ABSTRACT

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12th GERMPLASM & BREEDING
AND
9th MOLECULAR BIOLOGY
WORKSHOPS

IMPROVEMENT OF SUGAR CANE
FOR STRESS ENVIRONMENTS

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Kyushu Okinawa Agricultural Research Center / National Agriculture and Food Research Organization (KARC/NARO)

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Yanmar Agribusiness Co., Ltd.
12th Germplasm & Breeding section abstracts (BO, BP)

Oral presentation abstracts (BO)

BO1  Determining breeding values of parental genotypes for sugarcane yield  
Ntombi Mbuma, Marvellous Zhou*, Rouxlene Van der Merwe

BO2  Estimating breeding values in sugarcane breeding using SAS mixed models  
Marvellous Zhou*

BO3  How to make the best sugarcane crossings managing the flowering time  
Luciana Gonçalves Chaves Castellani*, Michael Keith Butterfield

BO4  Evaluation of extent of flowering and island pithiness in commercial parent  
varieties in Mauritius  
Satish Koonjah, Goolam Badaloo*, Michael Mangar

BO5  Total antioxidant activity in early generation and commercial sugarcane  
genotypes in Louisiana's sugarcane variety development program  
Anna Hale*, Himaya Mula-Michel, James Todd

BO6  Vegetation index as a parameter for identifying spatial variability zones in  
early stage selection trials  
Danilo Eduardo Cursi*, Hermann Paulo Hoffmann, Monalisa Sampaio Carneiro,  
Roberto Giacomini Chapola, Antonio Ribeiro Fernandes Junior, Matheus Gabriel  
Acorsi, Márcio dos Anjos, Rodrigo Gazaffi

BO7  Evaluation of crossing combination for improvement of ratoon yield in  
Tanegashima island, Japan  
Taiichiro Hattori*, Katsuki Adachi, Michiko Hayano, Makoto Umeda, Takeo  
Sakaigaichi, Minoru Tanaka, Yusuke Tarumoto

BO8  Creation of genetic variation and selection for drought tolerance in  
sugarcane  
Tanapon Chaisan*, Wannasiri Wannarat, Jetsada Authapun

BO9  Breeding for higher total cane biomass for marginal environments and for  
year-round harvest in Mauritius  
Goolam Badaloo*, Deepack Sanchurn

BO10 Optimizing genomic selection in sugarcane for phenotyping cost and  
selection accuracy  
Kosuke Hamazaki*, Yusuke Ueta, Taiichiro Hattori, Takayoshi Terauchi, Yoshifumi  
Terajima, Jun-ichi Nagai, Masaaki Mori, Hiroyoshi Iwata

BO11 Use of genomic selection to speed up gains in sugarcane breeding  
Phillip Jackson*, XianmingWei, Emily Deomano, Karen Aitken

BO12 Utilizing wild germplasm in sugarcane breeding – progress and prospects  
Phillip Jackson*
BO13  Characteristics of intergeneric hybrids between *Saccharum* spp. hybrid and *Erianthus arundinaceus*
Yoshifumi Terajima*, Pachakkil Babil, Nobuko Ohmido, Masumi Ebina, Shin Irei, Akira Sugimoto, Hiroko Takagi

BO14  Web-based pedigree database for sugarcane breeding
Yusuke Tarumoto*, Katsuki Adachi, Shin Irei

BO15  Development of mobile application for searching Thai commercial cane varieties
Ratana Tangwongkit*, Borpit Tangwongkit, Prasit Vongsateam, Jakgrit Kuntong, Thawat Hamarn, Pongsak Chonthanasawad, Lop Phavaphutanon

BO16  Selection for brown rust sugarcane resistant varieties using seedlings from fuzz
Edison Silva*, Fabricio Martinez, Tito León, Cervando Madrid, Fabián Fiallos, Roberto Díaz Juárez

BO17  Evaluation of disease resistance in sugarcane crosses in China
Rong-zhong Yang*, Hui Zhou, Fang Tan, Zhong-feng Zhou, Xiu-peng Song, Shi-yun Tang

BO18  How to improve selection decisions in the first replicated yield trial (RYT) of sugarcane selection programs?
Jean-Yves Hoarau*, Laurent Barau, Audrey Thong-Chane, Thomas Dumont

BO19  High-throughput UAV platform for early stage selection in sugarcane clonal assessment trials
Jayampathi Basnayake, Sijesh Natarajan, Xianming Wei, Prakash Lakshmanan

