRE B<sup>2</sup>, GAUTZ L<sup>3</sup> AND ABDELLAOUI R<sup>1</sup>

<sup>1</sup>*Institut Agronomique et Vétérinaire Hassan II, B.P. 6202-Instituts, Rabat, 10 101 Morocco*

<sup>2</sup>*LSU Ag Center Research & Extension, St. Gabriel Research Station, 5755 LSU Ag Road, St. Gabriel, LA 70776, USA*

<sup>3</sup>*Bioengineering, CTAHR, University of Hawaii at Manoa, 1955 East-West Road, AgSc 218, Honolulu, HI 96822, USA*

[r.jorio@iav.ac.ma](mailto:r.jorio@iav.ac.ma) [blegendre@agcenter.lsu.edu](mailto:blegendre@agcenter.lsu.edu)

[lgautz@hawaii.edu](mailto:lgautz@hawaii.edu) [r.abdellaoui@iav.ac.ma](mailto:r.abdellaoui@iav.ac.ma)

## Abstract

Recent changes in the national and international environments of the Moroccan sugar industry pose competitive and efficiency issues. These changes often bring into question the very survival of the Moroccan sugar industry, especially that of the mills. The search for profitability for both sugarcane and sugar beet operations becomes imperative for the long-term survival of the industry. In order to ensure profitability, the industry must focus on novel management tools for harvest and transport operations of both sugarcane and sugar beet. The harvest, transport, reception, and crushing system for both sugar crops are very important components of sugar production that require a systems approach through modelling in order to facilitate the optimal use of the resources involved.

For this study, theory of queues and simulation techniques were used that incorporate sugarcane harvest, transport, reception and crushing into a mathematical programming model to facilitate both scheduling of harvest and transport. The model was developed for the SURAC sugar mill but could be adapted to all other sugarcane and sugar beet mills operating in Morocco. SIMUL8 was identified as the appropriate software for the modelling exercise.

Model validation showed great agreement between observed and simulated results. The model without constraints was used to determine the optimal number of transport units, dispatching strategy, and daily schedules. Simulation results show that the number of transport vehicles could be reduced by 50% and, at the same time, efficiency could be improved by maximising the number of daily round trips per vehicle.

*Keywords:* harvesting, transport, scheduling, model, simulation

## Biography

*Rachida Jorio is a PhD Professor at the Institut Agronomique et Veterinaire Hassan II, Rabat, Morocco where she has been teaching Mathematics for over twenty years. She is a mathematician and civil engineer. Her Ph.D research was in agricultural engineering and dealt with the modelling of the harvesting, transporting, reception and crushing system of sugarcane in the Gharb Region of Morocco. Her work was co-supervised by professor Benjamin Legendre from Louisiana State University and Loren Gautz from the University of Hawaii at Manoa. She went on several field trips to Louisiana, Hawaii, Texas and Florida sugar mills. She is also the first prize winner of the fourth edition of the national contest of innovation, research, development and technology organised by the Moroccan Association of Research and Development (R&D MAROC. Web Cite: [www.rdmoroc.com](http://www.rdmoroc.com)).*

*She is an active member of the PROTEA project between CIRAD and INRA, France and The University of Kwazulu-Natal, SASRI in South Africa. The project is entitled: "Supply Chain Management applied to the South African Sugar Industry".*

## PERFORMANCE OF ONBOARD WEIGHING SYSTEMS ON SUGARCANE TRANSPORT VEHICLES

COLE A K<sup>1</sup>, BAIER T<sup>2</sup> AND LYNE P W L<sup>3</sup>

<sup>1</sup>*Kevarid Sugar, Postnet Suite 22, Private Bag X5516, Scottburgh, 4180, South Africa*

<sup>2</sup>*School of Bioresources Engineering & Environmental Hydrology,  
University of KwaZulu-Natal, Private Bag X01, Scottsville, 3209, South Africa*

<sup>3</sup>*South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa*

[kevard@scottburgh.co.za](mailto:kevard@scottburgh.co.za) [203505975@ukzn.ac.za](mailto:203505975@ukzn.ac.za) [peter.lyne@sugar.org.za](mailto:peter.lyne@sugar.org.za)

### Abstract

To minimise the cost of transporting sugarcane it is important to optimise the payload. Overloading the vehicle will damage the roads and the vehicle, and compromise safety. There is also the risk of prosecution. Underloading the vehicle will result in lost revenue and increased costs. There are two aspects to loading a vehicle; one is to ensure that the gross mass is correct, and the other is to ensure that the load is correctly distributed between the various axles. These objectives are difficult to achieve with a crop such as sugarcane, where the bulk density of the material varies substantially. Other industries with similar problems, such as the timber industry, have settled on load-cell based ‘onboard’ weighing systems as the only practical answer to the problem.

One year of data from a sugarcane grower and haulier in the Sezela area has been analysed to assess the suitability of using an onboard weighing system in a sugarcane haulage operation. The results have been compared with a vehicle that has an airbag suspension with a simple weighing mechanism, and a vehicle with spring suspension and no weighing system.

The conclusion is that the onboard weighing system achieves the desired load far more consistently than the airbag system, which in turn is more consistent than the spring suspension. The ability to consistently achieve maximum payloads means that the cost of the onboard weighing system can be recovered over one or two seasons.

*Keywords:* sugarcane, transport, onboard weighing, payload, overload, load-cell

### Biography

*Kevin Cole is a graduate of the University of Natal where he obtained a BSc. Engineering (Agric). He has worked for SASRI and Unitrans Sugar and now runs an agricultural operation at Braemar on the South Coast of Kwa-Zulu Natal. He is currently involved in the Sugar and Timber Industries and runs a small transport operation as well.*

**TUESDAY 18<sup>TH</sup> JULY**  
**OPENING AND PLENARY SESSIONS**  
**16:10 – 17:45**

**PLENARY SESSION THREE:**  
**JOINT FACTORY AND AGRICULTURE**  
**SESSION: TRANSPORT AND**  
**MECHANISATION II**

Chair: Peter Lyne

## EVALUATION OF THE ILLOVO MECHANICAL CANE CUTTER

LANGTON M<sup>1</sup>, SMITHERS J C<sup>1</sup>, BEZUIDENHOUT C N<sup>1</sup> AND LYNE P W L<sup>2</sup>

<sup>1</sup>*School of Bioresources Engineering & Environmental Hydrology,  
University of KwaZulu-Natal, Private Bag X01, Scottsville, 3209, South Africa*

<sup>2</sup>*South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa*

[beeh@ukzn.ac.za](mailto:beeh@ukzn.ac.za) [peter.lyne@sugar.org.za](mailto:peter.lyne@sugar.org.za)

### Abstract

Labour for sugarcane cutting in South Africa is expected to become scarce as a result of growth in the manufacturing sector and the effect of HIV/AIDS on the available workforce. Manual harvesting is often favoured or unavoidable because of steep slopes and the high costs associated with mechanical harvesting. A brush-cutter with a redesigned blade configuration, named the Illovo mechanical cane cutter, was developed and evaluated during a series of field trials. A range of system properties were measured during testing at Isonti farm on the South Coast in 2005, where the dusty working environment affected the cutter adversely, and an improved filter system was recommended. Currently, the durability of the blade is the most limiting factor and contributes significantly to costs. Blade wear occurs rapidly when cane is cut close to the ground, and an economic break-even point is needed to balance cutting height and blade replacement costs. Although the system is efficient, several areas are highlighted for further research to help curb excessive costs.

*Keywords:* mechanical harvesting, brush-cutter, cutter performance, Illovo cutter

### Biography

## SOIL COMPACTION DECISION SUPPORT

MARX B J<sup>1</sup>, BEZUIDENHOUT C N<sup>1</sup>, LYNE P W L<sup>2</sup> AND VAN ANTWERPEN R<sup>2</sup>

<sup>1</sup>*School of Bioresources Engineering & Environmental Hydrology,  
University of KwaZulu-Natal, Private Bag X01, Scottsville, 3209, South Africa*

<sup>2</sup>*South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa*

[bezuidenhoutc@ukzn.ac.za](mailto:bezuidenhoutc@ukzn.ac.za)

[peter.lyne@sugar.org.za](mailto:peter.lyne@sugar.org.za) [rianto.van-antwerpen@sugar.org.za](mailto:rianto.van-antwerpen@sugar.org.za)

### Abstract

Soil compaction caused by in-field vehicles poses a threat to optimal cane production and overall soil sustainability. Complex soil mechanics regulate compaction, and a wide range of factors, such as axle loads, soil texture and soil moisture, determine the severity of a compaction event. As a result of the complexity and sensitivity of soil compaction, managing soil compaction is difficult and few operators in South Africa base their day-to-day decisions on an estimate of damage to the soil under the current conditions. Recent research provided a modelling tool to assist in understanding the different processes and impacts that occur during soil compaction. The model, named SOCOMO, has been verified in different countries, including South Africa, and is based on sound mechanistic principles. The aim of this short communication is to demonstrate the use of this model with respect to decision support in the South African sugar industry. Users may choose to run the model on regular intervals to estimate the potential damage posed by soil compaction, or they may use static look-up tables as a quick reference. The authors make some suggestions on how to move towards operational soil compaction management. These include the use of climate forecasts and prioritising different operations.

*Keywords:* soil compaction, SOCOMO model, decision support, management, model, modelling

### Biography

*Barend Marx is currently working for Partners in Development in Pietermaritzburg. Partners in Development are civil engineering consultants and project managers that focus on rural sanitation and water supply.*

*Barend completed his BSc Agricultural Engineering in 2003 and his MSc in 2005 at the University of KwaZulu-Natal. His project involved soil compaction and some of its effects on agricultural soils. He developed a decision support tool for soil compaction management, which will be presented during this short communication.*

*Barend grew up on a tobacco farm in northern Zimbabwe, and has been in South Africa since 2000.*

## AN APPROACH TOWARDS THE DERIVATION OF A REFERENCE TRAFFIC SEASON FOR SUGARCANE IN SOUTH AFRICA TO MANAGE SOIL COMPACTION

BEZUIDENHOUT C N<sup>1</sup>, SCHULZE R E<sup>1</sup>, MARX B J<sup>1</sup>, MAHARAJ M<sup>1</sup>, HULL P J<sup>1</sup>  
AND LYNE P W L<sup>2</sup>

<sup>1</sup>*School of Bioresources Engineering and Environmental Hydrology,  
University of KwaZulu-Natal, Private Bag X01, Scottsville, 3209, South Africa*

<sup>2</sup>*South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa*

[bezuidenhoutc@ukzn.ac.za](mailto:bezuidenhoutc@ukzn.ac.za) [peter.lyne@sugar.org.za](mailto:peter.lyne@sugar.org.za)

### Abstract

Soil compaction induced by agricultural vehicles is a complex process which requires either extensive measurements or mathematical modelling to quantify the impact. One of the most sensitive and changing variables influencing the degree of soil compaction is soil moisture content, and a thorough knowledge of this variable can be useful in managing compaction. This short communication reports on attempts to link long-term simulations of soil moisture content, derived using the ACRU agrohydrological model, to simulations of soil compaction obtained using the SOCOMO model. Soil moisture content and compaction were simulated for a reference soil and a reference agricultural vehicle. The spatially reported results display a discrete traffic season, during which chances of causing severe compaction damage are significantly reduced. This reference traffic season could be used to strategically determine when vehicles should enter sugarcane fields. It must, however, be noted that the reference traffic season may need to be adjusted for different soils, vehicles, land use practices and also rainfall regimes in different seasons.

*Keywords:* soil compaction, SOCOMO model, ACRU model, soil moisture, infield traffic season

### Biography

*Carel Bezuidenhout is the SASRI Senior Research Fellow at the School of Bioresources Engineering and Environmental Hydrology at the University of KwaZulu-Natal in Pietermaritzburg. He specialises in systems modelling, focussing on agricultural and environmental issues. His Ph.D. was on sugarcane production forecasting. He is a member of the SA Institute of Agricultural Engineers and the American Society of Agricultural and Biological Engineers. Recent research focussed primarily on sugarcane and forestry issues, including transportation, climate, soils and environmental systems.*



# SIMULATION MODEL TO REDUCE THE IMPACT OF RAIN STOPS AND BREAKDOWNS ON SUGARCANE HARVESTING, TRANSPORT AND CRUSHING SYSTEM PERFORMANCES

JORIO R<sup>1</sup>, LEGENDRE B<sup>2</sup>, GAUTZ L<sup>3</sup> AND ABDELLAOUI R<sup>1</sup>

<sup>1</sup>*Institut Agronomique et Vétérinaire Hassan II, B.P. 6202-Instituts, Rabat10 101 Morocco*

<sup>2</sup>*LSU Ag Center Research & Extension, St. Gabriel Research Station, 5755 LSU Ag Road, St. Gabriel, LA 70776, USA*

<sup>3</sup>*Bioengineering, CTAHR, University of Hawaii at Manoa, 1955 East-West Road, Ag Sc 218, Honolulu, HI 96822, USA*

[r.jorio@iav.ac.ma](mailto:r.jorio@iav.ac.ma) [blegendre@agcenter.lsu.edu](mailto:blegendre@agcenter.lsu.edu)

[lgautz@hawaii.edu](mailto:lgautz@hawaii.edu) [r.abdellaoui@iav.ac.ma](mailto:r.abdellaoui@iav.ac.ma)

## Abstract

In Morocco, sugarcane is normally harvested between January and June. The rainy season also begins in January and harvesting during this period delays harvesting operations and causes cane quality problems. As a result, growers are penalised for delivering poor quality cane and the harvest is often extended beyond June. Further, the yield in the subsequent stubble crops is reduced for sugarcane fields harvested in July and August. Besides the negative effect of late harvesting on the subsequent crop yields, sugarcane, which has been harvested after June, is more vulnerable to frost damage. Other considerations include mill breakdowns, lack of co-ordination between harvesting, deliveries and crushing, these cause the stockpiling of more cane in the millyard. This leads to cane and juice deterioration and poor quality feedstock for the mills.

A computer model has been developed which could be used to evaluate different methods and to determine the optimal supply chain management which reduces the impact of rain and breakdown stoppages, thus improving overall harvesting and mill efficiency. Simulated results, compared to the ones observed, show that there can be a 68% and a 25% reduction in the average truck waiting time at the mill entrance and before unloading respectively. The average waiting time of one ton of cane before processing is reduced by 31%. The optimal strategy carried by the model, demonstrates that there is scope to not exceed the millyard capacity and not extend the harvest after June.

*Keywords:* sugarcane, rain delays, breakdowns, supply chain management, simulation model

## Biography

*Rachida Jorio is a PhD Professor at the Institut Agronomique et Veterinaire Hassan II, Rabat, Morocco where she has been teaching Mathematics for over twenty years. She is a mathematician and civil engineer. Her Ph.D research was in agricultural engineering and dealt with the modelling of the harvesting, transporting, reception and crushing system of sugarcane in the Gharb Region of Morocco. Her work was co-supervised by professor Benjamin Legendre from Louisiana State University and Loren Gautz from the University of Hawaii at Manoa. She went on several field trips to Louisiana, Hawaii, Texas and Florida sugar mills. She is also the first prize winner of the fourth edition of the national contest of innovation, research, development and technology organised by the Moroccan Association of Research and Development (R&D MAROC. Web Cite: [www.rdm Maroc.com](http://www.rdm Maroc.com)).*

*She is an active member of the PROTEA project between CIRAD and INRA, France and The University of Kwazulu-Natal, SASRI in South Africa. The project is entitled: "Supply Chain Management applied to the South African Sugar Industry".*

**WEDNESDAY 19<sup>TH</sup> JULY**  
**AGRICULTURE SESSION 1**  
**09:00 – 10:05**

**GENERAL AGRICULTURE AND BREEDING**

Chair: Kerry Redshaw

# SELECTION AND MANAGEMENT OF VARIETIES THROUGH THE FELIXTON SEEDCANE SCHEME

FORTMANN R R<sup>1</sup>, BRENCHLEY P G<sup>1</sup> AND MATHEW A K<sup>2</sup>

<sup>1</sup>*South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa*

<sup>2</sup>*Felixton Pest Disease and Variety Control Committee,  
PO Box 180, Empangeni, 3880, South Africa*

[tom.fortmann@sugar.org.za](mailto:tom.fortmann@sugar.org.za) [pat.brenchley@sugar.org.za](mailto:pat.brenchley@sugar.org.za) [felpd@saol.com](mailto:felpd@saol.com)

## Abstract

Good variety selection is the key to successful sugarcane farming. Making this choice every year can be overwhelming for the individual grower, considering that there are over 30 varieties released for use in the South African sugar industry.

In the Felixton mill supply area, the seedcane scheme is compulsory, requiring all commercial (large scale) growers to order sufficient certified seedcane to replant a minimum of 5% of their area under sugarcane each season. The certified seedcane is first planted into farm nurseries where it is bulked-up and thereafter it is planted into commercial fields. To ensure that commercial co-operators produce sufficient certified seedcane of each variety, growers have to order both the correct amount and the best variety for each field that is to be replanted, two years (seasons) in advance.

