

CONFERENCE PROCEEDINGS

8th International Conference on Silicon in Agriculture



Sheraton New Orleans Hotel
New Orleans, Louisiana USA
May 23-26, 2022



8th International Conference on Silicon in Agriculture

**Sheraton New Orleans Hotel
New Orleans, Louisiana, USA**

May 23-26, 2022

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PLENARY SPEAKER

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KEYNOTE SPEAKERS

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Dr. Clístenes Nascimento, Federal University of Pernambuco, Recife, Brazil

Dr. Miroslav Nikolic, University of Belgrade, Belgrade, Serbia

Dr. Olivia Reynolds, Charles Sturt University, Australia

Dr. Wendy Zellner, The University of Toledo, Ohio, USA

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ACKNOWLEDGEMENTS

Collins Kimbeng, LSU AgCenter Sugar Research Station

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Foreword

We would like to welcome everyone to New Orleans, Louisiana, USA, the site of the 8th International Conference on Silicon in Agriculture (ICSA). After 23 years, the conference is once again hosted in the US. Since then, the conference is held every three years and has become the venue for the silicon scientific community and industry to meet and share the latest information on silicon research in agriculture as well as foster camaraderie among the participants from around the world. We also discuss issues and research opportunities, and collaborations. The 8th ICSA theme “Innovate and Integrate Silicon Research for Sustainable Agriculture” reflects our awareness as a community of the evolving needs and challenges in agriculture.

The conference proceedings consist of 53 research abstracts in oral (25) and poster (28) presentations. We have research topics on the role of silicon in alleviating biotic and abiotic stress in plants and updates on the analytical procedures for determining silicon in soils and plants. The presentations on the implications of silicon in agricultural systems and climate change are well in tune with the conference theme. Elucidating the function of silicon at the plant cellular level and the introduction of new silicon sources are the focus of several presentations. Graduate students are presenting highlights of their research through the 5-minute rapid oral and poster presentations. All these outcomes indicate our resiliency and determination to continue our work, despite all challenges encountered and set-backs during the peak of the worldwide COVID-pandemic.

We would like to thank our sponsors for their generous financial support and for working with us to ensure the success of this conference. We thank you all for your patience. Indeed, this conference has been long overdue, and the 8th ICSA organizing committee could not be more delighted to finally open the conference to everyone.

Sincerely,

8th ICSA Organizing Committee

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CONFERENCE PROGRAM

May 23, 2022

| | | | |
|--------------|----|--|-------------------------------------|
| 5:00 – 6:30 | PM | Early Registration Sponsors Table Set-up Posters Set-up | Rhythms I Lagniappe Rhythms I |
| 6:30 – 10:00 | PM | Reception | Waterbury Ballroom |

May 24, 2022

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|-----------------|----|--|---|
| 7:00 – 9:00 | AM | Continental Breakfast Registration Sponsors Table Set-up Posters Set-up Upload Presentations | Waterbury Ballroom Rhythms I Lagniappe Rhythms I Waterbury Ballroom |
| 9:00 – 9:10 | AM | Conference Opening Dr. Brenda Tubana President ISSAG | Waterbury Ballroom |
| 9:10 – 9:25 | AM | Welcome Remarks Dr. Michael Salassi LSU AgCenter Associate Vice President Program Leader for Plant and Soil Sciences | Waterbury Ballroom |
| 9:25 – 10:00 | AM | Plant Silicon Interactions between Organisms and the Implication for Agroecosystems Dr. Scott Johnson Plenary Speaker | Waterbury Ballroom |
| 10:00 – 10:30 | AM | Break/Poster Viewing/Exhibit | |
| 10:30 – 1:55 PM | | Program Theme I: Role in Biotic and Abiotic Stress <i>Moderator: Dr. Miroslav Nikolic</i> <i>Timekeeper: Dr. Jelena Pavlovic</i> | Waterbury Ballroom |
| 10:30 – 11:00 | AM | Keynote: Silicon-Facilitated Plant Defense Against Biotic Stress: Recent Advances Dr. Olivia Reynolds Charles Sturt University | |
| 11:00 – 11:20 | AM | Silicon Alleviates Antimony Phytotoxicity in Giant Reed Dr. Marek Vaculik Comenius University in Bratislava | |
| 11:20 – 11:40 | AM | The Effect of Foliar Application of Silicon on the Expression of Genes Involved in Plant Response to Stress Dr. Anna Konieczny INTERMAG | |