BO20  Investigation of genotype by environment interactions in Louisiana breeding, USA
James Todd*, Yong-Bao Pan, Collins Kimbeng, Edwis Dufrene, Herman Waguespack, Michael Pontif

BO21  Multi-local selection of sugarcane analyzed with GGE biplots: overview of results at a glance and scope of lessons
Jean-Yves Hoarau*, Susie Guilly, Laurent Barau, Audrey Thong-Chane, Thomas Dumont

BO22  Genetic variability of yield traits in diverse sugarcane ecologies of selection in Réunion island
Thomas Dumont, Jean-Yves Hoarau*, Laurent Barau, Audrey Thong-Chane, Bernard Siegmund

BO23  Studying three-way interaction under generalized sites regression model in sugarcane final assessment trials
Gabriela Estéfano Saraiva Leme, Danilo Eduardo Cursi, Roberto Giacomini Chapola, Hermann Paulo Hoffmann, Rodrigo Gazaffi*

BO24  Methodology for selecting sugarcane clones for dry environments
Zhao Peifang, Phillip Jackson*, Liu Jiayong, Chen Xuekuan, Jaya Basnayake, Prakash Lakshmanan, Zhao Xindong, Fan Yuanhong
Screening of elite sugarcane germplasm for developing high sugar varieties in South India  
S. Rajeswari*, S. Parthiban, P. Bharathi, K. Shanmugha Sundaram, S.J. Lakshman

Evaluation of cultivar performance of sugarcane in the temperate area in Japan  
Shozo Okada*, Masami Ueno, Yoshinobu Kawamitsu

Performance of selected Phil 2009 series of sugarcane varieties in four mill districts in Luzon  

Long-term evaluation of the productivity of sugarcane cultivars in the Daitoh islands, Okinawa  
Hiroo Takaragawa*, Eizo Taira, Masami Ueno, Yoshinobu Kawamitsu

Rapid adoption of new varieties through post-release trials in Ecuador  
Edison Silva C.*, Fabricio Martinez, David Palomeque, Walter Jara, Glenda Toala

Identifying breeding groups to select sugarcane genotypes according to sucrose accumulation curves  
Santiago Ostengo*, Angélica Rueda Calderón, Cecilia Bruno, María I. Cuencya, Mónica Balzarini

Evaluation of the phenotypic diversity for traits related to plant growth and sugar content in a sugarcane germplasm collection  
Warodom Wirojsirasak*, Sucharat Butphu, Phunsuk Laotongkum, Chirawat Prasitsom, Laurent Soulard, Prapat Punpee, Peeraya Kromsa-ard

Poster presentation abstracts (BP)

**BP1**  
Thai sugarcane promising clone KK07-250  
Werapon Ponragdee*, Piyarat Jangpol, Ammarawan Tippayawat, Taksina Sansayawichai, Wanlipar Suchato, Wanlee Amonpon, Boonyapha Srijata, Sukalya Jenhang, Sunattha Attisilwet

**BP2**  
Agronomic traits and root distribution of intergeneric F₁ and BC₁ hybrids between *Saccharum* spp. hybrid and Thai *Erianthus arundinaceus* in North-East Thailand  
Amarawan Tippayawat*, Yoshifumi Terajima, Werapon Ponragdee, Taksina Sansayawichai, Shin Irei, Akira Sugimoto, Shotaro Ando

**BP3**  
Breeding new resilient and high yielding sugarcane cultivars for stress environments in Brazil  
Geraldo Veríssimo de Souza Barbosa, João Messias Dos Santos*, José Vieira Silva, Lalilton Soares, Carlos Assis Diniz, Ediane Gonçalves De Freitas, Adelison Mascarenhas de Oliveira Silva, Danilo Eduardo Cursi, Hermann Paulo Hoffmann

**BP4**  
Seed characterization and preservation for fuzz exchange  
Edison Silva*, Fabricio Martínez, Tito León, Cervando Madrid, Mayra Valdez, Roberto Díaz Juárez
BP5  Effect of high temperatures on flowering and true seed germination in sugar cane
Maria B. Garcia, Carolina Diaz Romero, Santiago Ostengo*, Jorge Forciniti, Maria I. Cuenery

BP6  Presence of a resistance gene to brown rust (Bru1) in Brazilian varieties and sugarcane clones
Samantha Cenci Jaronski Dos Santos, Lucimeris Ruaro, Tales Romano, Joao Carlos Bespalhok Filho*