A simple method was developed to assist the Felixton growers with correct variety selection. This method takes soils, production potential, pests, diseases and variety characteristics, as well as the variety disposition on the farm at the time, into consideration and involves a visit to individual growers by the Extension Officers and the Pest and Disease Manager. Valuable feedback from growers on the characteristics and potential of the newer varieties is obtained during these visits.

The result is that new varieties entering the Felixton mill supply area are either rapidly accepted or discarded. This paper will demonstrate the value of the organised seedcane scheme to local area crop protection as well as rapid adoption of SASRI varieties.

*Keywords:* sugarcane, seedcane, seedcane scheme, varieties, variety planning

## Biography

*Tom Fortmann joined the South African Sugarcane Research Institute (SASRI) in 1980 as an extension officer based in Empangeni. He has filled the position of regional extension officer for the Zululand region since 1990. Prior to joining SASRI he worked for the Department of Agriculture after obtaining a BSc in Agriculture from Natal University and an honours degree in Agriculture Extension from the Pretoria University.*

*Tom has served on the Felixton Local Pest Disease and Variety Control Committee since its inception in 1982 where he has been closely involved with variety selection, seedcane production as well as pest and disease control.*

## THE IMPACT OF TRASHING ON YIELD RESPONSE IN THE SOUTH AFRICAN SUGAR INDUSTRY: A SUMMARY OF RESULTS FROM SEVERAL BT TRIALS

VAN ANTWERPEN R<sup>1</sup>, MEYER J H<sup>1</sup> AND THOMPSON G D<sup>2</sup>

<sup>1</sup>*South African Sugarcane Research Institute, Private Bag X02, Mount Edgecombe, 4300, South Africa*

<sup>2</sup>*43A Old Main Road, Gillitts, 3610, South Africa*

[rianto.van.antwerpen@sugar.org.za](mailto:rianto.van.antwerpen@sugar.org.za) [jan.meyer@sugar.org.za](mailto:jan.meyer@sugar.org.za)

### Abstract

During the 1960s and 1970s, Dr Gerald Thompson initiated several burning and trashing (BT) trials to complement the BT1 trial, which is well known to sugarcane scientists around the world. BT1, which is located at the South African Sugar Research Institute (SASRI) at Mount Edgecombe, was established in 1939 and is still maintained today by SASRI staff. The duration of other BT trials, which were all conducted near the coast, north and south of Durban, was only two to three years, but, unlike BT1, the results have not been widely published. Measurements in these trials were mainly of cane yield, and all crops were harvested between 1978 and 1981. Two more trashing trials were established in 2000 in the midlands, the first on a heavy soil and the second on a light red soil. The first of the two BT trials reported here is being maintained, but the latter was terminated after the first crop. The average trashed over burnt yield response for the BT1 trial is 9 tons/ha/an, and this figure is commonly used in the sugar industry to represent the response that can be expected from a trashing system. However, past internal reports at SASRI have quoted responses ranging from 25 to -23 tc/ha/an. In certain years, small responses to trashing were recorded for BT1 and in other years much higher responses. This paper summarises the results from eight BT trials, with the added objective of quantifying yield response to trashing based on rainfall and the season in which the crops were harvested.

*Keywords:* trashing, burning, rainfall, soil type, cane yield, altitude, region

### Biography

*Rianto van Antwerpen is a senior soil scientist in the Plant and Environment Resource Centre at SASRI. He obtained his PhD quantifying root growth and water uptake of sugarcane.*

*Other aspects of his past research include salinity and sodicity, tillage strategies to maximise soil quality and yield, and soil compaction.*

*Currently he is running several projects to quantify the biological, physical and chemical health of soils in the sugarcane industry, which also includes further soil compaction work, and various aspects of green cane harvesting.*

## PRELIMINARY OBSERVATIONS ON SUGAR BEET (*BETA VULGARIS SACCHARIFERA*) GROWING AT MUMIAS, KENYA

MUTONYI J, CHEBOSI P K AND MAGUGE F

*Mumias Sugar Company Limited, Private Bag, Mumias, Kenya*

[jmutonyi@mumias-sugar.com](mailto:jmutonyi@mumias-sugar.com) [pchebosi@mumias-sugar.com](mailto:pchebosi@mumias-sugar.com)

[fmaguge@mumias-sugar.com](mailto:fmaguge@mumias-sugar.com)

### Abstract

Sugar beet is a fleshy root crop processed for sugar production. It is native to temperate countries and hence has been associated with the temperate environments. The leading sugar beet producing regions include the European Union, the USA and Russia. Despite being a temperate crop, sugar beet trials have been going on in some selected tropical countries (e.g. India and South Africa).

Proponents of tropical sugar beet production argue that this would be a viable solution to problems facing sugarcane farmers in the tropics. According to David and Young (1981), sugar beet matures and is ready for harvest in 5-6 months. The short maturity period of sugar beet may result in a quick and reliable income for farmers, unlike sugarcane that matures in 18-24 months in Kenya.

Observations on two cultivars grown at Mumias have illustrated a technical potential for sugar beet production. The crop established in July 2005 (short rains season) recorded over 95% germination. It showed fair resistance to pests and diseases and the tuber sizes were within the normal ranges of those reported elsewhere. Yield estimation at 5-6 months indicated a potential of 40-47 tons/ha.

Introduction of sugar beet in Kenya would supplement sugarcane production, resulting in sugar crops diversification. This may culminate in a regular income for farmers as well as domestic sugar security.

*Keywords:* sugarcane, sugar beet, *Beta vulgaris saccharifera*, cultivars, tropics, varieties

### Biography

*Jonathan Mutonyi is a Manager at Mumias Sugar Company, the leading sugar producer in Kenya. He is an Agronomist by profession; his M.sc. from the University of Nairobi, Kenya was on high quality fodder legumes for zero- grazing.*

*He is the current Chairman of the Agriculture Division, Kenya Society of Sugarcane Technologists (KSSCT). He is a member to the International Society of Sugarcane Technologists (ISSCT). He made a Poster presentation at the 78th SASTA.*

*Much of his recent work that is earmarked for Ph.D. studies is on food security in the Mumias sugarcane zone.*

**WEDNESDAY 19<sup>TH</sup> JULY**  
**AGRICULTURE SESSION 2**  
**10:40 – 12:00**

Agriculture:  
Session 2

## **CROP PHYSIOLOGY AND MODELLING**

Chair: Abraham Singels

## THE EFFECT OF ROW SPACING ON INTER-ROW COMPETITION IN SUGARCANE

SMIT M A AND SINGELS A

*South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa*

[michiel.smit@sugar.org.za](mailto:michiel.smit@sugar.org.za) [abraham.singels@sugar.org.za](mailto:abraham.singels@sugar.org.za)

### Abstract

Knowledge of yield response to row spacing in sugarcane is contradictory and lacks understanding of the underlying mechanisms. This communication reports on an investigation into the impact of competition for light on crop development and growth for row spacings ranging from 0.63 to 2.79 m, as observed in an experiment conducted at Mount Edgecombe.

Results show that intra-row interception of radiation peaked at the same time for all row spacings, and coincided with the occurrence of peak tiller population and peak green leaf number. Green leaf number declined sharply when inter-row interception of radiation exceeded 90%, which occurred progressively later as row spacing increased. Aboveground biomass and stalk yield were affected by competition at an early stage. The information obtained in this study could be used to refine and develop new concepts for modelling the effect of row spacing.

*Keywords:* tiller population, radiation interception, yield, competition, leaf senescence, thermal time, row spacing

### Biography

*Dr Michiel Adriaan Smit principal crop scientist at the South African Sugar Research Institute. He received his PhD in Crop physiology from Purdue University, USA (1986) and has been agronomist, programme leader and assistant director with the ARC Grain crops Institute, Potchefstroom prior to his appointment at SASRI. His research currently focuses on the effects of climate and water stress on sugarcane physiology. He serves on the executive board of both the South African Society of Crop Production (SASCP) and the South African Sugarcane Industry Agronomy Association (SASIAA).*

## AN INVESTIGATION ON THE UTILITY OF THE SUNSCAN CEPTOMETER IN ESTIMATING THE LEAF AREA INDEX OF A SUGARCANE CANOPY

CHIRORO D<sup>1</sup>, MILFORD J<sup>2</sup> AND MAKUVARO V<sup>3</sup>

<sup>1</sup>*Department of Physics, Midlands State University, Private Bag 9055, Gweru, Zimbabwe*

<sup>2</sup>*Department of Physics, University of Zimbabwe, PO Box MP167, Mount Pleasant, Harare, Zimbabwe*

<sup>3</sup>*Department of Horticulture, Midlands State University, Private Bag 9055, Gweru, Zimbabwe*

[dfchiroro@yahoo.com](mailto:dfchiroro@yahoo.com)

### Abstract

The usefulness of the SunScan ceptometer in estimating the leaf area index (LAI) of a sugarcane crop canopy was investigated. This was determined by making LAI measurements with the instrument at selected points in the field, followed by destructive sampling at the same points. The two sets of data were then compared. Measurements of LAI were also taken at one point of the field at various times of day in order to determine the effect of time of sampling on the results. The SunScan ceptometer gave LAI estimates which were  $95\% \pm 2\%$  of the value that was obtained by destructive sampling. It thus appears to be useful in measuring LAI in a sugarcane crop. Measurements of LAI at different times of day showed that the best results are obtained around solar noon.

*Keywords:* leaf area index, sugarcane, SunScan ceptometer

### Biography

*Dominic Chiroro is a Physics lecturer at Midlands State University (Zimbabwe). His area of speciality is Agricultural Meteorology. Besides this research on sugarcane has also done research on the characterization of the radiation regime in a sugarcane canopy as well as the relationship between leaf area index and biomass in a sugarcane canopy.*



# A QUANTITATIVE STUDY OF WATER STRESS EFFECT ON SUGARCANE PHOTOSYNTHESIS

KOONJAH S S<sup>1</sup>, WALKER S<sup>2</sup>, SINGELS A<sup>3</sup>, VAN ANTWERPEN R<sup>3</sup>  
AND NAYAMUTH A R<sup>1</sup>

<sup>1</sup>Mauritius Sugar Industry Research Institute, Réduit, Mauritius

<sup>2</sup>University of Free State, Bloemfontein, South Africa

<sup>3</sup>South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa

[skoonjah@msiri.intnet.mu](mailto:skoonjah@msiri.intnet.mu) [walker.sci@mail.uovs.ac.za](mailto:walker.sci@mail.uovs.ac.za) [abraham.singels@sugar.org.za](mailto:abraham.singels@sugar.org.za)

## Abstract

Water scarcity is often the most common limiting factor to sugarcane production. With the ongoing climate change, the occurrence and duration of drought periods is expected to increase in the future. Water stress affects many processes linked to growth and development, among which is photosynthesis. If such effects were to be incorporated into models, it would lead to more accurate cane and sugar yield prediction. In this context, a trial was established under a rainshelter facility at Mount Edgecombe with well-watered and water-stressed sugarcane variety NCo376. The rate of photosynthesis (PN), light interception (LI), plant extension rate (PER), leaf temperature ( $\Phi_T$ ) and leaf water potential ( $\Psi_L$ ) were measured, together with the soil water potential.

Mild water stress affected PER to a relatively greater extent than LI and PN. Difference in PN between the well-watered and water-stressed sugarcane were observed when the  $\Psi_L$  of the latter reached  $-0.7$  MPa. At this stage the PN which was at  $20.0 \mu\text{mol}/\text{m}^2/\text{s}$  started to decline, reaching the lowest level of  $2.2 \mu\text{mol}/\text{m}^2/\text{s}$  at a  $\Psi_L$  of  $-1.6$  MPa. A strong correlation ( $R^2=0.97$ ) was obtained when regressing PN with  $\Psi_L$  so that for every  $0.1$  MPa decrease in  $\Psi_L$  there was a linear reduction in PN of  $1.6 \mu\text{mol}/\text{m}^2/\text{s}$ . The  $\Phi_T$  of the stressed cane was higher due to the poorer cooling effect from higher stomatal resistance and accompanying reduction in transpiration rate. Regressing the values of PN against that of  $\Phi_T$  in the range of  $25$  to  $40^\circ\text{C}$  showed that PN in the stressed crop decreased linearly by  $0.4 \mu\text{mol}/\text{m}^2/\text{s}$  for every one-degree rise in temperature. The diurnal pattern of PN in the well-watered crop followed closely the daily trend of incoming solar radiation, whereas in the stressed cane ( $-1.6$  Mpa  $\Psi_L$ ) PN was reduced to almost zero after midday. Hence, the photosynthetic efficiency of the stressed cane at  $-1.6$  MPa was  $0.22\%$  compared with  $1.09\%$  for the unstressed crop. The lower biomass accumulation in the water stressed cane was attributed to reduced LI, PER and PN.

**Keywords:** water stress, photosynthesis, leaf water potential, leaf temperature, light interception, efficiency

## Biography

*Abraham Singels has been an agronomist at SASRI since 1996. He obtained a Ph.D. in Agrometeorology from the University of the Orange Free State in 1992. He specializes in developing crop models for research and management applications. He has been an active members of SASTA since 1997 and is also a members of the SA Society of Crop Production and the American Society of Agronomy.*

## MODELLING TRASH MANAGEMENT AND ITS IMPACTS: MODEL PERFORMANCE

VAN DEN BERG M, JONES M AND VAN ANTWERPEN R

*South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa*

[maurits.vandenberg@sugar.org.za](mailto:maurits.vandenberg@sugar.org.za) [matthew.jones@sugar.org.za](mailto:matthew.jones@sugar.org.za)

[rianto.van-antwerpen@sugar.org.za](mailto:rianto.van-antwerpen@sugar.org.za)

### Abstract

Evaluating the costs and benefits of trashing or burning requires situation-specific quantification of expected agronomic and economic factors. Costs of long-term field trials covering all possible combinations of climate zones, soils and different periods of the year are prohibitive, so good simulation modelling is necessary. The objective of this short communication is to demonstrate the performance of a newly-developed standalone trash model to be integrated into the Canesim sugarcane simulation model. The model simulates the physical state of trash on a field, and its effects on crop growth conditions, with particular reference to the water balance. The model was applied to 22 consecutive crops of the BT1 burning vs trashing trial at Mt Edgecombe.

On average, per crop, the modelled trash intercepted 44 mm of rain water, reduced runoff/stormflow by 39 mm and soil evaporation by 152 mm, resulting in increased drainage by 53 mm, and increased transpiration by 92 mm. The average difference (trashed-burnt) in corresponding observed cane yields was 8.1 t/ha. High correlation coefficients between observed yields and simulated transpiration for burnt ( $r^2=0,60$ ) and trashed ( $r^2=0,73$ ) conditions, and the practically coinciding regression lines suggest that the model performs well. The amended Canesim model will enhance SASRI crop forecasting and will assist the industry in making site-specific analyses of the pros and cons of green cane harvesting. Further testing is necessary. Data to do this are being collected in the Midlands, Pongola and Komatipoort. Nutritional aspects are addressed in a new project.

*Keywords:* modelling, sugarcane, green cane harvesting, trash blanket, water balance

### Biography

*Maurits van den Berg is Systems Modeller at the South African Sugarcane Research Institute (SASRI). He is also the manager of SASRI's Resource Optimisation Research Programme. Before coming to SASRI in 2004, he worked at several Institutes and Universities in the Netherlands, Mozambique and Brazil. He has an MSc from Wageningen and a PhD from Utrecht University, both in the Netherlands. While his roots are in Soil Science, the most common denominator in his recent work is model development and application in areas as diverse as land use change, biodiversity, plant-soil-water relations and crop growth. He was recently appointed as chair person of the International Consortium for Sugarcane Modeling (ICSM). In his current position at SASRI, he has also been given the responsibility to develop his other passion: The science and art of Technology Transfer.*

**WEDNESDAY 19<sup>TH</sup> JULY**  
**AGRICULTURE SESSION 3**  
**14:00 – 15:30**

**WATER MANAGEMENT**

Chair: Carel Bezuidenhout

Agriculture:  
Session 3

# AUSTRALIAN SUGAR INDUSTRY RESPONSE TO WATER PRICE INCREASES

DANZI E

CANEGROWERS, GPO Box 1032, Brisbane QLD 4001, Australia

[Eric.danzi@canegrowers.com.au](mailto:Eric.danzi@canegrowers.com.au)

## Abstract

The Australian sugar industry has come under significant pressure in recent years as a result of low sugar prices and an increase in the cost of oil and water. National Competition Policy in Australia has overhauled many sectors of the Australian economy, including the electricity, water and transport sectors, in an effort to increase competition and eliminate subsidisation. The water policies being implemented in Australia due to National Competition Policy are highlighted in this paper.

Water prices for many Australian cane growers have doubled. The paper shows some impacts of water policies on the Australian sugar industry, including how the policies are jeopardising the viability of growing sugarcane in many regions. Increases in water prices were compared with overall business costs and the profitability of sugarcane growers in Australia.