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| 11:40 – 12:00 | AM | Effect of Silicon Application on Orange Rust Control in Different Sugarcane Varieties Dr. Bruno Nicchio Federal University of Uberlandia | |
| 12:00 – 1:00 | PM | Lunch | Lagniappe |
| 1:00 – 1:20 | PM | Effect of Soil Silicon Amendment on Rice Insect Pest Complex in Louisiana Dr. James Villegas LSU AgCenter | |
| 1:20 – 1:35 | PM | Benefits of Silicon Fertilization in Contrasting Sugarcane Cultivars to Drought-Tolerance Subjected to Late Water Deficit Dr. Monica Camargo Agência Paulista de Tecnologia dos Agronegócios | |
| 1:40 – 1:55 | PM | Program Theme I Panel Discussion <i>Moderator: Dr. Miroslav Nikolic</i> <i>Timekeeper: Dr. Jelena Pavlovic</i> | |
| 1:55 -3:00 | PM | 5-Minute Rapid Oral Competition (Graduate Students) <i>Moderator: Dr. Brenda Tubana</i> <i>Timekeeper: Dr. Marilyn Dalen</i> | Waterbury Ballroom |
| 3:00 – 3:30 | PM | Break | |
| 3:30 – 4:30 | PM | Poster General Session Poster Graduate Student Presentation | Rhythms I |
| 4:30 – 6:30 | PM | Big Easy Ghost Tour <i>Coordinator: Dr. James Villegas</i> | Meeting Place: Waterbury Ballroom |
| 7:00 – 10:00 | PM | Cultural Night <i>Hosts: Drs. Henk-Maarte Laane & Brenda Tubana</i> <i>Music: Dr. Jazz and the New Orleans Sounds</i> | Waterbury Ballroom |

May 25, 2022

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|-------------|----|---|--------------------|
| 7:00 – 8:00 | AM | Continental Breakfast | Waterbury Ballroom |
| 8:00 – 9:45 | | Program Theme II: Chemistry and Analysis of Silicon in Soils and Plants <i>Moderator: Dr. James Villegas</i> <i>Timekeeper: Dr. Marilyn Dalen</i> | Waterbury Ballroom |
| 8:00 – 8:30 | AM | Keynote: Extraction and Estimation of Si in Soils and plants: Downsides and Front-Line Appraisals Dr. Nagabovanalli B. Prakash University of Agricultural Sciences | |

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| 8:30 – 8:50 | AM | The Correlation between Amorphous Content and Soluble Silica of Calcium Silicate Slags Using X-Ray Diffraction and Colorimetric Analysis Jessica Lyza Edward C. Levy Corporation | |
| 8:50 – 9:10 | AM | Effect of Slag Based Gypsum on Silicon Availability, Uptake and Yield of Rice, Maize, and Groundnut in India Dr. Prabhudev Dhumgond University of Agricultural Sciences | |
| 9:10 – 9:30 | AM | Condensed Silica as a New Source for Si-Fertilizer with Huge Potentials Tor S. Hansen Elkem Materials | |
| 9:30 – 9:45 | AM | Program Theme II Panel Discussion <i>Moderator: Dr. James Villegas</i> <i>Timekeeper: Dr. Marilyn Dalen</i> | |
| 9:45 – 10:15 | AM | Break/Poster Viewing/Exhibit | |
| 10:15 – 12:00 | | Program Theme III: Plant Growth, Development and Metabolism <i>Moderator: Dr. Fabricio Rodrigues</i> <i>Timekeeper: Dr. Marilyn Dalen</i> | Waterbury Ballroom |
| 10:15 – 10:45 | AM | Keynote: Beyond Biosilicification and the Cell Wall: How Does Silicon Function as a Plant Nutrient? Dr. Wendy Zellner The University of Toledo | |
| 10:45 – 11:05 | AM | Genes Related to Silicon Transport and Accumulation in Selected Crops Dr. Boris Bokor Comenius University in Bratislava | |
| 11:05 – 11:25 | AM | Silicon Fertilization and Paddy Field Dr. Chanchal Malhotra Baba Mastnath University | |
| 11:25 – 11:45 | AM | Elucidating Silicon Responses with <i>Nicotiana tabacum</i> Dr. Scott Leisner The University of Toledo | |
| 11:45 – 12:00 | AM | Program Theme III Panel Discussion <i>Moderator: Dr. Fabricio Rodrigues</i> <i>Timekeeper: Dr. Marilyn Dalen</i> | |