BP7  Nitrogen use efficiency – a tool for screening drought tolerant sugarcane varieties at early growth stage
Dinh Thai Hoang*, Hidoo Takaragawa, Yoshinobu Kawamitsu

BP8  Selection of energy cane clones by logistic model
J Borella, B P Brasileiro, Ricardo Augusto De Oliveira, Joao Carlos Bespalhok Filho*

BP9  Association of physiological responses and root distribution patterns to ratooning ability and yield of the 2nd ratoon crop in elite sugarcane clones
Patcharin Songsri*, Saranya Chumphu, Nuntawoot Jongrungklang

BP10 Physiological traits related to high sugar yield of 40 sugarcane genotypes grown under rainfed condition
Patcharin Songsri*, Jiraporn Nata, Nuntawoot Jongrungklang, Nam-aoi Bootprom

BP11 Association of the physiological responses on yield and agronomic traits of 19 sugarcane genotypes grown under rainfed condition
Patcharin Songsri*, Jiraporn Nata, Nuntawoot Jongrungklang

BP12 Leaf anatomical traits of sugarcane F1 hybrid derived from parents having different genetic background
Supapon Jumkudling*, Worasitikulya Taratima, Patcharin Songsri, Nuntawoot Jongrungklang
Oral presentation abstracts (MO)

**MO1** Worldwide genetic diversity of *Saccharum spontaneum* and level of diversity captured in a sugarcane breeding program
Karen Aitken*, Jingchuan Li, George Piperidis, Cai Qing, Fan Yuanhong, Phillip Jackson

**MO2** A monoploid reference sequence for the highly complex genome of sugarcane
Olivier Garreau, Gaetan Droc, Karen Aitken, Bernard Potier, Marie-Anne Van Sluys, Catherine Hervouet, Edwin van der Vossen, Robert Henry, Jeremy Schmutz, Angélique D'Hont*

**MO3** Identification and characterization of genes responsible for the brown rust resistance (Bru1) effect
Joshi SV*, Lloyd Evans D

**MO4** Analysis of QTL related to resistance to smut disease using Japanese wild sugarcane (*Saccharum spontaneum*)
Masaaki Mori*, Yusuke Ueta, Tatsuro Kimura, Hiroyuki Enoki, Takeo Sakaiichi, Yusuke Tarumoto, Minoru Tanaka, Taitchiro Hattori, Makoto Umeda, Michiko Hayano, Katsuki Adachi

**MO5** Genome-wide association mapping for traits related to drought tolerance and biomass in sugarcane (*Saccharum spp.*) using EST-SSR markers
Laurent Soulard*, Warodom Wirojsirasak, Nitiya Juabsap, Chirawat Prasitsom, Prapat Punpee, Peeraya Klomsa-ard, Klararong Sirroth

**MO6** Isolation of specific genomic DNA segments from *E. arundinaceus* and chromosome identification
Yongji Huang, Fan Yu, Ling Luo, Zuhu Deng*, Jiayun Wu, Muqing Zhang

**MO7** Mapping cold-tolerant photosynthetic quantitative trait loci in (*Saccharum spontaneum* x *Saccharum spp.*) hybrids for ultimate introgression into sugarcane
Vanessa Gordon*, Wittney Mays, Lindsay Clark, Shailendra Sharma, Chifumi Nagai, Ray Ming, Erik Sacks

**MO8** The developmental stages of sugarcane are equivalent between plants of different chronological ages
Donna Glassop*, Mark P. Hodson, Panagiotis K. Chrysanthopoulos, Anne Rae

**MO9** Transcriptomic characterization and potential marker development of contrasting sugarcane genotypes in response to leaf abscission, resistance to Pokkah boeng and water stress
Shiqiang Xu, Jihua Wang, Heyang Shang, Youzong Huang, Wei Yao, Baoshan Chen, Muqing Zhang*
MO10 Guidelines for commercial release of transgenic sugarcane in Argentina
Aldo Noguera, Ramón Enrique, María Francisca Perera*, Santiago Ostengo, Josefina Racedo, Diego Costilla, Silvia Zossi, María Inés Cuenya, María Paula Filippone, Björn Welin, Atilio Pedro Castagnaro

MO11 Development of transgenic sugarcane associate with increasing biomass, sugar and stress tolerance in Colombia
Jerón Lópex*, Hugo James, Marcela Franco, Isabel Ocampo, Rocio Barrios, Fredy Salazar, Fredy Garcés