The response from the industry has been to argue for fair and justifiable water prices that do not unjustly put growers out of business. Also, there has been a massive campaign through the Water Use Efficiency program to increase the efficiency of irrigating sugarcane. This has led to financial incentives being offered to improve farm practices including purchasing new centre pivot irrigation systems. Consequently, there has been a marked improvement in irrigation efficiency that has allowed growers to better cope with the higher water prices.

*Keywords:* sugarcane, water, Australia, Queensland, pricing, irrigation

## Biography

*Eric Danzi works for CANEGROWERS Australia as the Senior Manager Planning and has worked for CANEGROWERS for 7 years. He manages restructuring and planning activities and water issues for the Queensland sugar industry.*

*Eric has spent considerable time on a range of water issues relating to water pricing, allocation and management. As part of his restructuring and planning activities, Eric has also been heavily involved in assisting the Queensland sugar industry adjust to recent low world sugar prices by facilitating the development of strategic plans for around half the sugar growing areas of Queensland.*

*Eric formally worked for ABARE in the Commonwealth Department of Agriculture Forestry and Fisheries Australia for 5 years and the Reserve Bank of Australia. Eric was raised on a fruit orchard and has a Bachelor of Commerce degree with honours in economics.*

## ESTIMATES OF REGIONAL SCALE WATER USE FOR SUGARCANE IN SOUTH AFRICA

BEZUIDENHOUT C N<sup>1</sup>, LECLER N L<sup>2</sup>, GERS C<sup>2</sup> AND LYNE P W L<sup>2</sup>

<sup>1</sup>*School of Bioresources Engineering & Environmental Hydrology,  
University of KwaZulu-Natal, Private Bag X01, Scottsville, 3209, South Africa*

<sup>2</sup>*South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa*

[bezuidenhoutc@ukzn.ac.za](mailto:bezuidenhoutc@ukzn.ac.za)

### Abstract

Water use of rain-fed sugarcane has come under the spotlight in South Africa, largely as a result of changes in legislation and a focus on streamflow reduction activities. In this study, Thompson's (1976) relationship between sugarcane yield and evapotranspiration is applied in conjunction with regional cane production records. These were used to provide regional estimates of water use of commercial rain-fed and irrigated sugarcane as affected by environmental limitations. The mean water use of sugarcane at an industry scale was 598 mm/annum. This included irrigated cane and is approximately 40% of the mean industry potential evapotranspiration for a full canopy crop. An estimate of water use of rain-fed cane is approximately 36% of potential evapotranspiration. The results given in this paper provide strong evidence that simple comparisons of the potential evapotranspiration of different crops or land covers are of little value in determining potential hydrological impacts.

*Keywords:* sugarcane water use, Thompson model, modelling, evapotranspiration, streamflow reduction activities

### Biography

*Neil Lecler is a Senior Research Engineer at the South African Sugarcane Research Institute. His PhD was on the development and application of tools and methods to assess the performance of irrigation and water management systems. He has worked in the former Bophuthatswana, at the University of Natal (now University of KwaZulu-Natal) and for the Zimbabwe Sugar Association Experiment Station. He frequently serves on numerous Water Research Commission project reference groups and review panels, is on the Committee of the KwaZulu-Natal branch of the South African Irrigation Institute, and is the South African Sugar Association representative on the South African National Committee on Irrigation and Drainage. He has a close association with the University of KwaZulu-Natal and is frequently asked to be an external examiner, to help supervise final year design projects and to take a leading role in the supervision of post-graduate students. Neil played a pioneering role in developing applications for long-range climate forecasts, including crop yield forecasts for the sugar industry. Much of his recent research effort has been aimed at developing and integrating tools, management systems and institutional arrangements to support more effective water use at both field and catchment scales. Neil has authored or co-authored more than forty publications including Journal articles, book chapters and papers in both national and international conference proceedings. He is very keen on sport and treasures the opportunity to canoe, play golf, squash, cricket, tennis and/or go bass or fly fishing.*

## APPLICATION OF A CATCHMENT-SCALE IRRIGATION SYSTEMS MODEL

LECLER N L<sup>1</sup>, MOULT N<sup>2</sup> AND SMITHERS J C<sup>2</sup>

<sup>1</sup>South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa

<sup>2</sup>School of Bioresources Engineering and Environmental Hydrology,  
University of KwaZulu-Natal, Private Bag X01, Scottsville, 3209, South Africa

[Neil.Lecler@sugar.org.za](mailto:Neil.Lecler@sugar.org.za) [nick.moult@gmail.com](mailto:nick.moult@gmail.com) [Smithers@ukzn.ac.za](mailto:Smithers@ukzn.ac.za)

### Abstract

ACRUcane is a computer simulation modelling tool developed to manage and assess catchment water supply and demand interactions and the associated impacts on the profitability of irrigated sugarcane. The model was configured to represent a catchment in northern KwaZulu-Natal (Pongola) with runoff feeding into a dam which supplied water for a dragline irrigation system. Various ‘what if’ scenarios representing potential changes to the irrigation system or management practice were assessed. Analysis of the simulated scenarios showed the interdependencies between irrigation application uniformity and irrigation scheduling. Improved application uniformities needed to be combined with improved scheduling to obtain maximum benefit, estimated to be approximately R3000/ha. Improved scheduling resulted in fewer seasons with water shortages and crop yield reductions. Replacing the dragline system with subsurface drip (SSD) resulted in gains in the proportion of applied water used beneficially and a small increase in crop yields. However, the amount of water applied using both types of irrigation system and the impacts on the dam storage levels were very similar. The increased capital cost of the SSD system relative to the dragline system resulted in marginally lower profits.

*Keywords:* sugarcane, hydrology, economics, irrigation, irrigation systems, modelling, irrigation scheduling

### Biography

*Neil Lecler is a Senior Research Engineer at the South African Sugarcane Research Institute. His PhD was on the development and application of tools and methods to assess the performance of irrigation and water management systems. He has worked in the former Bophuthatswana, at the University of Natal (now University of KwaZulu-Natal) and for the Zimbabwe Sugar Association Experiment Station. He frequently serves on numerous Water Research Commission project reference groups and review panels, is on the Committee of the KwaZulu-Natal branch of the South African Irrigation Institute, and is the South African Sugar Association representative on the South African National Committee on Irrigation and Drainage. He has a close association with the University of KwaZulu-Natal and is frequently asked to be an external examiner, to help supervise final year design projects and to take a leading role in the supervision of post-graduate students. Neil played a pioneering role in developing applications for long-range climate forecasts, including crop yield forecasts for the sugar industry. Much of his recent research effort has been aimed at developing and integrating tools, management systems and institutional arrangements to support more effective water use at both field and catchment scales. Neil has authored or co-authored more than forty publications including Journal articles, book chapters and papers in both national and international conference proceedings. He is very keen on sport and treasures the opportunity to canoe, play golf, squash, cricket, tennis and/or go bass or fly fishing.*

## THE EFFECT OF PLANT RESIDUE LAYERS ON WATER USE AND GROWTH OF IRRIGATED SUGARCANE

OLIVIER F C AND SINGELS A

*South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa*

[francois.olivier@sugar.org.za](mailto:francois.olivier@sugar.org.za) [Abraham.singels@sugar.org.za](mailto:Abraham.singels@sugar.org.za)

### Abstract

The industry is under pressure to use water more efficiently. One way of achieving this is through the retention of a layer of plant residues to reduce wasteful evaporation from the soil. However, a residue layer could also inhibit crop growth. This communication reports on the results obtained from a field experiment conducted at Pongola on three weighing lysimeters, to measure the impact of residue layers on crop water use, canopy development, crop growth and final yield.

*Keywords:* plant residue, trash, water use, irrigation, evapotranspiration, stalk population, canopy development

### Biography

*Francois Olivier is employed as irrigation scientist at the South African Sugarcane Research Institute. He is an active member of the South African Society for Crop Production, South African Irrigation Institute (SABI) and the South African Sugar Technologist Association.*

*He is located on the Mpumalanga Research Station near Komatipoort, where he conducts various water related research projects to increase water use efficiency of irrigated sugarcane and provides advice to growers and extension officers on appropriate irrigation scheduling criteria, software and new irrigation technology.*

*Recent research work has been on quantifying the effects of a trash blanket on crop growth and water use.*

## **DRYING OFF SUGARCANE ON SOILS WITH LOW WATER HOLDING CAPACITY**

OLIVIER F C, DONALDSON R A AND SINGELS A

*South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa*

[francois.olivier@sugar.org.za](mailto:francois.olivier@sugar.org.za)

### **Abstract**

Suspending irrigation at a predetermined time before harvesting was compared with a gradual drying off through reduced irrigation, with the aim of producing guidelines for drying off shallow soils. This communication reports on the pros and cons of each approach.

*Keywords:* sugarcane, drying off, soils, irrigation, yield, harvesting

### **Biography**

*Francois Olivier is employed as irrigation scientist at the South African Sugarcane Research Institute. He is an active member of the South African Society for Crop Production, South African Irrigation Institute (SABI) and the South African Sugar Technologist Association.*

*He is located on the Mpumalanga Research Station near Komatipoort, where he conducts various water related research projects to increase water use efficiency of irrigated sugarcane and provides advice to growers and extension officers on appropriate irrigation scheduling criteria, software and new irrigation technology.*

*Recent research work has been on quantifying the effects of a trash blanket on crop growth and water use.*



**WEDNESDAY 19<sup>TH</sup> JULY**  
**AGRICULTURE SESSION 4**  
**16:00 – 16:50**

**POSTER SESSION**

Chair: Carolyn Baker

Agriculture:  
Session 4

## A SUCCESSFUL METHODOLOGY FOR THE ESTABLISHMENT OF AN EXTENSION PROGRAMME IN A SMALL GROWER AREA

GILLESPIE W A<sup>1</sup> AND MITCHELL F J<sup>2</sup>

<sup>1</sup>*South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa*

<sup>2</sup>*Department of Agriculture and Environmental Affairs,  
Private Bag X9059, Pietermaritzburg, 3200, South Africa*

[william.gillespie@sugar.org.za](mailto:william.gillespie@sugar.org.za) [Felicity.Mitchell@dae.kzntl.gov.za](mailto:Felicity.Mitchell@dae.kzntl.gov.za)

### Abstract

The objective of this programme was to create awareness of the value of improved land use management practices to minimise threats to production, via technical and practical mentorship and to highlight the economic implications of non-sustainable production. The insect pest *Eldana saccharina* was used as the vehicle to raise awareness of the cost to the community of not applying good land use practices. The step-wise methodology implemented was highly successful in that it (i) raised awareness as to the value of interaction between extension and growers in the design and development of a programme, (ii) made highly technical research results relevant and better understood by extension staff and the growers, (iii) emphasised a business approach to small growers, and (iv) established the value of a programme of work with defined goals and time lines.

*Keywords: Eldana saccharina, small-scale extension, mentorship, improved management*

### Biography

#### *Academic Qualifications*

*1977 to 1979 - Cedara Diploma of Agriculture*

#### *Work Experience*

*1989 - Joined the South African Sugarcane Research Institute.*

*1989 to 1991 - Farm Planning department. Work involved farm planning, soil surveying and run off plots and catchments.*

*1991 to 1999 Field Services department. Managed the Mount Edgecombe Field Research station from 1991 to 1995 and the Pongola Field Research Station from 1995 to 1999. Work involved the provision of resources to the scientists and the maintenance of trials.*

*1999 to present, Extension Department as Extension Officer Small Scale Growers. Seconded to the Department of Agriculture and Environment Affairs (DAEA) to train, mentor and assist the DAEA Agricultural Extension Officers in transferring technology to Small Scale Growers.*

## MODELLING TRASH MANAGEMENT AND ITS IMPACTS: METHODOLOGY

JONES M AND VAN DEN BERG M

*South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa*

[matthew.jones@sugar.org.za](mailto:matthew.jones@sugar.org.za) [maurits.vandenberg@sugar.org.za](mailto:maurits.vandenberg@sugar.org.za)

### Abstract

A stand-alone sugarcane trash model, which is to be incorporated into the Canesim crop simulation model, has been developed. The objective of this poster is to present and discuss the approaches for modelling the trash dynamics and the effects of trash on soil-water balance and crop growth conditions. In principle, the model can also be used to address residues from other crops.

The model uses the state-variable approach, with a time step of one day. Model inputs are initial trash mass and thickness, specific surface area and daily weather data. The trash is modelled as a two-layered profile, with different dynamic characteristics for each layer. Trash decomposition rate is calculated as a function of temperature and water content; settling as a gradual change in trash density towards an equilibrium value. For the water balance, the model takes into account the effect on rainfall interception, using equations based on trash area index ( $P$ , an analogue of leaf area index); the effect on evaporation is taken according to a Beer's law equivalent, as a negative exponential function of  $P$ ; and calculation of runoff is based on the approach used in the ACRU model. A tentative empirical approach is followed for modelling soil and trash temperature.

Results of sample runs are presented to illustrate effects on individual and integrated processes. Suggestions for future research and development are outlined.

*Keywords:* modelling, sugarcane, green cane harvesting, trash blanket

### Biography

*Matthew Jones is a Scientific Programmer working for the South African Sugarcane Research Institute. He has a B.Sc (Hons) in Computer Science, and worked for several years in web application development, prior to taking up crop modelling at SASRI. He is currently registered for an M.Sc in Crop Modelling at the University of KwaZulu-Natal. Recent research directions include investigations into model structure and modularisation, sugarcane biomass simulations for energy production, and sugarcane residue modelling.*

**USE OF LAPTOPS AND PDAS IN THE FIELD COLLECTION OF  
SURVEY DATA ON *ELDANA SACCHARINA*  
(LEPIDOPTERA: PYRALIDAE) IN SUGARCANE**

KUPPEN J P AND LESLIE G W

*South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa*

[Jay.Kuppen@sugar.org.za](mailto:Jay.Kuppen@sugar.org.za) [Graeme.Leslie@sugar.org.za](mailto:Graeme.Leslie@sugar.org.za)

**Abstract**

In the past, paper data sheets have been routinely used in the field to record survey data on *Eldana saccharina* Walker (Lepidoptera: Pyralidae). These data sheets required significant staff time to collate, validate and summarise. In 2001, laptop PCs were tested as field data recorders to replace the paper data sheets and, in 2004, a personal digital assistant (PDA) was tested. It was found that data handling with this device was as efficient as with laptops.

Reported in this poster is the use of electronic equipment in the field which reduced many of the problems associated with paper records.

*Keywords: Eldana saccharina, stalk borer, surveys, data sheets, sugarcane, computerisation*

**Biography**

*Jay Kuppen is the Research Technician (Insecticides) in Crop Biology Research Centre.*

*He has been in SASRI since 1982, with Pest Control and AVCASA qualifications. His main interests are the use of insecticides and methodology against pests.*

**ATTRACTION OF *ELDANA SACCHARINA* (LEPIDOPTERA: PYRALIDEA) TO CERTAIN *FUSARIUM* ISOLATES IN OLFACTORY CHOICE ASSAYS**

MCFARLANE S A AND RUTHERFORD R S

*South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa*

[sharon.mcfarlane@sugar.org.za](mailto:sharon.mcfarlane@sugar.org.za) [stuart.rutherford@sugar.org.za](mailto:stuart.rutherford@sugar.org.za)

**Abstract**

In olfactory choice assays using maize kernels inoculated with a range of *Fusarium* isolates, *Eldana saccharina* larvae showed a marked preference for certain isolates while avoiding others. Larvae that were found feeding on some inoculated kernels were noticeably larger than those feeding on the uninoculated controls.

*Keywords:* sugarcane, *Eldana saccharina*, *Fusarium*, olfactory choice assays

**Biography**

*Sharon McFarlane is a Plant Pathologist at SASRI and has an MSc from the School of Life and Environmental Sciences at UKZN, Durban. Although her primary focus is on general sugarcane pathology, some of her time in recent years has been spent on the effect of Fusarium spp. on the development of Eldana. She has presented six SASTA papers and has co-authored ten others. She has also presented two posters and has been co-author of another.*

## INCIDENCE OF *FULMEKIOLA SERRATA* (THYSANOPTERA: THIRIPIDAE) IN SOUTH AFRICAN SUGARCANE

WAY M J, LESLIE G W, KEEPING M G AND GOVENDER A

*South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa*  
[mike.way@sugar.org.za](mailto:mike.way@sugar.org.za) [graeme.leslie@sugar.org.za](mailto:graeme.leslie@sugar.org.za) [malcolm.keeping@sugar.org.za](mailto:malcolm.keeping@sugar.org.za)

### Abstract

During 2004 sugarcane thrips, *Fulmekiola serrata* Kobus (Thysanoptera: Thripidae) was recorded for the first time damaging sugarcane in Umfolozi in the South African industry. The cause of this outbreak is unclear. In all likelihood elevated temperatures played a major role. Rolled sugarcane leaf spindles and curled leaf margins are inhabited. Minute brown and winged adults move erratically when exposed. Whitish-yellow immature stages have red eyes. Feeding activity may cause young leaf tips to be tied together, while older leaf damage resembles scorched yellowish necrotic patches. Surveying showed 96.2% of fields were infested by *F. serrata*, with 67.2% of spindles infested. Thrips density industry-wide averaged 5.2 per spindle, ranging from 10.6 at Umfolozi to 0.4 at Noodsberg in the cooler Midlands.

