ABSTRACT

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12th GERMPLASM & BREEDING
AND
9th MOLECULAR BIOLOGY
WORKSHOPS

IMPROVEMENT OF SUGARCANE FOR STRESS ENVIRONMENTS

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on Germplasm, Breeding, and Molecular Biology

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Japan International Research Center for Agricultural Sciences (JIRCAS)

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

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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 Santchurn*

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, Xianming Wei, 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 Martínez, 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*

BO25 **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*

BO26 **Evaluation of cultivar performance of sugarcane in the temperate area in Japan**
Shozo Okada, Masami Ueno, Yoshinobu Kawamitsu*

BO27 **Performance of selected Phil 2009 series of sugarcane varieties in four mill districts in Luzon**
Rachel Sarol, M.V. Serrano, N. Guiyab, A. Casupanan, P. Macamos Jr., L. Santiago III, S. Ocampo, L. Caranguian*

BO28 **Long-term evaluation of the productivity of sugarcane cultivars in the Daitoh islands, Okinawa**
Hiroo Takaragawa, Eizo Taira, Masami Ueno, Yoshinobu Kawamitsu*

BO29 **Rapid adoption of new varieties through post-release trials in Ecuador**
Edison Silva C., Fabricio Martínez, David Palomeque, Walter Jara, Glenda Toala*

BO30 **Identifying breeding groups to select sugarcane genotypes according to sucrose accumulation curves**
Santiago Ostengo, Angélica Rueda Calderón, Cecilia Bruno, María I. Cuenya, Mónica Balzarini*

BO31 **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 Klomsa-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 Srihata, Sukalya Jenhang, Sunattha Attisilwet*

BP2 **Agronomic traits and root distribution of intergeneric F_1 and BC_1 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, Lailton Soares, Carlos Assis Diniz, Edjane Gonçalves De Freitas, Adeilson 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**
María B. García, Carolina Díaz Romero, Santiago Ostengo, Jorge Forciniti, María I. Cuenya*

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, Hiroo 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**
Supaporn Jumkudling, Worasitikulya Taratima, Patcharin Songsri, Nuntawoot Jongrungklang*

9th Molecular Biology section abstracts (MO, MP)

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 Garsmeur, 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 Sakaigaichi, Yusuke Tarumoto, Minoru Tanaka, Taiichiro 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, Klanarong Sriroth*

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**
Jershon López, Hugo Jaimes, 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, Rimmon 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 (Bru1) 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, Edwis Dufrene, Anna Hale, Michael Grisham, Herman Waguespack Sr., Atticus Finger*

BO21

MULTI-LOCAL SELECTION OF SUGARCANE ANALYZED WITH GGE BIPLOTS: OVERVIEW OF RESULTS AT A GLANCE AND SCOPE OF LESSONS

Jean-Yves Hoarau[1*,2], Susie Guilly[1], Laurent Barau[1], Audrey Thong-Chane[1], Thomas Dumont[1]

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Multi-environment trials (METs) represent the final stage of breeding programs prior to the commercial release of new varieties. Optimized analysis of METs impact genetic gains subsequently delivered to cane growers. The information provided by METs can be large and therefore complex to analyze and interpret when considering many environments of selection. An overview and a comprehensive interpretation of METs can be laborious on the sole basis of many tables of summary data and quantitative analyses of yield components. A complementary approach to interpreting many tables of figures can be obtained using "*Genotype main effect plus Genotype-by-Environment*" (GGE) analysis. The two-way data table of adjusted genotype means x locations is first standardized by environment. The resulting "standardized GGE matrix" of *genotype main effect* (G) and *genotype x environment* interaction (GE) is then subjected to a singular value partitioning between the genotype and environment eigenvectors. Genotypes and environments are represented on biplots defined by axes representing the most significant principal components (PCs). In order to assess effectiveness of GGE biplots to analyze sugarcane METs of Réunion Island, GGE analysis was performed on 21 sugarcane varieties tested in the MET network of eRcane that consists of seven sites of selection. These sites cover a wide range of ecologies of production representative of the main sugarcane growing areas of the industry. Varieties were assessed during two crop-cycles for tonne cane per hectare (TCH), estimable recoverable sugar (ERS), fiber content (FIB) and an economic index (EI). A biplot represented by both PC1 and PC2 : (i) adequately approximated the total GGE variation of TCH (76.52%) and ERS (71.55%) data, (ii) represented very accurately the GGE data of FIB (90.23%) and (iii) represented less efficiently the GGE data of EI (63.41%). Such two-dimensional GGE biplots of genotypes and locations permitted to visualize at a glance: (i) congruent scatterings of genotypes on trait biplots for traits linked by significant positive (TCH and EI) or negative (TCH and ERS) correlations; (ii) a succinct summary of interrelationships among environments; (iii) best performing candidates and reliable rankings of genotypes in each environment; and (iv) the ranking of mean performance and stability of genotypes across environments. This GGE biplots graphical statistical tool permits to grasp a large scope of lessons relative to multi-local selection in the particular context of eRcane programme and provide a useful tool to rapidly assist decision-making at the time of selection.

Keywords: Multi-environment trials (METs), Genotype main effect plus Genotype-by-Environment (GGE) biplot