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|--------------|----|--|--------------------|
| 12:00 – 1:00 | PM | Lunch | Lagniappe |
| 1:00 – 2:35 | | Program Theme IV: Agricultural Systems, Climate Change and Ecology <i>Moderator: Dr. Brenda Tubana</i> <i>Timekeeper: Krizzia Guardado</i> | Waterbury Ballroom |
| 1:00 – 1:30 | PM | Keynote: Silicon Soil-Plant Dynamics in Nutrient-Poor Environment Dr. Miroslav Nikolic University of Belgrade | |
| 1:30 – 1:45 | PM | Soil Application of Calcium Silicate Slag and the Effects on Soil pH, Crop Yield and Quality of Corn, Potatoes, Tomatoes and Cucumbers Grown in Michigan Soils Dr. Patrick McGinnity Edward C. Levy Corporation | |
| 1:45 – 2:00 | PM | The Effect of Particle Size on the Solubility and Release of Monosilicic Acid from Silicate Slag and Silicon Uptake by Wheat (<i>Triticum aestivum</i>) Dr. Wooiklee Paye New Mexico State University | |
| 2:00 – 2:15 | PM | The Effects of Stabilized Silicic Acid on Fish and Shrimps Dr. Henk-Maarte Laane ReXil Agro | |
| 2:15 – 2:30 | PM | Silica Uptake and Effects in Forest Tree Plants Tommy Landberg Stockholm University | |
| 2:30 – 2:40 | PM | Program Theme IV Panel Discussion <i>Moderator: Dr. Brenda Tubana</i> <i>Timekeeper: Krizzia Guardado</i> | |
| 2:40 – 2:55 | PM | Break/Poster Viewing/Exhibit | |
| 2:55 – 4:30 | | Program Theme V: Biostimulant, Soil Amendment, and Fertilizer: What's New in the Industry <i>Moderator: Dr. Wendy Zellner</i> <i>Timekeeper: Krizzia Guardado</i> | Waterbury Ballroom |
| 2:55 – 3:25 | PM | Keynote: Crop Response to Silicon Fertilization in Northeastern Brazil Dr. Clistenes Nascimento Federal University of Pernambuco | |

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|-------------|----|--|--------------------|
| 3:25 – 3:40 | PM | Questions and Answers About Root Silicification Dr. Alexander Lux Comenius University in Bratislava | |
| 3:40 – 3:55 | PM | Alkali-Enhanced Biochar as a Soil Amendment for Providing Plant-Available Si Dr. Jim Wang LSU AgCenter | |
| 3:55 – 4:10 | PM | Magnesium Silicate and Its Potential Use for Agricultural Production in Colombia Dr. Carlos Gauggel Mg12 ZOMAC SAS | |
| 4:10 – 4:25 | PM | A New Alternative Source for Si-Fertilizer by Using Ground SiMn-Slag Tor S. Hansen Eramet Norway | |
| 4:25 – 4:35 | PM | Program Theme V Panel Discussion <i>Moderator: Dr. Wendy Zellner</i> <i>Timekeeper: Krizzia Guardado</i> | |
| 4:35 – 5:30 | PM | Business Meeting Presiding, Dr. Brenda Tubana ISSAG (Financial Report, Board Members Nomination) Recognition, Dr. Lawrence Datnoff Graduate Student Winners, Dr. Clistenes Nascimento Appointment New President & Site of 9 th ICSA | Waterbury Ballroom |
| 5:30 – 6:30 | PM | ISSAG Officers and Board Members Meeting | TBA |
| 6:30 | PM | Dinner in the Big Easy (on your own) | |

