

Second

Silicon in Agriculture Conference



August 22-26, 2002

Tsuruoka, Yamagata, Japan

Second
Silicon in Agriculture
Conference

Organized by
Silicon in Agriculture Organizing Committee
and
Japanese Society of Soil Science and Plant Nutrition

August 22-26, 2002
Tsuruoka, Yamagata, Japan

Welcome Message

Welcome to Tsuruoka and welcome to the Second Silicon in Agriculture Conference.

The first conference was held in Florida, three years ago. We are so pleased to have again the chance that many scientists of different disciplines who are interested in silicon meet together and discuss on common concerns.

In this conference, under six sessions, 30 oral and 55 poster presentations will be held. Besides scientific program, we plan a half-day field excursion to have a glance at Shonai plains, one of the most famous rice producing area in Japan, and also we plan two satellite symposia. The one is "Sustainable paddy farming systems in Shonai Plains" under joint auspices of the Shonai Paddy Farming Promotion Society, many farmers in the Shonai area will take in the symposium. The other is an open lecture meeting for Tsuruoka citizen titled "Agriculture and Environment".

In order to hold the conference, we were financially supported by the local government and contributions from companies and individual scientists in this country. We are very appreciative of these supports.

We will be amply rewarded, if you will feel that you are profiting by listening to the presentations of others and by an active exchange of ideas during the conference.

Again, we cordially welcome all delegates and accompanying persons who are kindly participating in the Second Silicon in Agriculture Conference in Tsuruoka, Japan.

A handwritten signature in cursive script, reading "Eiichi Takahashi".

Eiichi Takahashi

Sponsors

Tsuruoka City Hall

Yamagata Prefecture

Intelligent Cosmos Academic Foundation

Asahi Kasei Corporation

Calcium Silicate Fertilizer Association

EPDC Coal Tech & Marine Co Ltd

Fuji Silysia Chemical Ltd

The Japan Iron and Steel Federation

Kaihatsu Fertilizer Sales Co Ltd

Kaihatsu Hiryo Co Ltd

Onoda Chemical Industry Co Ltd

Sumitomo Chemical Co Ltd

Taki Chemical Co Ltd

Zen-Noh (National Federation of Agricultural Co-operative Associations)

Supporting Organizations

Ministry of Agriculture, Forestry and Fisheries, JAPAN

Yamagata University

The Crop Science Society of Japan

The Phytopathological Society of Japan

Japanese Society of Breeding

Japanese Society for Horticultural Science

Japanese Society of Plant Physiologists

Japanese Society for Tropical Agriculture

Organizing Committee

- Dr. Eiich Takahashi
Emeritus Professor of Kyoto University
- Dr. Ho Ando
Yamagata University
- Dr. Shuichi Asanuma
Japanese Society of Soil Science and Plant Nutrition
- Dr. Kiyoshi Ishiguro
National Agricultural Research Center for Tohoku Region
- Dr. Hiroaki Hayashi
The University of Tokyo
- Dr. Sumio Ito
National Agricultural Research Center
- Dr. Kozo Iwasaki
Kochi University
- Dr. Jian Feng Ma
Kagawa University
- Dr. Toru Matoh
Kyoto University
- Dr. Naoharu Mizuno
Rakuno Gakuen University
- Dr. Naoto Owa
Niigata University
- Dr. Masahiko Saigusa
Tohoku University
- Dr. Hirokazu Sumida
National Agricultural Research Center for Tohoku Region
- Dr. Hiroshi Takatoh
The Fertilizer Research Foundation
- Dr. Kazuhiko Watanabe
Hyogo Prefectural Agricultural Institute

Scientific Program

Plenary Lectures

- 1 **Silicon in Plant Nutrition** 1
Epstein E
- 2 **An Introduction to the Silicon Research in Japan** 6
Takahashi E

Session 1. *Silicon and Plant Diseases* (11-19)

- 11 **Silicon in Plant Cell Defenses Against Cereal Powdery Mildew Disease** 15
Zeyen RJ
- 12 **Research of Silicate for Improvement of Plant Defense against Pathogens in Japan** 22
Kanto T
- 13 **Relationship between Susceptibility of Rice Plants to Blast Disease and Leaf Silica Content under Different Atmospheric CO₂ Conditions** 27
Kobayashi T, Ishiguro K, Nakajima T, Kim HY, Okada M and Kobayashi K
- 14 **Silicon Induces a Defense Response to Rice Blast Infection** 29
Rodrigues FA, Benhamou N, Datnoff LE, Bélanger RR, Jones JB and Korndörfer GH
- 15 **Effect of Silicon Nutrient on Bacterial Blight Resistance of Rice (*Oryza sativa* L.)** 31
Chang SJ, Tzeng DDS and Li CC
- 16 **Accumulation of Silicon around Penetration Sites of *Magnaporthe grisea* and Silicon-dependent Promotion of Superoxide Generation after Inoculation on Rice Leaf Epidermis** 34
Maekawa K, Watanabe K, Kanto T, Aino M and Iwamoto Y
- 17 **Influence of Silicon Sources on Foliar Blast, Neck Blast, Grain Spots and Yield of Flooded Rice** 39
Santos GR, Korndörfer GH, Pelúzio JM, Didonet J, Reis Filho JCD and Cesar NS
- 18 **Effect of Silicon Rates on Some of the Most Important Diseases and Yield of Flooding Rice Crop** 40
Santos GE, Korndörfer GH and Reis Filho JCD
- 19 **Pre-treatment of Sargent Crabapple Leaf Discs with Potassium Silicate Reduce Feeding Damage by Adult Japanese Beetle** 41
Shirazi AM and Miller FD