**Keywords:** sugarcane thrips, *Fulmekiola serrata*, Thysanoptera, Thripidae, pest incidence, pest density, sap suckers

### Biography

*Mike Way has worked as an entomologist with SASRI since 1991. His main interests concern developing insect monitoring techniques, insect distribution, biology and ecology. Recent work involves researching a pheromone-based trapping system for *Eldana saccharina*, and estimating yield loss due to this borer. He has been involved with monitoring the following: *E. saccharina*, to determine its current pest status and to investigate factors influencing populations on commercial and small-scale grower farms; white grub, to assess species diversity and abundance; and thrips, to assess its severity in the industry. He is an active member of the Entomological Society of Southern Africa.*

**WEDNESDAY 19<sup>TH</sup> JULY**  
**FACTORY SESSION 1**  
**08:45 – 10:15**

**ENGINEERING: DIFFUSERS**

Chair: Barry Cornish

# A REVIEW OF CANE DIFFUSION AT SEZELA AND UMZIMKULU SUGAR FACTORIES

MUNSAMY S S<sup>1</sup> AND BACHAN L<sup>2</sup>

<sup>1</sup>*Illovo Sugar Limited – Sezela, South Africa*  
<sup>2</sup>*Illovo Sugar Limited – Umzimkulu, South Africa*

[smunsamy@illovo.co.za](mailto:smunsamy@illovo.co.za) [lbachan@illovo.co.za](mailto:lbachan@illovo.co.za)

## Abstract

The cane diffusion process is widely used in the South African sugar industry for extraction purposes. This paper reviews the operation and maintenance of three stationary screen, horizontal bed diffusers installed at Sezela and Umzimkulu sugar factories. Two identical units were installed at Sezela factory in the 1983/84 season and a similar unit was installed at Umzimkulu factory in the 1991/92 season.

All three diffusers produced extraction efficiencies above 98% and, in the 2005/06 season, all three units produced extractions of above 98,5%. The Umzimkulu diffuser was able to produce high extraction efficiencies at higher than design cane throughputs. All three diffusers operate at high imbibition rates of around 440% imbibition on fibre.

The highest cost maintenance item is chain replacement. The average life of a chain has been around 14 years. The chain pins and bushes need to be replaced on average every 6-8 years. A negative aspect of cane diffusion is the extraction of acetic acid and corrosion of downstream equipment. Corrosion is severe in vapour pipes, evaporator and pan domes. However, it can be minimised by using corrosion resistant materials such as 3CR12 steel.

*Keywords:* cane diffuser, horizontal bed diffuser, extraction, diffuser chain, diffuser maintenance, diffuser corrosion, factory process

## Biography

*Stanley Munsamy: Sugar technologist who has been involved in diffuser operation and optimisation since 1983. Was at Sezela when both the diffusers were installed in the 1983/84 season and is presently Operations Manager at Sezela.*

*Lal Bachan: Sugar technologist who has been involved in diffuser operation and optimisation. Was at Umzimkulu when the diffuser was installed in the 1991/92 season and is presently Operations Manager at Umzimkulu.*



# THE EFFECT OF CLAY TYPE SOIL IN THE DIFFUSER AT UMFOLOZI MILL

RAMA S, DEHRMANN R A, ZUNGU H AND SWEET D G

*Ushukela Milling, Umfolozi, Private Bag X12, Mtubatuba, 3935, South Africa*

[srama@illovo.co.za](mailto:srama@illovo.co.za) [rdehrmann@illovo.co.za](mailto:rdehrmann@illovo.co.za)

[hzungu@illovo.co.za](mailto:hzungu@illovo.co.za) [dsweet@illovo.co.za](mailto:dsweet@illovo.co.za)

## Abstract

The major cane supply to Umfolozi (UF) mill is from the Umfolozi River flood plains, viz the Flats which contain soil that is rich in aluminium silicate (clay). Due to the sticky nature of the clay, it adheres to the harvested cane and ends up inside the De-Smet diffuser. Tests were done to study the effects of suspended solids and ash in diffuser inter-stage juice, that would eventually settle onto the cane bed. Suspended solids profiles indicate an increase in solids/ash concentration across the cane bed, and a decrease in solids/ash concentration in inter-stage juices. Since clay is impermeable in nature, the degree of percolation is reduced and results in flooding. When flooding occurs, imbibition and throughput have to be reduced to maintain steady operating conditions, thus compromising extraction. Removing the solids/ash from the cane entrance of the diffuser, where the solids/ash concentration in inter-stage juice is the greatest, would ensure a cleaner bed and reduce the tendency to flood. This would ensure effective percolation. Two methods of solids/ash removal will be considered, the hydro cyclone (de-sander) and the conventional clarifier.

*Keywords:* solids, ash, clay, diffuser percolation, flooding, hydro cyclone, clarification, factory process

## Biography

*Sinthe Rama is the Chemical EIT at Ushukela - Umfolozi Sugar Mill. She has a Btech Degree in Chemical Engineering.*

# FIRST IMPRESSIONS OF ADI CHAIN INSTALLED IN THE AMATIKULU DIFFUSER

REIN M<sup>1</sup>, SMITH L<sup>2</sup>, STRACHAN B<sup>3</sup> AND WIRMINGHAUS R<sup>4</sup>

<sup>1</sup>*Tongaat Hulett Sugar, Private Bag Amatikulu, 3801, South Africa*

<sup>2</sup>*Tongaat Hulett Sugar, Private Bag 3, Glenashley, 4022, South Africa*

<sup>3</sup>*Invicta Bearings, PO Box 33431, Jeppestown 2043, South Africa*

<sup>4</sup>*Joerg Foundry, PO Box 732, Rustenburg, 0300, South Africa*

[matthew.rein@hulett.co.za](mailto:matthew.rein@hulett.co.za)<sup>1</sup> [leon.smith@hulett.co.za](mailto:leon.smith@hulett.co.za)<sup>2</sup>

[bobs@invictabearings.co.za](mailto:bobs@invictabearings.co.za)<sup>3</sup> [rolfwi@mweb.co.za](mailto:rolfwi@mweb.co.za)<sup>4</sup>

## Abstract

Amatikulu Sugar Mill has installed Austempered Ductile Iron (ADI) block links and side plates on two diffuser chain strands. These links were cast in South Africa at a substantially lower cost than forged chain links. Some development emerged concerning the pattern, casting procedures and quality assurance required to ensure that high quality links were produced. Extensive tests were performed on the new links, including tensile and ultrasonic tests, and the cutting of cast links to inspect casting quality and procedure. Old links were also tensile-tested for comparisons.

The two chain strands have been in use for one season and have proven successful. Some links were disassembled for inspection after one season and the inspection results of these links and the rest of the chain are discussed.

Some other advantages of using ADI are also discussed. These advantages include lower cost, through-hardening of links, smaller chain order size and a shorter delivery time.

*Keywords:* Austempered Ductile Iron, ADI, diffuser, diffuser chain, factory process

## Biography

*Matthew Rein is currently the Mechanical Engineer at Amatikulu Sugar Mill, having already worked at Entumeni, Felixton and Gledhow in various capacities. A SASTA member, he holds a Btech degree in Mechanical Engineering and a Government Certificate of Competency in Factories (Mechanical).*

**WEDNESDAY 19<sup>TH</sup> JULY**  
**FACTORY SESSION 2**  
**10:45 – 12:15**

**ENERGY AND ELECTRICAL**  
**10:45 – 12:15**

Chair: Bruce Moor

# LOAD FLOW STUDY FOR NCHALO MILL

CHAKHWANTHA S G

*Electrical Section, Illovo Sugar Ltd, Nchalo Mill, Private Bag 50, Blantyre, Malawi*

[schakhwantha@illovo.co.za](mailto:schakhwantha@illovo.co.za)

## Abstract

In any production factory, knowledge of the operating power factor (PF) is of great importance because it is included in the electricity tariff by the supply authority, who calculate the maximum demand charge per kilovolt ampere (kVA), to account for the load current's effect on the supply system's efficiency. For a given kilowatt (kW) power demand, a low power factor gives a high kVA maximum demand charge and *vice versa*. The PF value also indicates how much of the designed capacity of installed power distribution equipment is being used to supply useful power to production equipment, and how much capacity is limited as a result of the distribution equipment being used wastefully to transmit ineffective reactive (wattless) current.

The requirement for such information justifies the analysis of a factory's power reticulation system to identify areas for useful improvement(s).

This paper presents the assessment of Nchalo mill's reticulation system, together with the analysis performed on the obtained information. Implementation of recommendations following from the analysis resulted in a reduction in the risk of factory blackouts and damage to critical mill equipment.

*Keywords:* power factor, capacitors, active power, reactive power, electricity tariff, maximum demand

## Biography

*Stephen Chakhwantha holds a BSc Electrical Engineering obtained from the University of Malawi in November 2004 and is a non-registered member of the Malawi Institute of Engineers. He first gained practical experience as a trainee engineer on attachment in the plastics and tobacco industries, involved with installation, programming, and application of motors, drives and industrial control systems.*

*He is currently in his second year of training as an Electrical Engineer on Illovo Sugar Group's Engineer-in Training (EIT) program at Nchalo mill in Chikwawa, Malawi, where he was recently involved in a major capital project involving upgrading of the protection systems on the mill's four turbo-alternators.*

*His interests include power electronics and protection systems.*

# POWER FACTOR CORRECTION USED TO RELEASE SYSTEM CAPACITY FOR CO-GENERATION AT UMZIMKULU MILL

MYENI Z S

*Illovo Sugar Limited, PO Box 59, Port Shepstone, 4240.*

[samyeni@illovo.co.za](mailto:samyeni@illovo.co.za)

## Abstract

Co-generation is an alternative means of generating extra revenue for the sugar industry. A rawhouse factory without any downstream has the ability to co-generate if it is running efficiently. Power factor correction can improve the electrical efficiency of the plant but can only be economically viable for a raw-house factory if it is co-generating. Improving electrical efficiency releases system capacity and this capacity can also be used to co-generate. There are few methods that can be used to correct the power factor and they have their advantages and disadvantages. Most South African companies have opted for static capacitors to reduce inductive losses especially when they do not generate their own electricity. A few factors need to be considered before capacitors can be installed because these factors can have adverse effect on the system.

## Biography

# WHY DO WE CONTINUE TO BURN SO MUCH COAL?

REID M J

[dennymike@intekom.co.za](mailto:dennymike@intekom.co.za)

## Abstract

Several sugar mills in southern Africa have adverse fuel balances for various reasons, and end up burning enormous amounts of coal. Some of the reasons for this are discussed, and two in particular are analysed in detail: time efficiency and imbibition.

The variables that are directly related to the energy efficiency of a sugar mill are listed and their relative effects are discussed.

The effect of time efficiency is evaluated, and some guidelines are provided that may help in reducing this factor.

The use of a very high rate of imbibition to achieve good extraction has almost become the norm in southern Africa. In some circumstances, the cost of this practice in increased fuel consumption can outweigh the gains achieved through high extraction.

A theoretical exercise has been carried out that explores the effect of changes in imbibition on extraction and on the fuel balance. Equations are derived, using historical performance figures, for the relationship between imbibition and extraction, and allowances for other effects are discussed.

A hypothetical sugar mill which relies on coal to provide sufficient steam is used as the basis of calculations. These calculations compare the relative cost of reduction in extraction with a saving in coal used, and show that in certain conditions, reduction of imbibition can result in a net saving in costs.

*Keywords:* imbibition, extraction, fuel, steam balance, energy, time efficiency

## Biography

*Mike Reid is a free-lance sugar engineering consultant whose sugar career commenced in 1973 with two years as Chief Engineer at Reynolds Brothers, Sezela. He subsequently moved to TMD, Tongaat Hulett Sugar, and later worked as Head of Engineering at Sugar Milling Research Institute responsible for engineering research, conceptual design and advisory work for the SMRI member sugar mills. During this time he presented eight technical papers at SASTA and ISSCT congresses, and served on several Industrial committees.*

*After nearly five years as Factory Consulting Engineer at Ubombo Sugar during their R100 million expansion, he retired and has since been involved in several consulting projects.*

**WEDNESDAY 19<sup>TH</sup> JULY**  
**FACTORY SESSION 3**  
**14:00 – 14:20**

**FACTORY POSTERS**

Chair: Steve Davis

Sponsor: Novozymes SA (Pty) Ltd

## EVALUATION OF THE BERTHOLD TECHNOLOGIES MICROWAVE PROBE

MITCHELL G E<sup>1</sup> AND SPRINGER H K<sup>2</sup>

<sup>1</sup>*Tongaat-Hulett Sugar Ltd, PO Box 1501, Durban, 4000, South Africa*

<sup>2</sup>*Mecosa (Pty) Ltd, PO Box 651240, Benmore, 2010, South Africa*

[Gregg.Mitchell@huletts.co.za](mailto:Gregg.Mitchell@huletts.co.za) [measure@mecosa.co.za](mailto:measure@mecosa.co.za)

### Abstract

The Hulett's refinery (Hulref) currently uses radio frequency (RF) probes to measure the brix of the material in the white pans. Due to Hulref boiling massecuites at higher temperatures (85°C) a number of problems were experienced with the RF probe. These included:

- The electronics failing on the probe head due to the higher temperature.
- Over time the probe measurements drifted.

Due to the reported benefits of using the microwave probe, it was decided by Hulref to evaluate this tool. The first benefit was that the probe electronics are remote to the probe head, and as a result the probe is very robust. Secondly, the probe looks at the crystal and the mother liquor when measuring the brix concentration of the sample. This benefit allows for easy probe calibration or set-up on the plant.

A Berthold Technologies microwave probe was installed on pan 2 for evaluation. The probe was set up in the working environment on the white boiling pan. Both continuous and batch pan probe installations were evaluated on pan 2 and this poster presentation summarises the work done during 2005 on the probe.

*Keywords:* refinery process, massecuites, boiling, microwave probe, radio frequency probe

### Biography

*Gregg Mitchell is a process engineer at Hulett's Refinery responsible for the refined sugar crystallization plant. Gregg has a national diploma and bachelor of technology degree in chemical engineering. He has also complied with the training requirements of the engineer in training scheme at Tongaat Hulett's Sugar and has occupied a position of Process Engineer at the Refinery since 1999.*

*He started his working career thirteen years ago in the raw sugar factory at Maidstone Mill and has been working at the Hulett's Refinery for the past eight years. This is his first SASTA poster presentation, but he has presented a full paper at the 2003 congress.*

*Henning Klaus Springer is the Managing Director of Mecosa (Pty) Ltd. He obtained his BSc Electrical Engineering degree from the University of the Witwatersrand. After having worked in the mining industry as Junior Engineer, Section Engineer and Engineering Manager with Anglo American Corporation for more than 10 years, he started with Mecosa (Pty) Ltd as Technical Director. In August 2000 he was appointed as Managing Director. During his years in the mining industry as well as the 9 years with Mecosa (Pty) Ltd, Henning Springer has gained significant knowledge and experience in the theory and practice of process measurements.*

*A particular area of his expertise is the microwave measurement technique which was developed by Berthold Technologies for the measurement of moisture in solids as well as the concentration measurement of sugar massecuites and other fluids.*



## **SURVEY ON THE USE OF STARCH HYDROLYSING ENZYMES IN SOUTH AFRICA**

SCHOONEES B M

*Sugar Milling Research Institute, University of KwaZulu-Natal, Durban 4041, South Africa*

[bschoonees@smri.org](mailto:bschoonees@smri.org)

### **Abstract**

A survey was conducted to document the current practices and procedures around the use of  $\alpha$ -amylase enzymes for the control of levels of starch in South African sugar factories. Five factories were selected based on the prevalence of starch in each specific cane growing area and the historical routine application of  $\alpha$ -amylase by the particular factory.

All of the factories made use of a commercial mixture of heat-stable  $\alpha$ -amylases produced by genetically modified strains of *Bacillus licheniformis*. These enzymes can operate at temperatures around 105°C, but preferably at 95°C, and at lower pH and calcium levels than previous generations of enzymes. The optimum operational pH is 5.9, with a required calcium content of 40 mg/kg.

The survey highlights the commonalities between the factories as well as deviations from the optimum or recommended conditions, and possible pitfalls with regards to the handling and use of enzymes.