May 26, 2022

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|-------------------|----|--|--------------------------|
| 7:00 – 8:00 | AM | Continental Breakfast | Waterbury Ballroom |
| 8:30 AM – 7:00 PM | PM | Tour to Baton Rouge Coordinator: Dr. Brenda Tubana LSU AgCenter Soil Fertility Team | Hotel Front Parking Area |
| 8:00 – 8:30 | AM | Bus Boarding | |
| 8:30 | AM | Depart | |
| 10:00 – 11:30 | AM | LSU AgCenter Sugar Research Station Dr. Collins Kimbeng, Sugarcane Breeding & Genetics Dr. Michael Pontiff, Plant Breeder | |
| 12:00 – 2:30 | PM | Lunch @ LSU AgCenter Botanic Garden at Burden Dr. Jeff Kuehny, Resident Director | |
| 3:00 – 5:00 | PM | Baton Rouge Downtown | |
| 5:00 | PM | Depart for New Orleans | |
| 7:00 | PM | Arrive at Sheraton New Orleans Hotel Dinner (on your own) | |

Silicon Modulates Root Phenomics and Leaf Ionomics in Oak under *Phytophthora* Infection and Low Phosphorus Conditions

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¹Institute for Multidisciplinary Research, University of Belgrade, Serbia

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Poster Presentation #14, Rhythms I

ABSTRACT

Pedunculate oak (*Quercus robur* L.) is the most abundant deciduous tree species in Europe with high economical and ecological importance. Different species of *Phytophthora* are considered as one of the most important factors responsible for deterioration of oak forest, causing serious root damage not only in the forest trees, but also in the nurseries. Oak seedlings were grown in plastic pots with extremely low phosphorus (P) soil (1.5 mg kg⁻¹ total P; no available Olsen-P detected). Silicon (Si) and P were supplied as Na₂SiO₃ (300 mg Si kg⁻¹ dry soil) and KH₂PO₄ (180 mg P kg⁻¹ dry soil), respectively. Four treatments (-P/-Si, -P+/Si, +P/-Si, and +P+/Si) were used in the experiment. After two months of experiment, a half of the plants in each treatment were root-inoculated with *Phytophthora plurivora*. After further four weeks, the first symptoms of *P. plurivora* infection appeared in leaves (*e.g.*, leaf necrosis and wilting). Plants were then carefully removed from the pots, divided into roots and shoots, and the roots were scanned and analyzed by the WinRHIZO® software. Foliar concentrations of Si, P, K, Ca, Mg, B, Cu, Fe, Mn, and Zn were determined by ICP-OES, while the concentrations of N and S were determined by CHNS Analyzer. The addition of Si obviously improved root health status (*e.g.*, decreasing the number of lesions and necrosis intensity) in the infected plants grown under -P conditions, which was followed by an increased foliar P concentration. The Si supply significantly increased the root variables (*e.g.*, total root volume, root length, and area of thin roots) in both -P and +P plants inoculated with *P. plurivora*. Therefore, *P. plurivora* infection and supply of P and Si modulated the nutrient uptake and thereby changed the leaf ionomics, especially for infected -P plants supplied with Si (*e.g.*, significantly increased B, Cu, and Si foliar concentrations and decreased Fe, Mn, Ca, Mg, K, and S foliar concentrations). Furthermore, Si fertilization significantly declined losses in plant dry biomass caused by *P. plurivora* infection and/or P deficiency, showing biomass comparable to non-infected +P plants.

Keywords: *Phytophthora plurivora*, Plant nutrition, Root infection