Poster presentation abstracts (MP)

MP1 Development of microsatellite markers from sugarcane (Saccharum officinarum L.) Phil 97-3933
John Moises G. Relles*, Rimon T. Armones, and Antonio C. Laurena

MP2 Assessment of genetic diversity of first priority parentals of the sugar regulatory administration
John Moises G. Relles*, and Antonio C. Laurena

MP3 Transcriptomic analysis of sugarcane callus in response to an Agrobacterium-mediated transformation process
Elaine Cristina Alexandre, Leonardo Cardoso Alves, Renato Vicentini*, Monalisa Sampaio Carneiro*

MP4 Length and nucleotide sequence polymorphism at the trnL and trnF non-coding regions of chloroplast genomes among Saccharum and Erianthus species
Yong-Bao Pan*, James R. Todd, Brian E Scheffler, Lionel Lomax, Sheron Simpson, Fanny Liu, Michael P. Grisham

MP5 Presence of a resistance gene to brown rust (Brl1) in Brazilian varieties and sugarcane clones
Samantha Cenci Jaronski Dos Santos, Lucimeris Ruaro, Tales Romano, Joao Carlos Bespalhok F*

MP6 Improvement of sugarcane for stress environments in South Africa
Watt DA*

MP7 Comprehensive transcriptome analysis reveals genes in response to water deficit in the growing point of Saccharum
Hui Zhou*, Rong-zhong Yang, Xi-hui Liu, Yang-rui Li

MP8 A molecular identity database of sugarcane (Saccharum spp.) clones constructed with microsatellite (SSR) DNA markers
Yong-Bao Pan*, James Todd, Brian E. Scheffler, Lionel Lomax, Sheron Simpson, Edwin Dufrene, Anna Hale, Michael Grisham, Herman Waguespack Sr., Atticus Finger
HOW TO IMPROVE SELECTION DECISIONS IN THE FIRST
REPLICATED YIELD TRIAL (RYT) OF SUGARCANE SELECTION
PROGRAMS?

Jean-Yves Hoarau1*,2, Laurent Barau1, Audrey Thong-Chane1, Thomas Dumont1

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In the context of opportunities of revenue diversification from sugarcane, cane biomass remains
the primary criteria of selection considered in variety development programs (VDPs).
Measurements of cane yield (CY) is performed in replicated yield trials (RYTs) which usually
start from the middle term of VDPs. Prediction of the genotypic value of candidate varieties
(BLUP) for their cane yield is sought after as accurate as possible. In particular, confidence
level in selection decision taken in the first RYT stage is crucial to expect for highest genetic
gains for CY at the end of selection programs. Before RYTs, most of the initial genotype
candidates are discarded in non-replicated stages due to insufficient performance for some traits
showing good heritability. However, the first RYT can still contain a relatively large number
of candidates, reaching about one to several hundred candidates (depending on programs). In
some fields with a hilly topography a full replicate might involve risks of spatial heterogeneity
due to possible differences in soil fertility, depth or humidity. Multidimensional regression
spline methods represent a potentially attractive option to correct for potentially complex spatial
heterogeneities. Such methods can be implemented in the framework of mixed linear models
(REML algorithm). The study aimed to assess the potential of multidimensional regression
spline (MRS) methods to improve selection decision in the first RYT stage of eRcane program.
The MRS methods were applied to four variety trial series of 120 to 138 candidates. These
candidates were tested for CY on 15m² plots in a first RYT stage in a randomized complete
block design (RCBD) in two replicates. In each series, the 30 elite candidates were advanced
to the second RYT stage in a RCBD in three replicates on 45m² plots. Compared to the
conventional RCBD model, MRS methods allowed a reduction of the residual coefficient of
variation of CY in the first RYT stage (0.65% to 4.36%), depending on series considered.
Correlation between the first and second RYT stages for CY was improved (3% to 10%) when
considering variety BLUPs inferred in the first RYT from MRS data modeling. The set of the
highest 30 candidates for CY in the first RYT stage differed from 2 to 10 genotypes when
comparing BLUPs inferred from RCBD and MRS models. These four case studies illustrate
opportunities of improved trial precision and selection decision provided by data modelling of
CY using MRS approaches.

Keywords: Replicated yield trial, Spatial heterogeneity, Multidimensional regression spline