*Keywords:* enzymes, amylase, starch, survey, evaporator, hydrolysis, factory process

### **Biography**

*Dr Barbara M Schoonees joined the Sugar Milling Research Institute in 2002 as a Senior Research Officer. She holds a Masters Degree in Organic Chemistry from the University of the Free State and a D Tech degree in Organic Process Development from the PE Technikon. Since entering the Sugar Industry, she has authored or co-authored four SASTA papers and five SASTA posters. She has also been a member of the SASTA Council since 2004.*

*Recent work includes the elucidation and control of polysaccharides in a sugar factory environment as well as focus on clarification with specific reference to colour and gums removal.*

**WEDNESDAY 19<sup>TH</sup> JULY**  
**FACTORY SESSION**  
**14:20 – 15:40**

**COMMERCIAL SESSION**

Chair: Barbara Schoonees

# ZUKA - THE NEW RANGE OF RADICALLY IMPROVED BATCH CENTRIFUGALS FROM FIVES CAIL

PILOT G

*Head of Centrifugals Department, Fives Cail, 22 rue du Carrousel,  
Parc de la Cimaise, 59 666 Villeneuve d'Ascq, France*

[gpilot@fivescail.com](mailto:gpilot@fivescail.com)

## Abstract

Fives Cail Group centrifugals handle more than 25 million metric tons of sugar every year worldwide, offering a complete range covering all applications: beet, cane and refining. Fives Cail Group's continuous development programme ensures regular improvement of its centrifugals, which are recognised for their solid construction and reliability.

After a detailed marketing review made in 2003, the first steps of an important development commenced in 2004. Five project teams concentrated on the following aspects: conception, fabrication, driving unit, automation and services.

A prototype was manufactured at the end of 2004 and installed for tests at the beginning of 2005 in a factory in France. The tests took place throughout 2005. More than 20 machines of the new design have already been ordered.

The new models provide the following benefits:

- The performance, significantly increased, brings productivity gains from 20% to 30% in comparison with the previous models.
- The technical innovation applied to both the mechanical and electrical components, have led to a complete revision of the design of the machines.
- This total design concept has resulted in a machine with cleaner styling, both aesthetically and practically.
- The new service and support concept provides technical support by both remote assistance 'on line' and more interactive, user-friendly and more convenient technical documentation with CD-ROM support.

## Biography

*Gerald Pilot is 36 years old, he is a Graduate Engineer and an MBA (Master of Business Administration) from the Edhec Business School. He joined Fives Cail group in 2001, after having spent 4 years in an engineering company providing complete bottling lines for soft drink and mineral water producers (Coca-Cola, Pepsi, Danone, Nestlé).*

*He is the manager of the Centrifugals & Pumps Business Unit of Fives Cail group which is responsible for the marketing, project management, manufacture, assembly and commissioning of the centrifugal machines and pumps.*

# IMPROVED FACTORY OPERATION WITH QUALITY MANAGEMENT INFORMATION

VON PANNIER C AND KING S

*10 Flanders Drive, Gleneagles Park, Mount Edgecombe, 4300, South Africa*

[cindy@infowave.co.za](mailto:cindy@infowave.co.za) [selking@yebo.co.za](mailto:selking@yebo.co.za)

## Abstract

Building on its 10-year focus on the sugar industry, JSE-listed InfoWave developed the *CaneLab* software package using Oracle's relational database technology. The *CaneLab* software package consists of three modules. The first module, *Factory Laboratory* was ready by September 2003, and has been implemented successfully in four countries since then. The purpose of this module is to provide improved quality of results from the laboratory. All instrument readings are updated directly into the database, which alleviates errors associated with manual recording, and improves accuracy and reliability of results.

*CaneLab's Weighbridge* and *Cane Testing* modules followed in March 2005. The *CaneLab Weighbridge* module enables automatic recording of cane, sugar and other product tonnages to ensure that accurate information is securely stored in the database. This, along with other cane delivery data captured into the system, is immediately available to cane supply management, providing improved scheduling and control of the cane deliveries by grower, haulier or area, and thereby streamlining the delivery process. An innovative intranet facility allows management to view lab results and images from the weighbridge at their desktop in real-time, improving decision making.

The *Cane Testing* module caters for most sampling methods, and is preconfigured with analytical methods for DAC, Press and FEJ analysis. The system also caters for allocation of results to untested cane, and local rules and calculations for cane payment. Grower payment advices are produced weekly and reconciled to ensure accurate payment.

Continuous improvements, such as the addition of *Weighbridge* security and access control, and digital bag counting, ensure that industry-specific problems are resolved timeously by *CaneLab* software.

*Keywords:* CaneLab, factory laboratory, weighbridge, cane testing, factory process

## Biography

# **MICROWAVE MEASUREMENT TECHNOLOGY: NEW APPLICATIONS IN SUGAR PRODUCTION FOR THE MEASUREMENT OF DENSITY, TOTAL SOLIDS AND CONCENTRATION (E.G. BRIX)**

THEISEN K H

*pro-M-tec Theisen GmbH, Pforzheimer Str. 162, 76275 Ettlingen, Germany  
Tel: +49 7243 5306-0 Fax: +49 7243 5306-11*

[kh.theisen@pro-m-tec.de](mailto:kh.theisen@pro-m-tec.de)

## **Abstract**

The microwave concentration measurement is one of the most modern technologies used in industry for process measurement and control. Measurement systems have been successfully employed for Brix control on pans (batch and continuous) in the sugar making process. Recent developments allow the technology to be applied to virtually all measurement points requiring the process variable determination and control of concentration, density or total solids in sugar plants.

Over the past few months new applications, especially the concentration measurements in large pipelines and measurements in tanks and mixers have shown that microwave technology thereby offers unique and new solutions to the sugar producing industry.

This paper discusses measurement experiences with microwave concentration (Brix) measurement on large pipelines, in mixers and vessels. Particular focus is on the concentration measurement of magma and molasses, with discussion of the technical aspects, considerations and advantages of the employment of microwave technology in these new applications.

*Keywords:* microwaves, Brix, concentration, density, pan control, molasses

## **Biography**

*Karl-Heinz Theisen studied physics and mathematics at the Ruhr University in Bochum, Germany. Within his field of process measurement systems he has focused on density measurements via contactless methods, including nuclear measurement principles. Thereafter he spent 7 years working as product manager for microwave process measurement systems for dry content determination, before starting his own company in 1996, pro-M-tec Theisen GmbH. His company pro-M-tec specialises in developing and marketing of microwave based industrial instrumentation for determining water content, density and concentration parameters in process fluids. Under the vision of Karl-Heinz Theisen, pro-M-tec introduced and firmly established the microwave principle for wide use in the sugar industry.*

**THURSDAY 20<sup>TH</sup> JULY**  
**AGRICULTURE SESSION 5**  
**08:30 – 10:15**

**SPECIAL FOCUS ON ELDANA**

Chair: Graeme Leslie

Sponsor: Omnia Fertilisers (Pty) Ltd)

# FIRST RECORDS OF THE STEM BORER COMPLEX (LEPIDOPTERA: NOCTUIDAE; CRAMBIDAE; PYRALIDAE) IN COMMERCIAL SUGARCANE ESTATES OF ETHIOPIA, THEIR HOST PLANTS AND NATURAL ENEMIES

ASSEFA Y<sup>1</sup>, CONLONG D E<sup>1,2</sup> AND MITCHELL A<sup>3</sup>

<sup>1</sup>*School of Biological and Conservation Sciences, University of KwaZulu-Natal, Private Bag X01, Scottsville, 3209, South Africa*

<sup>2</sup>*South African Sugarcane Research Institute, Private Bag X02, Mount Edgecombe, 4300, South Africa*

<sup>3</sup>*Agricultural Scientific Collections Unit, Orange Agricultural Institute, NSW Department of Primary Industries, Forest Rd, Orange NSW 2800, Australia*

[yosepharm@yahoo.com](mailto:yosepharm@yahoo.com) [Andrew.Mitchell@dpi.nsw.gov.au](mailto:Andrew.Mitchell@dpi.nsw.gov.au) [Des.Conlong@sugar.org.za](mailto:Des.Conlong@sugar.org.za)

## Abstract

In 2003 and 2004, surveys were completed on sugarcane estates in Ethiopia to determine the lepidopteran stem borer species composition and the impact of natural enemies on the borers in sugarcane and in indigenous host plants. A total of 174 sugarcane plots and four species of indigenous host plants in irrigation canals, wetlands and field margins, were evaluated. Surveys revealed the presence of three lepidopteran stem borer species on sugarcane: *Busseola* sp., *Chilo partellus* and *Sesamia calamistis*. *Eldana saccharina* was recovered from indigenous sedges present in irrigation canals on Metehara and Wonji sugar estates. *Busseola* sp. was the predominant stem borer of sugarcane on Finchawa and Wonji estates. *C. partellus* and *S. calamistis* were recovered in very low numbers at all estates. Three parasitoid species, *Cotesia flavipes*, *Cotesia sesamiae* (both from larvae collected at Wonji Estate), and *Linnaemya* sp. (from Finchawa Estate) emerged from field-collected stem borer life stages. The percentage parasitism by these parasitoids was low, from 2.3 to 4.7%. Two fungal and one bacterial pathogen were isolated from larvae of the borers found. The bacterial pathogen, *Bacillus thuringiensis*, was found to be an important mortality factor of stem borer larvae in young sugarcane at Wonji estate, with an average parasitism of 34.9%.

**Keywords:** stem borers, Ethiopia, parasitoids, sedges, sugarcane, insect pests

## Biography

*Des Conlong is a senior entomologist with SASRI. He has been with this organisation since 1981. During this time he received his PhD for his work on pest-parasitoid interaction on Eldana saccharina in its indigenous host plant Cyperus papyrus. He is also an Honorary senior lecturer in the School of Biological and Conservation Sciences, University of Kwazulu-Natal, where he supervises post-graduate students keen to work on habitat management, biological control and insect rearing.*

*He has travelled extensively throughout sub-saharan Africa in the search for parasitoids of Eldana saccharina. During this time he established many collaborative working relationships with international institutes such as the International Institute for Tropical Agriculture in West Africa, and the International Centre for Insect Physiology and Ecology based in Nairobi, Kenya. In addition, many links were made with sugarcane industries in many countries, this paper being one of the outputs of this collaboration.*

*Yoseph Assefa will not be able to present the paper at SASTA. He will most likely be on his way back to Ethiopia. Des has been supervising Yoseph, in conjunction with Dr Andrew Mitchell, the other co-author, for the last 3 years on this project which he is using for his PhD.*

## IMPACT ON YIELD DUE TO EARLY AND LATE PHASE INFESTATION BY *ELDANA SACCHARINA* (LEPIDOPTERA: PYRALIDAE)

GOEBEL F R<sup>1</sup> AND WAY M J<sup>2</sup>

<sup>1</sup>*CIRAD Unité de recherche Systemes Canniers, TA 70/09, Avenue Agropolis,  
34398 Montpellier, cedex 5, France*

<sup>2</sup>*South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa*

[regis.goebel@cirad.fr](mailto:regis.goebel@cirad.fr) [mike.way@sugar.org.za](mailto:mike.way@sugar.org.za)

### Abstract

The effects of *Eldana saccharina* Walker (Lepidoptera: Pyralidae) damage on stalk yield components in field trials are reported. The experiment design involved reducing pest pressure with an insecticide to provide undamaged stalks or applying artificial inoculation techniques to elevate pest pressure to obtain damaged stalks for comparison. At harvest, trial results showed lower biomass, lower sucrose and higher fibre content in stalks that had been infested early in the season when compared with stalks that were infested during the maturation stage of the crop cycle.

*Keywords:* sugarcane, *Eldana saccharina*, Lepidoptera, Pyralidae, stalk borer, agricultural practices

### Biography

*François-Régis Goebel is an entomologist from CIRAD, an international research organisation that is based in France and has 2000 people working on tropical crops for the developing countries. After starting his career in 1989 on cotton and maize in Senegal, FR Goebel moved to Réunion Island where he spent six years and completed his PhD on the sugarcane stem borer Chilo sacchariphagus, a major problem in la Reunion, Mauritius and now in some of the sugar estates in Mozambique. In 2000 he was seconded to SASRI for four years, where he developed strong links with the entomology department on Eldana and IPM. He contributed to the reinforcement of regional collaboration on stemborers, particularly with La Réunion.*

*He returned to Montpellier in France after 15 years of expatriation, and is currently involved in research management in the department of annual crops at CIRAD.*



# DIFFERENCES IN MITOCHONDRIAL DNA AND FERTILITY OF CROSSES BETWEEN POPULATIONS OF *ELDANA SACCHARINA* (LEPIDOPTERA: PYRALIDAE) FROM KENYA AND SOUTH AFRICA: POSSIBLE EVIDENCE FOR CRYPTIC SPECIES?

ASSEFA Y<sup>1</sup>, CONLONG D E<sup>1,2</sup> AND MITCHELL A<sup>3</sup>

<sup>1</sup>*School of Biological and Conservation Sciences, University of KwaZulu-Natal,  
Private Bag X01, Pietermaritzburg, Scottsville, 3209, South Africa*

<sup>2</sup>*South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa*

<sup>3</sup>*Agricultural Scientific Collection Unit, Orange Agricultural Institute,  
NSW Department of Primary Industries, Forest Rd, Orange NSW 2800, Australia*

[yosepharm@yahoo.com](mailto:yosepharm@yahoo.com) [Des.Conlong@sugar.org.za](mailto:Des.Conlong@sugar.org.za) [Andrew.Mitchell@dpi.nsw.gov.au](mailto:Andrew.Mitchell@dpi.nsw.gov.au)

## Abstract

Genetic differentiation in two populations of *Eldana saccharina* Walker, a Rift Valley population from *Cyperus papyrus* L. bordering Lake Naivasha in Kenya and a South African population from sugarcane, sedges (*Cyperus* spp.) and laboratory colonies at SASRI was examined. To explore the phylogeographical relationships of the populations, 561 bp of mitochondrial DNA (mtDNA) was sequenced from 13 individuals. All individuals from Kenya shared a common haplotype, and the South African sequences were clustered under a second haplotype. These populations have a sequence divergence equivalent to sequence divergences found in sister species. Could this be the first evidence of a cryptic species within *E. saccharina*? To examine this hypothesis, inter-population crosses were made to produce an F<sub>1</sub> generation, and these were backcrossed with the South African parent population. Fertility of eggs produced by the F<sub>1</sub>/parent population cross was significantly reduced when compared with fertility of the 'true' SA line, and the F<sub>1</sub>/ F<sub>1</sub> cross. The mating experiments thus suggest that the Kenyan and South African populations are at least partially reproductively isolated. This is consistent with the large DNA distances observed in mtDNA sequences. The infertility of the hybrids followed Haldane's rule, where heterozygotic females are more infertile than the males.

*Keywords:* mitochondrial DNA, *Eldana saccharina*, Rift Valley, stalk borers, genetic relationships

## Biography

*Des Conlong is a senior entomologist with SASRI. He has been with this organisation since 1981. During this time he received his PhD for his work on pest-parasitoid interaction on Eldana saccharina in its indigenous host plant Cyperus papyrus. He is also an Honorary senior lecturer in the School of Biological and Conservation Sciences, University of Kwazulu-Natal, where he supervises post-graduate students keen to work on habitat management, biological control and insect rearing.*

*He has travelled extensively throughout sub-saharan Africa in the search for parasitoids of Eldana saccharina. During this time he established many collaborative working relationships with international institutes such as the International Institute for Tropical Agriculture in West Africa, and the International Centre for Insect Physiology and Ecology based in Nairobi, Kenya. In addition, many links were made with sugarcane industries in many countries, this paper being one of the outputs of this collaboration.*

*Yoseph Assefa will not be able to present the paper at SASTA. He will most likely be on his way back to Ethiopia. Des has been supervising Yoseph, in conjunction with Dr Andrew Mitchell, the other co-author, for the last 3 years on this project which he is using for his PhD.*

# HABITAT MANAGEMENT USING *MELINIS MINUTIFLORA* (POACEAE) TO DECREASE THE INFESTATION OF SUGARCANE BY *ELDANA* *SACCHARINA* (LEPIDOPTERA: PYRALIDAE)

BARKER A L<sup>1,2</sup>, CONLONG D E<sup>1,3</sup> AND BYRNE M J<sup>2</sup>

<sup>1</sup>South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa

<sup>2</sup>School of Animal, Plant and Environmental Sciences,  
University of the Witwatersrand, PO Wits, South Africa

<sup>3</sup>School of Biological and Conservation Sciences, University of KwaZulu-Natal,  
Private Bag X01, Scottsville, Pietermaritzburg, South Africa

[Alistair.Barker@sugar.org.za](mailto:Alistair.Barker@sugar.org.za) [Des.Conlong@sugar.org.za](mailto:Des.Conlong@sugar.org.za) [Marcus@gecko.biol.wits.ac.za](mailto:Marcus@gecko.biol.wits.ac.za)

## Abstract

In field trials planted in the Midlands North and Gingindlovu areas, *Melinis minutiflora* Beauv. was intercropped in various ways with sugarcane in fields bordered by *Cyperus dives* C.B. Cl. to determine whether the presence of this grass reduced *Eldana saccharina* Walker numbers and infestation levels in sugarcane. Results showed *E. saccharina* populations were decreased by up to 50% and *E. saccharina* damage was reduced by up to 57% when compared with control fields. In addition, no competition was recorded between *M. minutiflora* and adjacent sugarcane rows in terms of sugarcane yield loss. Where *M. minutiflora* was planted along field margins, weed biomass was reduced by up to 79%.

These results are discussed in the context of *E. saccharina* population management, field margin weed management and potential economic benefits accrued from using this approach.

Keywords: sugarcane, *Eldana saccharina*, habitat management, *Melinis minutiflora*, economic benefit, *Cyperus dives*

## Biography

Alistair Barker is a student working at the South African Sugarcane Research Institute, currently completing his Masters degree in Entomology. Alistair is a registered student at the University of the Witwatersrand, where he completed his undergraduate Bachelor of Science degree and an honours degree in Zoology.

Alistair did some work in the Entomology Insect Unit at SASRI at the beginning of 2004 and is due to hand in his Masters thesis at the end of 2006.

# PROGRESS IN THE USE OF AERIALLY APPLIED FASTAC® (ALPHA-CYPERMETHRIN) FOR THE CONTROL OF THE SUGARCANE BORER *ELDANA SACCHARINA* (LEPIDOPTERA: PYRALIDAE.), AND AN ASSESSMENT OF ITS COMMERCIAL IMPACT

LESLIE G W, STRANACK R A AND DE HAAS O

*South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa*

[Graeme.leslie@sugar.org.za](mailto:Graeme.leslie@sugar.org.za) [Rowan.stranack@sugar.org.za](mailto:Rowan.stranack@sugar.org.za) [Otto.dehaas@sugar.org.za](mailto:Otto.dehaas@sugar.org.za)

## Abstract

Four field-scale aerial application trials for *E. saccharina* control were conducted with Fastac applied six times (once every two weeks) and eight times (once every three weeks) to carry-over crops from September to December. The insecticide was applied at a rate of 200 ml product/ha by means of a microlight aircraft fitted with CDA spray heads

Results showed that damage was significantly lower in the treated than the untreated cane, estimates being 73% and 67% of control estimate (six applications and eight applications respectively) in the final survey. Similarly, *E. saccharina* numbers were significantly lower in the treated cane, estimates being 79% and 76% of the control estimate (six applications and eight applications respectively), based on transformed data.

Estimates of ERC% at harvest showed that this was significantly higher in treated cane in two of the four trials conducted, but there were no differences in ERC% estimates between the two insecticide treatments.

In the region of the industry where the trials were conducted, this approach to *E. saccharina* control is being used commercially. Evidence is presented which shows that this approach has had an impact on *E. saccharina* levels in commercial carry-over crops, so improving farm economics.

It is concluded that aerial application of Fastac can suppress *E. saccharina* infestations and the commercial use of this approach shows promise.

*Keywords: Eldana saccharina, insecticides, Fastac, aerial application, commercial use, sugarcane*

## Biography

*Graeme Leslie: Principle Entomologist, SASRI, has been involved in Eldana control research since the outbreak of this pest in the late 1970's.*

*His work has encompassed a range of projects covering a number of control options of this pest. These have included aspects of biological control (parasitoids, predators and pathogens) as well as host plant resistance and insecticides.*

*Latterly he has, along with SASRI Extension staff and growers, developed the use of an insecticide for suppressing Eldana infestations in carry-over sugarcane. His current work is aimed at improving the usefulness of insecticide use in IPM programs for the control of sugarcane pests.*

**THURSDAY 20<sup>TH</sup> JULY**  
**AGRICULTURE SESSION 6**  
**10:45 – 12:30**

Agriculture:  
Session 6

## **SUGARCANE PESTS AND NEMATODES**

Chair: Vaughan Spaul

**A NEW ASSOCIATION: *TRICHOGRAMMA BOURNIERI* PINTUREAU AND BABAUT (HYMENOPTERA: TRICHOGRAMMATIDAE) AND *CHILO SACCHARIPHAGUS* BOJER (LEPIDOPTERA: CRAMBIDAE) IN SUGARCANE IN MOZAMBIQUE**

CONLONG D E<sup>1,2</sup> AND GOEBEL F R<sup>3</sup>

<sup>1</sup>South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe 4300, South Africa

<sup>2</sup>School of Biological and Conservation Sciences, University of KwaZulu-Natal,  
Private Bag X01, Scottsville, 3209, South Africa

<sup>3</sup>CIRAD, c/o CSIRO European Laboratory - Campus International de Baillarguet,  
TA 40/L (Bât. L, Bur. 05) - 34980 Montferrier sur Lez, France

[Des.conlong@sugar.org.za](mailto:Des.conlong@sugar.org.za) [Regis.goebel@cirad.fr](mailto:Regis.goebel@cirad.fr)

**Abstract**

*Chilo sacchariphagus* Bojer, a sugarcane borer indigenous to South East Asia and the Indonesian Islands, was identified from Mozambican sugarcane in 1999. Prior to a biocontrol programme being implemented against it, intensive pre-release surveys for any indigenous natural enemies of the borer were completed. Negligible parasitism of larvae and pupae was recorded. In contrast, egg batches were heavily parasitised. Parasitoid adults emerging from eggs were *Trichogramma bournieri* Pintureau and Babault only. The impact of *T. bournieri* on *C. sacchariphagus* eggs in Mozambique are presented, and the potential of using this parasitoid against *C. sacchariphagus* in an augmentation biocontrol programme is discussed.

**Keywords:** sugarcane, new association, *Trichogramma*, *Chilo*, Mozambique, biocontrol

**Biography**

*Des Conlong is a senior entomologist with SASRI. He has been with this organisation since 1981. During this time he received his PhD for his work on pest-parasitoid interaction on Eldana saccharina in its indigenous host plant Cyperus papyrus. He is also an Honorary senior lecturer in the School of Biological and Conservation Sciences, University of Kwazulu-Natal, where he supervises post-graduate students keen to work on habitat management, biological control and insect rearing.*

*He has travelled extensively throughout sub-saharan Africa in the search for parasitoids of Eldana saccharina. During this time he established many collaborative working relationships with international institutes such as the International Institute for Tropical Agriculture in West Africa, and the International Centre for Insect Physiology and Ecology based in Nairobi, Kenya. In addition, many links were made with sugarcane industries in many countries, this paper being one of the outputs of this collaboration.*

## RESPONSE OF *GONIOZUS INDICUS* (HYMENOPTERA: BETHYLIDAE) TO SUGARCANE AND *CYPERUS PAPYRUS* VOLATILES

SMITH J M<sup>1,3</sup>, CONLONG D E<sup>1,2</sup>, BYRNE M<sup>3</sup> AND FREROT B<sup>4</sup>

<sup>1</sup>South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa

<sup>2</sup>School of Biological and Conservation Sciences,  
University of KwaZulu-Natal, Private Bag X01, Scottsville, 3610, South Africa

<sup>3</sup>School of Animal, Plant and Environmental Sciences,  
Wits University, Private Bag X3, WITS, 2050, South Africa

<sup>4</sup>Mediateurs chimiques, INRA, 78026, Versailles, France

[jenny.smith@sugar.org.za](mailto:jenny.smith@sugar.org.za) [des.conlong@sugar.org.za](mailto:des.conlong@sugar.org.za)  
[marcus@gecko.biol.wits.ac.za](mailto:marcus@gecko.biol.wits.ac.za) [frerot@versailles.inra.fr](mailto:frerot@versailles.inra.fr)

### Abstract

Gas chromatography revealed different volatile emissions from uninfested and infested sugarcane, and uninfested *Cyperus papyrus* L, when compared with infested *C. papyrus*. In addition, *Goniozus indicus* Ashmead showed an attraction to samples containing frass from *Eldana saccharina* Walker that had fed on *C. papyrus*, and no attraction to samples containing frass from *E. saccharina* that had fed on sugarcane. These results indicate that chemical cues are important for *G. indicus* to locate a host habitat, and that the cues may be missing from *E. saccharina* infested sugarcane.

**Keywords:** gas chromatography, SPME, chemical cues, parasitoids, *Cyperus papyrus*, *Eldana saccharina*, *Goniozus indicus*

### Biography

Jenny Smith is a lecturer at the University of Zululand and is currently completing her Ph.D. In association with SASRI, WITS and INRA. Her honours degree, completed at the University of Pretoria, focused on pest management. Her Masters degree was an ecological study of two metrics which use invertebrates to assess riparian conditions of rivers was completed at the University of KwaZulu Natal.

# RECENT DEVELOPMENTS IN THE CONTROL OF *IDAECAMENTA EUGENIAE* (COLEOPTERA: SCARABAEIDAE: MELOLONTHINAE) AT KINYARA SUGAR WORKS LTD, UGANDA

MUGALULA A<sup>1</sup>, TIBAKANYA G<sup>1</sup> AND CONLONG D E<sup>2,3</sup>

<sup>1</sup>*Kinyara Sugar Works, Masindi, Uganda*

<sup>2</sup>*South African Sugarcane Research Institute, Private Bag X02, Mount Edgecombe, 4300, South Africa*

<sup>3</sup>*School of Biological and Conservation Sciences, University of KwaZulu-Natal, Private Bag X01, Scottsville, Pietermaritzburg, 3201*

[MugalulaA@Kinyara.co.ug](mailto:MugalulaA@Kinyara.co.ug) [TibakanyaG@Kinyara.co.ug](mailto:TibakanyaG@Kinyara.co.ug) [Des.Conlong@sugar.org.za](mailto:Des.Conlong@sugar.org.za)

## Abstract

The presence of white grub infesting sugarcane at Kinyara Sugar Works Ltd (KSWL) in Uganda was first noticed in December 2001. The species was identified in 2002 by the Natural History Museum in London as *Idaecamenta eugeniae* Arrow. This was the first time *I. eugeniae* had been recorded from sugarcane.

This paper documents the adult flight patterns, the life cycle and the spread of *I. eugeniae* on the estate from 2003 to 2005. Results from cultural and insecticidal control treatments of infected fields, which lowered levels of the pest to less than two larvae per pit, are presented.

*Keywords:* white grub, Uganda, pest surveys, cultural control, chemical control

## Biography

*Since 1996, Andrew Mugalula has been the Estate Agronomist at Kinyara Sugar Works Ltd in Uganda.*

*His Ph.D. in Agricultural Sciences - Plant Protection was on the use of fungicides to control diseases of maize, at the Ukrainian Agricultural University, Kiev, UKRAIN, in 1993.*

*Agriculturist with good experience in plant protection in mainly maize and sugarcane, formulation and usage of chemicals and herbicides, control of pests and diseases. Good report writing and management skills.*

*He has trained as a sugarcane agronomist in South Africa, Mauritius and Swaziland.*

*He is the current Secretary of the Uganda Sugarcane Technologists' Association. He is a corresponding member of SASTA.*

*Much of the sugarcane entomology and pathology work at Kinyara is carried out in collaboration with SASRI.*

## MOLECULAR IDENTIFICATION OF SOUTH AFRICAN SUGARCANE WHITE GRUBS (COLEOPTERA: SCARABAEIDAE)

DITTRICH G<sup>1</sup>, CONLONG D E<sup>1,2</sup> AND MITCHELL A<sup>3</sup>

<sup>1</sup>*School of Biological and Conservation Sciences, University of KwaZulu-Natal,  
Private Bag X01, Pietermaritzburg, Scottsville, 3209, South Africa*

<sup>2</sup>*South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa*

<sup>3</sup>*Agricultural Scientific Collections Unit, Orange Agricultural Institute,  
NSW Department of Primary Industries, Forest Rd, Orange NSW 2800, Australia*

[Gudrun.Dittrich@sugar.org.za](mailto:Gudrun.Dittrich@sugar.org.za) [Des.Conlong@sugar.org.za](mailto:Des.Conlong@sugar.org.za) [Andrew.Mitchell@dpi.nsw.gov.au](mailto:Andrew.Mitchell@dpi.nsw.gov.au)

### Abstract

Several species of white grub are known to attack sugarcane in South Africa, many of which have not been identified. Correct identification of species is essential to develop sound control tactics. Morphological identification of larvae and adults is possible, but it is often difficult to link adults and larvae of the same species because of their distinct morphological differences. Complementary molecular diagnostic techniques are useful to match adults to larvae of the same species. A molecular analysis of the cytochrome oxidase *c* subunit I (COI) region of the mitochondrial genome was conducted on populations of white grub larvae and adults from various parts of the sugarcane growing regions. Results presented show it is possible to link larvae collected from soil in sugarcane fields with adults of the same species from light trap catches.

*Keywords:* Scarabaeidae, white grubs, mitochondrial DNA, COI, sugarcane, taxonomy

### Biography

*Gudrun Dittrich completed her BSc Agriculture at the University of KwaZulu-Natal, Pietermaritzburg after which she joined SASRI to do her masters in the Entomology department. Her project focuses on using DNA barcodes to identify problematic white grub species.*



## GREEN MANURE CROPS: AGRONOMIC CHARACTERISTICS AND EFFECT ON NEMATODES

BERRY S AND RHODES R

*South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa*

[Shaun.Berry@sugar.org.za](mailto:Shaun.Berry@sugar.org.za) [Ruth.Rhodes@sugar.org.za](mailto:Ruth.Rhodes@sugar.org.za)

### Abstract

Green manure crops can improve soil health and, if chosen correctly, reduce pest and disease problems. Nineteen different cover crops were planted into nematode-infested soil in early summer 2004. These crops were grown for three months, where after they were destructively sampled. A similar procedure was performed with nine cover crops planted in winter 2005.

Results indicated that, of the summer crops, babala, buckwheat, cowpeas, forage sorghum, Rhodes grass and velvet beans had a significantly greater per cent soil cover than sugarcane. Similarly, babala, cowpeas, Rhodes grass and velvet beans had a significantly higher aboveground biomass than sugarcane. Babala, cowpeas and tomatoes were associated with increases in *Meloidogyne javanica*. Ten crops significantly decreased the numbers of *Pratylenchus zae*.

All of the winter crops showed greater per cent soil cover than sugarcane, and six crops exhibited greater aboveground biomass. Most of the crops were associated with decreases in *Pratylenchus zae* and some crops, such as giant English rape, grazing vetch, lucerne, lupins and red clover, were associated with increases in *M. javanica*.

Taking into account the agronomic and nematode status, velvet beans, Rhodes grass and buckwheat would be most favourable for summer planting and oats (black), serradella and wheat for winter.

**Keywords:** green manure crops, plant parasitic nematodes, free living nematodes, sugarcane

### Biography

*Shaun Berry is a Nematologist at the SA Sugarcane Research Institute. His focus area is reducing yield loss due to plant parasitic nematodes and developing diagnostic methods for identification.*

*Ruth Rhodes is a soil scientist at the SA Sugarcane Research Institute. Her focus area is green manuring and the use of alternative crops in the sugarcane industry. Ruth has a passion for the environment and nature conservation.*

**EFFECT OF VARIETY COMBINATIONS ON YIELD OF SUGARCANE**SPAULL V W<sup>1</sup>, CADET P<sup>2</sup> AND BERRY S<sup>1</sup><sup>1</sup>*South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa*<sup>2</sup>*IRD, CBGP, CS 30016, Montpellier, France*[vaughan.spaull@sugar.org.za](mailto:vaughan.spaull@sugar.org.za) [patrice.cadet@mpl.ird.fr](mailto:patrice.cadet@mpl.ird.fr) [shaun.berry@sugar.org.za](mailto:shaun.berry@sugar.org.za)**Abstract**

Pests and diseases flourish where a susceptible host is abundant in both time and space. Hence monocropping can lead to considerable crop loss and even crop failure where no attempt is made to contain the pathogens. Conventionally, pathogens are controlled by means of chemicals, resistant cultivars and various agronomic practices that reduce infection. For some years interest has been given to cultivating mixtures of cultivars, or varieties, of the same plant species to reduce the incidence of disease. Combining cultivars that have different levels of disease susceptibility can disproportionately reduce the level of the disease in the field and thus improve yield. This short communication reports on outcomes of planting mixtures of sugarcane varieties. In one field trial, a combination of four varieties, N12, N21, N27 and N29, was planted in the same furrow. The yields of the second and third ratoons were greater than the averages of the varieties planted alone. The total yield benefit of the mixture over the five crops was 2.2 t ERC, equivalent to an average increase of 4.5%. In another trial on a soil where nematodes were a serious limiting factor, planting a mixture of NCo376, N12 and N31 or N39 in the furrow increased yield by about 40% over that of the average of the individual varieties planted alone.

*Keywords:* sugarcane variety mixtures, nematodes, yield

**Biography**

*Vaughan Spaull is the senior nematologist at SASRI. His PhD was on the ecology of the free-living nematodes on Signy Island in the Maritime Antarctic. His research at SASRI has focused on plant parasitic nematodes, demonstrating the need for their control in soils besides the very poor sands, identifying mechanisms of, and factors affecting crop loss from nematodes, conducting field trials to test new nematocides for sugarcane and assessing the use of entomopathogenic nematodes to control the stalk borer, *Eldana saccharina*. Currently, and in collaboration with his co-authors, the research has focused on methods to manage rather than control plant parasitic nematode by identifying varieties most suited to soils where nematodes are a problem, assessing the selection pressure against nematodes at SASRI's plant breeding selection sites and identifying factors that can change the nematode community structure in favour of less pathogenic species, including the effect of mixtures of varieties.*

**THURSDAY 20<sup>TH</sup> JULY**  
**AGRICULTURE SESSION 7**  
**13:30 – 14:30**

**SPECIAL FOCUS ON SILICON**

Chair: Malcolm Keeping

Sponsor: Omnia Fertilisers (Pty) Ltd)

Agriculture:  
Session 7

# **SILICON USE FOR PEST CONTROL IN AGRICULTURE: A REVIEW**

LAING M D, GATARAYIHA M C AND ADANDONON A

*Plant Pathology, University of KwaZulu-Natal, Pietermaritzburg, 3209, South Africa*

[laing@ukzn.ac.za](mailto:laing@ukzn.ac.za)

## **Abstract**

Silicon (Si) deficiency in crops has been recognised since the 1970s, and a substantial body of research, particularly on rice and sugarcane, now shows that silicon is a 'functional' plant nutrient. In particular, silicon application can significantly enhance insect pest and disease resistance in plants, with consequent yield increases. Responses to silicon application in reducing pest populations and plant damage are usually more obvious in susceptible than resistant varieties. Silicon depositions in monocots may provide a mechanical barrier against insect pests. However, this passive role of silicon is now being contested, and an active role of silicon has been shown in the physiological resistance of crops to diseases. Silicon is now considered to have a catalytic role in the expression of physiological resistance through the production of, among other chemicals, tannic and phenolic compounds. The application of silicon in crops provides a viable component of integrated management of insect pests and diseases because it leaves no pesticide residues in food or the environment, and it can be easily integrated with other pest management practices, including biological control. Given that at least 70% of Africa's soils are deficient to highly deficient in accessible silicon, this has implications for African agriculture.

*Keywords:* silicon, insect control, pest resistance, disease resistance, physiological resistance, IPM

## **Biography**

*Present post:* Professor and Chair of Plant Pathology, Director, African Centre for Crop Improvement (ACCI).

*Functions:* Academic leadership of Plant Pathology. Lecturing 3rd and 4th year students. Supervision of postgraduates. Fundraising. Liaison with growers and fellow scientists. Manage the ACCI, which has a multimillion rand budget funded by the Rockefeller Foundation, 9 staff and 50 PhD students. Manage large research projects such as two Innovation Fund projects on biocontrol. Manage research on biocontrol.

## AN ASSESSMENT OF SOIL EXTRACTION METHODS FOR PREDICTING THE SILICON REQUIREMENT OF SUGARCANE

KANAMUGIRE A<sup>1</sup>, MEYER J H<sup>1</sup>, HAYNES R J<sup>2</sup>, NAIDOO G<sup>1</sup> AND KEEPING M G<sup>1</sup>

<sup>1</sup>South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa

<sup>2</sup>University of Natal, Private Bag X01, Scottsville 3209, South Africa

[Andre.kanamugire@sugar.org.za](mailto:Andre.kanamugire@sugar.org.za)

### Abstract

Crop and sucrose loss from *Eldana saccharina* Walker (Lepidoptera: Pyralidae) damage still ranks as being the most important factor limiting productivity in the South African sugar industry. Recent studies at the South African Sugarcane Research Institute (SASRI) have emphasised the important role of applied silicon (Si) in improving the resistance of sugarcane to eldana infestation, especially in the more susceptible varieties such as N26 and N30. Available results from trials have indicated that the silicon requirement of sugarcane is predominantly a function of soil type, and properties such as soil pH, texture, organic matter and plant available silicon. This paper documents the results of recent glasshouse and laboratory studies of six published soil test procedures to determine the soil extractant that showed the best correlation with silicon uptake and prediction of a yield response to applied Si in sugarcane.

*Keywords:* soils, soil tests, soil extractant, silicon, *Eldana. saccharina*, calcium silicate, soil pH

### Biography

*Jan Meyer is the former Head of Crop Nutrition and Soils at SASRI and currently principal scientist until his retirement in November this year. Jan has been involved in crop nutrition and soil sustainability research over the past 40 years and researching the silicon requirement of sugarcane is his passion. He has been a prolific contributor to SASTA over the years with over 80 co-authored publications. This paper dealing with an evaluation of soil test procedures for Si forms part of Andre Kanamugire's MSc project, which Jan has supervised and presenting on behalf of Andre.*

## SILICON AND WATER STRESS SYNERGY IN RESISTANCE OF SUGARCANE CULTIVARS TO THE STALK BORER, *ELDANA SACCHARINA* (LEPIDOPTERA: PYRALIDAE)

KVEDARAS O L<sup>1,2</sup>, KEEPING M G<sup>1</sup>, GOEBEL F R<sup>3</sup> AND BYRNE M J<sup>2</sup>

<sup>1</sup>South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa

<sup>2</sup>School of Animal, Plant and Environmental Sciences, University of the Witwatersrand,  
Private Bag 3, Wits 2050, South Africa

<sup>3</sup>CIRAD Unite de recherche Systemes Canniers, TA 70/09, Avenue Agropolis,  
34398 Montpellier, cedex 5, France

[Olivia.Kvedaras@sugar.org.za](mailto:Olivia.Kvedaras@sugar.org.za), [Malcolm.Keeping@sugar.org.za](mailto:Malcolm.Keeping@sugar.org.za)  
[regis.goebel@cirad.fr](mailto:regis.goebel@cirad.fr) [marcus@gecko.biol.wits.ac.za](mailto:marcus@gecko.biol.wits.ac.za)

### Abstract

Silicon (Si) improves plant resistance to insect attack and may also enhance tolerance of water stress. The objective of this study was to evaluate whether Si-mediated resistance of sugarcane to the borer *Eldana saccharina* Walker (Lepidoptera: Pyralidae) is enhanced by water stress. Sugarcane cultivars, two resistant to *E. saccharina* (N21, N33) and two susceptible (N26, N11) were grown in a pot trial, in Si deficient river sand with (Si+) and without (Si-) calcium silicate. To induce water stress, irrigation to half of the trial was reduced prior to inoculation with *E. saccharina* eggs, and harvested 66 days later. Stressed and non-stressed plants of the same cultivar did not differ significantly in Si content. However, Si+ plants exhibited increased resistance to *E. saccharina* attack. In Si+ cane, *E. saccharina* larval survival and biomass was lower than in Si- cane, significantly so for stressed, susceptible cultivars N26 and N11, and for larval mass in non-stressed N26. Stalk damage was reduced in Si+ cane, significantly so for the stressed, susceptible cultivars N26 and N11, and non-stressed N26. This study showed that Si provides greater protection against *E. saccharina* attack in susceptible, water-stressed sugarcane than in non-stressed cane and/or resistant cultivars.

**Keywords:** calcium silicate, silicon, sugarcane, induced resistance, *Eldana saccharina*, water stress

### Biography

Olivia is an Australian currently residing in South Africa. Olivia was awarded her PhD Entomology (Australia) in 2003 where she worked on Australia's most significant pest of cotton, the cotton bollworm, *Helicoverpa armigera* (Hübner). In 2004, Olivia was awarded both a University of the Witwatersrand and NRF postdoctoral fellowship for two consecutive years and a subsequent University of Witwatersrand postdoctoral fellowship has been awarded for her final and now third year at the South African Sugarcane Research Institute (SASRI) under the guidance of Dr Malcolm Keeping (SASRI) and Prof. Marcus Byrne (Wits). Olivia is only SASRI's second postdoctoral fellow, which has set a precedent for others to follow.

Olivia's current area of research is on the role of silicon (Si) in enhancing the resistance of sugarcane cultivars to attack by the stem borer, *Eldana saccharina* Walker. Olivia is currently a Scientific Committee member of the Local Organising Committee for the International Conference of Entomology (ICE) to be held in Durban, South Africa 2008 and also for the IV Silicon in Agriculture Conference to be held in Durban, South Africa 2008. Olivia was also a Chair for the Entomological Society of Southern Africa Congress, Grahamstown, South Africa July 2005 and has refereed for a number of journals including African Journal of Entomology, Journal of Environmental and Experimental Botany and Proceedings of the Hawaiian Entomological Society.

**THURSDAY 20<sup>TH</sup> JULY**  
**AGRICULTURE SESSION 8**  
**15:00 – 16:00**

**DISEASES OF SUGARCANE**

Chair: Sharon McFarlane

## **FUNGICIDE TRIALS TO DETERMINE THE EFFECT OF BROWN RUST ON THE YIELD OF SUGARCANE VARIETY N29**

MCFARLANE K, MCFARLANE S A, MOODLEY D AND RUTHERFORD R S

*South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa*

[Keith.mcfarlane@sugar.org.za](mailto:Keith.mcfarlane@sugar.org.za)

### **Abstract**

Since the release of sugarcane variety N29 (genotype 84E1334) for commercial planting in the spring of 1997, severe infections of brown rust (*Puccinia melanocephala*) have been reported in this cultivar. Many growers have persevered with N29, risking substantial yield losses should the crop become infected. Two fungicide trials were established to assess the effect of brown rust on the yield of N29 in the KwaZulu-Natal Midlands where the disease is prevalent. The results of these trials are discussed.

*Keywords: Puccinia melanocephala, yield, brown rust, sugarcane diseases, fungicides*

### **Biography**

*Keith McFarlane has been working at the South African Sugarcane Research Institute (SASRI) for the past 17 years. He was initially employed as a Technician in the Farm Planning Department before becoming the Senior Research Technician in Pathology, a post he held for 9 years. In March this year, Keith was appointed Technical Team Manager at SASRI. Prior to joining SASRI, Keith managed a variety of farming operations in the UK.*



# FUNGICIDE SPRAYS TO CONTROL BROWN RUST (*PUCCINIA MELANOCEPHALA*) GAVE VARIABLE CANE AND SUGAR YIELD RESPONSES IN THE SOUTH-EAST LOWVELD OF ZIMBABWE

ZVOUTETE P

*Zimbabwe Sugar Association Experiment Station, Private Bag 7006, Chiredzi, Zimbabwe*

[255056@ecoweb.co.zw](mailto:255056@ecoweb.co.zw)

## Abstract

Four triazole fungicides cyproconazole (50 ppm), propiconazole (250 ppm), triadimefon (750 ppm) and triadimenol (250 ppm) applied as foliar sprays at 14-day intervals significantly reduced naturally occurring brown rust infections on sugarcane leaves in 1996. In trials undertaken in 2002/03 and 2003/04, triadimenol applied on varieties NCo376, N14 and ZN6 provided only partial rust control, with mean disease ratings in the most susceptible variety, ZN6, falling from 37% leaf coverage in unsprayed to 16% in sprayed crops. Cane and sugar yields of ZN6 increased by 18% and 16% respectively in 2002/03, but there was no increase in 2003/04. Cane and sugar yields of the more resistant NCo376 and N14 varieties were not affected by brown rust in both trials.

*Keywords:* sugarcane, rust, disease control, fungicide, cane yields, sugar yields.

## Biography

*Petros Zvoutete is the Senior Plant Pathologist at the Zimbabwe Sugar Association Experiment Station, the research arm of the Zimbabwe Sugar Industry. His MSc at Kansas State University was on the epidemiology of bacterial streak of sorghum. From 1987 to 1995 he researched on management of diseases of vegetable crops as well as undertake advisory and quarantine responsibilities.*

*Much of his work in the past ten years has been on diagnosis and monitoring of sugarcane diseases, screening germplasm for resistance to ratoon stunting, smut and leaf scald diseases as well as carrying out yield loss studies.*

## EVALUATING THE INHIBITORY ACTIVITY OF SYNTHETIC ANTI-MICROBIAL PEPTIDES AGAINST *USTILAGO SCITAMINEA*, *FUSARIUM VERTICILLIOIDES* AND *ELDANA SACCHARINA*

RAMGAREEB S AND RUTHERFORD R S

*South African Sugarcane Research Institute, Private Bag X02,  
Mount Edgecombe, 4300, South Africa*

[sumita.ramgareeb@sugar.org.za](mailto:sumita.ramgareeb@sugar.org.za) [stuart.rutherford@sugar.org.za](mailto:stuart.rutherford@sugar.org.za)

### Abstract

Varieties of sugarcane that show resistance to *Ustilago scitaminea* are more often than not susceptible to *Eldana saccharina* and vice versa. In addition, recent evidence suggests that *Fusarium verticillioides*, commonly found colonising stalk tissue surrounding borings, positively influences the survival, growth and fecundity of *E. saccharina*. Sugarcane varieties engineered with enhanced resistance to *U. scitaminea*, *F. verticillioides* and *E. saccharina* are potentially of great value to this industry. The aim of this study was to investigate the anti-microbial and insecticidal activities of synthetic cationic anti-microbial peptides as a prelude to a possible transgenic approach. Members of four classes of anti-microbial peptides (D4E1, GR7, REV4, PON-G1) were selected as candidates for *in vitro* testing against *U. scitaminea* (smut), *F. verticillioides* (fusarium) and *E. saccharina*. The Ponericin PON-G1 was found to be most effective against both fusarium and smut with low concentrations of 1.7  $\mu\text{M}$  and 0.1  $\mu\text{M}$ , respectively, reducing the growth of these pathogens by 50% after a 48 hour incubation period. The Indolicidin REV4 was not able to reduce fusarium growth by 50%, even at the highest concentration tested (52.9  $\mu\text{M}$  or 100  $\mu\text{g/ml}$ ); however, inhibitory activities were recorded against smut and *E. saccharina*. Preliminary tests suggest that exposure of neonate *E. saccharina* larvae to REV4, PON-G1 or GR7 results in a reduction in larval growth rate. Investigations were also done on the potential synergistic inhibition of these three peptides against fusarium. It was found that when REV4 was combined with PON-G1, it was able to enhance the action of this peptide such that a much lower concentration was required to elicit the same effect (50% reduction in growth) obtained when PON-G1 was tested individually. Further work on the synergistic inhibition of REV4, PON-G1 and GR7 against smut and *E. saccharina* are ongoing.

**Keywords:** Indolicidin, Ponericin, Magainin, Cecropin, *Eldana saccharina*, *Fusarium verticillioides*, *Ustilago scitaminea*

### Biography

*Sumita Ramgareeb completed her doctorate at the University of KwaZulu-Natal in 2004. Her dissertation investigated aluminium toxicity and resistance in Cynodon dactylon using in vitro techniques. Her research interest includes plant biotechnology and crop physiology. She now focuses her research efforts on another grass and is currently employed in the Crop Biology Resource Centre at SASRI.*

**THURSDAY 20<sup>TH</sup> JULY**  
**FACTORY SESSION 4**  
**08:30 – 10:30**

**PROCESSING: RAW HOUSE OPERATIONS**

Chair: Paul Schorn

Sponsor: Tongaat Hulett Sugar Limited

# APPLICATIONS OF CAPILLARY VISCOMETRY IN CANE SUGAR FACTORIES

LIONNET G R E AND PILLAY M

*Tongaat-Hulett Sugar Ltd, Private Bag 3, Glenashley, 4022, South Africa*

[raoul.lionnet@hulett.co.za](mailto:raoul.lionnet@hulett.co.za) [melanie.pillay@hulett.co.za](mailto:melanie.pillay@hulett.co.za)

## Abstract

The importance of viscosity in cane sugar processing is well established, particularly as far as exhaustion is concerned. Techniques for the determination of the viscosity and consistency of massecuites and of molasses have therefore been the subject of many investigations. Two types of instruments, the Brookfield rotating cylinder viscometer and the pipeline viscometer, have been utilised, with the former being used more extensively. Another type of instrument, the gravity driven glass capillary viscometer, is used by national standard organisations; it yields absolute viscosity data of high accuracy and with good precision.

This paper describes a number of applications for glass capillary viscometry. The technique was used to determine the concentrations of the usual clarification flocculant in water and in juices; to compare the viscosities of limed juice, clear juice and of diluted syrup; to measure the viscosity of A-molasses from different factories, and to carry out preliminary work on the effect of suspended solids on the viscosity of final molasses. The viscometers are inexpensive and easy to use.

Finally, double tube capillary viscometers are briefly mentioned.

*Keywords:* capillary, viscosity, viscometry, flow behaviour, flocculant, molasses, factory process

## Biography

*Raoul Lionnet is a sugar technologist working for the Technology and Engineering Group (TEG) of Tongaat Hulett Sugar. He has a diploma in sugar technology and a Ph.D. in chemistry.*

*He started his career as a factory process supervisor and then as chief chemist at the Darnall sugar mill. He then spent 11 years as a development technologist at Hulett's Research and Development. After a two-year stay at Darnall as Assistant Process Manager, he moved to the Sugar Milling Research Institute where he worked for 22 years, ending his career there as Assistant Director.*

*He has published papers for SASTA and for international conferences and journals.*

# NUMERICAL STUDY OF THE FLOW IN AIR FLOTATION SYRUP CLARIFIERS

ECHEVERRI L F AND REIN P W

*Audubon Sugar Institute, Louisiana State University AgCenter, Louisiana, USA*

[prein@agctr.lsu.edu](mailto:prein@agctr.lsu.edu)

## Abstract

Flotation clarification has been successfully introduced on an industrial scale in numerous liquid-solid separation processes, including the clarification of syrup in sugar factories, where reductions in colour, turbidity and suspended solids are achieved that are particularly beneficial in the direct production of white sugar. This paper presents results on the numerical simulation of the flow in syrup flotation clarifiers applying Computational Fluid Dynamics (CFD). Use is made of results from an experimental study of the hydrodynamic behaviour of the flocs. Based on the predicted flow field, the dynamic response of the clarifier has been simulated using the species model to obtain a 'virtual' residence time distribution, which is compared with results on tracer tests performed in a Tongaat-Hulett sugar mill. It is concluded that single-phase CFD solutions cannot describe correctly the flow in syrup clarifiers, where the buoyancy of the flocs appears to affect the flow field. The application of the Eulerian-Eulerian multiphase model has given better agreement with tracer results, and indicated possible flow patterns within syrup clarifiers. The numerical analyses suggested significant effects of the size of the flocs on the flow, the positioning of the outlets and the existence of stagnant zones. The introduction of inclined channels, or 'lamellas', within the flotation area to optimise the flow patterns is discussed, concluding that they are effective in preventing recirculation and turbulence, and could help to increase the throughput of syrup clarifiers substantially.

*Keywords:* clarification, flotation, syrup, CFD, separation, DAF, factory process

## Biography

*Luis Echeverri is a Ph.D. candidate in Mechanical Engineering at Louisiana State University, USA, where he works at Audubon Sugar Institute under direction of Dr Peter Rein and Dr Sumanta Acharya on the study of the flow in vacuum pans. Most of his professional career has been dedicated to the sugarcane process, initially in Colombia with CENICAÑA, and his current research comprises the application of Computational Fluid Dynamics (CFD) and modern flow measurement techniques in the analysis of multiphase buoyancy driven flows.*

# EXPERIENCES OF MASSECUITE PIPELINE EXPLOSIONS CAUSED BY THE HIGH TEMPERATURE DECOMPOSITION OF MOLASSES

GETAZ M<sup>1</sup>, ARCHIBALD R D<sup>2</sup> AND LOVE D J<sup>3</sup>

<sup>1</sup>*Fletcher Smith, Derby, England*

<sup>2</sup>*Tongaat-Hulett SugarLtd, Mafambisse, Moçambique*

<sup>3</sup>*David Love Process Engineering cc, Durban, South Africa*

[mikegetaz@fletchersmith.co.uk](mailto:mikegetaz@fletchersmith.co.uk) [davidlove@intekon.ca.za](mailto:davidlove@intekon.ca.za)

## Abstract

A recent experience of a destructive explosion of a massecuite pipeline has highlighted the importance of continuing to publicise the causes and consequences of this type of event in the interests of preventing further occurrences. Details of the recent explosion in Central America and a similar event at Darnall in the 1970s are described. The common factor in these explosions was the use of high pressure steam for steaming out cut-over/drain lines. The causes and mechanism of the reaction which precipitates this type of explosion are explained on the basis of published results of laboratory experiments which were instigated by a similar explosion in Australia. Recommendations for avoiding possible future explosions of this type are given.

*Keywords:* explosion, pipeline, massecuite, safety, factory process

## Biography

*David Love is an independent consultant, consulting primarily to Tongaat Hulett Sugar. He qualified as a chemical engineer from the University of Natal in 1974 and began his engineering career in municipal sewage treatment. In 1977 he joined the sugar industry working for Huletts Sugar. His work experience has covered research and development, production management, design and technical consulting. His doctorate was on the mathematical modelling and optimal control of continuous pans.*

*He has published a number of papers in the proceedings of both SASTA and ISSCT congresses. The papers have covered topics in the areas of extraction, clarification, juice heating, evaporation, crystallisation and process automation."*

**THURSDAY 20<sup>TH</sup> JULY**  
**FACTORY SESSION 5**  
**10:30 – 12:30**

**PROCESSING:  
CRYSTALLISATION AND  
CENTRIFUGATION**

Chair: Dave Meadows

Sponsor: Western States Machine Company and BNC Projects (Pty) Ltd.

# AUTOMATIC MEASUREMENT OF CRYSTAL SIZE DISTRIBUTION USING IMAGE PROCESSING

ARGAW G A, ALPORT M J AND MALINGA S B

*Applied Physics Group, School of Physics, Howard College Campus,  
King George V Avenue, University of KwaZulu-Natal, Durban 4041, South Africa*

[204506735@ukzn.ac.za](mailto:204506735@ukzn.ac.za) [alport@ukzn.ac.za](mailto:alport@ukzn.ac.za) [malingas2@ukzn.ac.za](mailto:malingas2@ukzn.ac.za)

## Abstract

In sugar production the optimal control of sugar crystal growth during the crystallisation stages is essential for producing sugar crystals having the required size specification. The growth process is usually monitored using a variety of indirect measurement techniques in addition to visual inspection. Such indirect measurements are subjective and hence prone to operator variability. For this reason, a more quantitative automatic system is required. Software routines were developed for the automated measurement of crystal size using classical image analysis techniques.

Five algorithms have been evaluated to automatically determine the size distribution from images of crystal samples captured by a digital camera attached to a microscope. The accuracy of the segmentation depends on the technique used to mark every crystal in the image.

The parameters of interest which were calculated from the size distribution include the mean aperture (MA) and coefficient of variance (CV). Mathematical morphology has been used as a tool to develop the algorithms. The results obtained using these algorithms were compared with each other and with a manually clicked measurement. The mean aperture was measured with an error of less than 20%. The accuracy of the results mainly depended on the number of crystals counted and the degree of crystal overlap.

*Keywords:* MA, CV, crystal size distribution, image processing, grain size analysis, factory process

## Biography

*Mr. Argaw, Getachew Abebe is full time Ph.D. student at the University of Kwa-Zulu Natal, School of Physics. His Ph.D. focus on designing and testing a system for automatic measurement of crystal size parameters.*

*Mr Argaw was lecturer of physics at the University of Alemaya, Ethiopia. He was also holding position as the assistant registrar of the university for three consecutive years.*



# TESTING OF WASH WATER EQUIPMENT IN A-CENTRIFUGALS AT FELIXTON MILL

JAGANATH S H

*Tongaat-Hulett Sugar Ltd, Private Bag X02, Felixton, 3875, South Africa*

[sean.jaganath@hulett.co.za](mailto:sean.jaganath@hulett.co.za)

## Abstract

The performance of the A-centrifugal station is of key interest in the final stages of raw sugar production, as it is one of the final unit operations that impacts on raw sugar quality. Good quality massecuite can easily be converted into poor quality sugar by bad curing conditions, and this paper discusses wash water equipment inside batch centrifugals.

A survey of the A-centrifugal station at Felixton (FX) raw sugar factory was conducted to establish what equipment exists, with a view to optimising raw sugar quality. This information was used to optimise operations on the A-centrifugals, especially with regards to wash water spray bars and nozzles. A brief trial was conducted at FX with a new multi-nozzle spray bar, and the results are discussed.

*Keywords:* centrifugals, A-exhaustion, nozzles, wash water, spray bar, sugar quality, factory process

## Biography

*Sean Jaganath is currently a Process Engineer at Felixton Mill of Tongaat Hulett Sugar Ltd. His career in the sugar industry began at the end of 1999 when he was accepted as an "Engineer in Training" in the Process Department. He completed the training program within two years and subsequently joined the process team at Felixton Mill.*

*Sean has a Bachelor of Technology degree in Chemical Engineering. He also recently completed a Management Development Program at UNISA. Sean's current work involves managing the backend operations of the production factory from syrup to sugar and molasses dispatch. He has previously managed the laboratory, water filtration plant and effluent plant. After work, he enjoys spending time with his family.*

# CENTRIFUGAL CONTROL WITH AUTOMATIC COLOUR MEASUREMENT

NIELSEN B C

*Neltec Denmark A/S, DK-6541 Bevtoft, Denmark*

[bcn@neltec.dk](mailto:bcn@neltec.dk)

## Abstract

In sugar mills, factories and refineries, the sugar colour varies depending on the quality of the massecuite. Compensation to get a more uniform quality is done by adjusting the amount of water spraying in the centrifugals. Delays in laboratory results and operator adjustments necessitate the sugar colour be kept at a safe margin below the maximum allowed colour. The time delays can be eliminated by applying automatic real-time colour measurement and using it for automatic control of the spray water. Consequently, the safety margin can be reduced. This leads to significant reductions in the amount of sugar melted in the centrifugals and sugar lost during recycling.

In 2005 two automatic Neltec ColourQ colorimeters were used to implement automatic control of the wash water in the centrifugals.

This paper explains how the instruments were installed, how results are obtained which show how colour varies throughout each charge, how the results are displayed to the operators and how the results are used to control the spraying in the centrifugals. The results and benefits from the automatic colour measurement before and after implementation of the automatic control are discussed.

*Keywords:* sugar colour, real-time, washing, control, quality, remelt

## Biography

*Bjarne Chr. Nielsen received his M.Sc(Physics) from the Danish Technical University. For twenty years he has worked in instrumentation for on-line colour measurement. He is the founder and manager of Neltec.*

# SOME COMMENTS ON THE ELONGATION RATIO OF CRYSTALS IN C-MASSECUITES

LIONNET G R E

*Tongaat-Hulett Sugar Ltd, Private Bag 3, Glenashley, 4022, South Africa*

[raoul.lionnet@hulett.co.za](mailto:raoul.lionnet@hulett.co.za)

## Abstract

Crystal size distribution (CSD) and elongation ratios for the crystals in South African C-masseccutes have been measured on a weekly basis for the past 20 seasons by the Sugar Milling Research Institute.

The degree of control available at the factory for these two parameters is different: the CSD and, more particularly, the average value of the crystal width, is controllable through such factors as the amount of slurry added and the number of masseccute cuts. The elongation ratio is determined by the presence of specific impurities such as kestoses and, possibly, dextran, which are introduced into the factory mostly through cane deterioration. Thus, the elongation ratio and any processing effects associated with it are generally outside the control of process management.

Elongation ratios in the Tongaat-Hulett Sugar factories during the 2005 season are examined, and attempts made to identify parameters that may be associated with them. Some effects associated with elongation ratios and various unit operations in the FX C-station are discussed. It appears that higher elongation ratios may be associated with poor exhaustions in the C-station at this factory.

*Keywords:* CSD, elongation ratio, exhaustion, C-crystal, factory process

## Biography

*Raoul Lionnet is a sugar technologist working for the Technology and Engineering Group (TEG) of Tongaat Hulett Sugar. He has a diploma in sugar technology and a Ph.D. in chemistry.*

*He started his career as a factory process supervisor and then as chief chemist at the Darnall sugar mill. He then spent 11 years as a development technologist at Huletts Research and Development. After a two-year stay at Darnall as Assistant Process Manager, he moved to the Sugar Milling Research Institute where he worked for 22 years, ending his career there as Assistant Director.*

*He has published papers for SASTA and for international conferences and journals.*

**THURSDAY 20<sup>TH</sup> JULY**  
**FACTORY SESSION 6**  
**13:30 – 15:00**

**PROCESSING :**  
**MAXIMISING SUCROSE RECOVERY**

Chair: Stanley Munsamy

# THE EFFECT OF SOME IMPURITIES ON THE TARGET PURITY FORMULA

DAVIS S B AND SCHOONEES B M

*Sugar Milling Research Institute, University of KwaZulu-Natal, Durban 4041, South Africa*

[sdavis@smri.org](mailto:sdavis@smri.org) [bschoonees@smri.org](mailto:bschoonees@smri.org)

## Abstract

In the South African cane sugar industry the Target Purity Difference (TPD) figure is used as a measure of factory performance in terms of molasses exhaustion, and is calculated on a weekly basis from analyses of composite final molasses samples. Some factories always have lower TPDs than others, while there is also a prominent seasonal effect. The factors affecting TPD are highly complex and trends or unexpected values cannot always simply be attributed to specific factors.

High TPD levels at some factories in recent years spurred an investigation into the possibility of including polysaccharides or specific ash components into the Target Purity (PD) formula in an attempt to limit the factors affecting the TPD to those that are under factory control.

Molasses sub-samples were spiked with starch, dextran and sarkaran to quantify the effects of polysaccharides on exhaustion. Molasses samples from three factories were collected in the 2004/5 season and analysed for polysaccharides and individual ash components. TPs were calculated and the samples were subjected to boil-down tests to determine the Equilibrium Purities.

The investigation found that none of the components under consideration had an effect on the molasses purity obtainable under equilibrium laboratory conditions. Inclusion of any of these components in the TP formula is therefore not justified.

*Keywords:* purity, exhaustion, polysaccharides, ash, molasses, reducing sugars, factory process

## Biography

*Steve Davis is the Head of the Processing Division at the Sugar Milling Research Institute. A Professional Chemical Engineer, he studied for his BSc and MSc in Engineering at the University of Natal in Durban.*

*He is currently a member of SASTA Council and the SASTA Congress Organising Committee, serving as joint Factory Programme Editor. He is also currently Chairman of the Factory Control Advisory Committee, which advises the industry on matters relating to factory calculations and performance parameters.*

*His research interests include clarification processes, colour removal from sugar juices and syrups (raw house and refinery), separation technologies and tracer testing. He has presented the Annual Review of the Milling Season in Southern Africa at the annual SASTA Congress since 2002.*

# PRACTICAL STEPS TAKEN AT TONGAAT-HULETT SUGAR FACTORIES TO ACHIEVE LOW TARGET PURITY DIFFERENCES

NINELA M<sup>1</sup> AND RAJOO N<sup>2</sup>

<sup>1</sup>*Tongaathulett Sugar, Technology & Engineering Group,  
Amanzimnyama, KwaZulu-Natal, South Africa*

<sup>2</sup>*Tongaathulett Sugar Maidstone Mill, Maidstone, KwaZulu-Natal, South Africa*

[muzi.ninela@huletts.co.za](mailto:muzi.ninela@huletts.co.za) [naveen.rajoo@huletts.co.za](mailto:naveen.rajoo@huletts.co.za)

## Abstract

Target Purity Difference (TPD) is one of the most important indicators of performance in a sugar factory. It is not only a good indicator of final molasses exhaustion, but also of back-end factory control. Factors affecting TPD were identified, and practical changes were made to the operations at Darnall in 2003, Maidstone in 2004 and 2005 and Amatikulu in 2005, resulting in significant improvement of TPD values at these factories during the respective crushing seasons.

The paper details the day-to-day boiling house operations that affected TPD results at these three South African Tongaat-Hulett Sugar factories. It further covers the practical application of the Sugar Milling Research Institute crystal size distribution information to improve massecuite and seed boiling procedures, and the effect of slurry preparation on molasses exhaustion.

*Keywords:* TPD, CSD, molasses exhaustion, panboiling, slurry, centrifugals, factory process

## Biography

*Muzi Ninela is a Chemical Engineer in the Technology and Engineering*

*Group: Tongaat-Hulett Sugar. He has spent the past ten years in the sugar production environment in different roles, starting as an Engineer-in-training, a Quality Assurance Manager and a Senior Sugar Technologist. He graduated with a Bachelor of Technology Degree in Chemical Engineering (1995) with further studies including Sugar Engineering, SABS ISO 9002 Quality Management Systems, Management Development Program (MDP) and Senior Management Program (SMP).*

# CRYSTAL RECOVERY EFFICIENCY: THREE YEARS ON

PEACOCK S D AND SCHORN P M

*Tongaat Hulett Sugar Limited, Technology & Engineering Group,  
Private Bag 3, Glenashley, 4022, South Africa*

[Steve.Peacock@Huletts.co.za](mailto:Steve.Peacock@Huletts.co.za)

## Abstract

The South African sugar industry has been reporting *crystal recovery efficiency* (XRE) as an overall measure of sugar mill performance since the start of the 2003 season. Now that industry data has been collected over three seasons, it is appropriate to evaluate the practical performance of the XRE concept. Standard overall performance yardsticks, such as value recovery, are compared against XRE as a means of assessing factory performance independent of the effects of cane quality. Measured values of XRE are also correlated with changes in factory performance and with parameters such as target purity difference, in order to relate variations in XRE to actual changes in the factory. In this way, it is possible to demonstrate the usefulness of XRE as a true measure of overall mill performance, independent of the distorting effects of any underlying variations in cane quality.

*Keywords:* crystal recovery efficiency, factory performance, cane quality, factory process

## Biography

*Steve Peacock is the Process Analysis Engineer in the Technology & Engineering Group of Tongaat Hulett Sugar. He is a registered Professional Engineer and has a cum laude Masters degree in Chemical Engineering, on the mathematical modelling of evaporators. He is two subjects away from finishing a BCom degree specialising in Quantitative Management, but will not admit to it if questioned. Steve's current work involves process modelling, process and equipment design and factory troubleshooting. He will sometimes solve difficult mathematical problems for his colleagues if they ask nicely. On the occasional days when his workload is light, he spends time with his family.*

**THURSDAY 20<sup>TH</sup> JULY**  
**FACTORY SESSION 7**  
**15:30 – 17:00**

**COLLOQUIUM ON CRYSTALLISATION**

Chair: Steve Davis