Session 2. *Silicon in Soils* (21-38)

- 21 **Plant-Available Silicon in Paddy Soils** 43
Sumida H
- 22 **Silicon Status of Selected Louisiana Rice and Sugarcane Soils** 50
Bollich PK and Matichenkov VV
- 23 **Persistence and Availability of Rice Plant Si in Soils** 54
Itoh S and Prakash NB
- 24 **Effect of Ca-Silicate Amendments on Soil Chemical Properties under a Sugarcane Cropping System** 57
Berthelsen S, Noble A, Kingston G, Hurney A and Rudd A
- 25 **Comparison of Three Methods for Evaluation of Available Silicon in Paddy Soils** 58
Kato N, Kumagai K, Nakagawa F and Sumida H

26	Enhancement of Available Silicate in a Soil by Potassium Uptake of some Crop Species	62
	Sugiyama M and Ae N	
27	Silicon Behavior in Terrace Paddy Fields Located in Hilly and Mountainous Regions	65
	Saigusa M, Kobayashi N and Itoh T	
28	Soil Classification on Deficiency of Activated Si	68
	Bocharnikova EA, Calvert DV and Matichenkov VV	
29	Estimation of Critical Level of Available Silicic Acid and Application Rate of Silicate Fertilizer for Paddy Fields	69
	Sato Y, Nagasawa K, Nakagawa F, Morioka M, Kumagai K and Ueno M	
30	The Concentration of Silica in Rice Plant with Reference to the Silica Status in Paddy Field and River Water in Yamagata Prefecture	72
	Kumagai K, Nakagawa F, Morioka M, Nagasawa K, Sato Y, Konno Y and Ueno M	
31	Evaluation of Silicon Sources by Biological and Incubation Test	76
	Korndörfer GH, Pereira HS, Camargo MS and Silva MF	
32	Dynamics of Silicon in Paddy Field with the Reference of the Amount of Silicon in Irrigation Water	77
	Hanzawa K, Suzuki M, Yaginuma T and Nogi T	
33	Effects of Cultivated Conditions on Si Uptake from Subsoil by Rice Plant	80
	Sato N	
34	Enhancement of Phosphorus Leaching by Soybean Cultivation Especially in Brazilian Oxisol	83
	Murakami M and Ae N	
35	Prospectives of Si Fertilization for Reduction of P and N Leaching from Cultivated Areas	86
	Matichenkov VV, Calvert DV and Snyder GH	
36	Effect of Recycling of Plant Silicon on Phosphorus Utilization in Paddy Soils of Karnataka, South India	87
	Prakash NB, Nagaraj H, Vasuki N, Janardhana Gowda NA and Siddaramappa R	
37	Reaction of Phosphate and Silica-alumina Solutions	91
	Nanzyo M	
38	Adsorption of Phosphate onto Silica Gel under Ferric Ion Coexisting Condition	95
	Nagai M, Katayama Y and Hori T	

Session 3. Silicon in Plants (41-62)

41	Silicon and Abiotic Stress	99
	Hodson MJ and Sangster AG	
42	The Role of Silicon in Turfgrass Disease Management	105
	Datnoff LE, Brecht MO, Kucharek TA and Nagata RT	
43	Characterization of Silicon Uptake by Rice	111
	Ma JF and Tamai K	
44	Comparison of Silicon Uptake Characteristics between Two Cultivars of Pumpkin (<i>Curcubita moschata</i> Duch)	114
	Iwasaki K, Matsumura A, Sakai N, Takemoto K and Tanaka S	
45	Silicate Accumulation in Aging Leaves of Dicotyledonous Canopy Trees: Effects of Phylogeny, Climate and Soil Silicate Availability	118
	Kitajima K	
46	Silicon Stimulates Oat Leaf Growth by Modifying Cell Wall Properties	121
	Hossain MT, Soga K, Wakabayashi K, Fujii S, Yamamoto R and Hoson T	

47	The Aqueous Chemistry of Organosilicate Complexes	125
	Knight CTG, Gillson AME, Deguns EW and Kinrade SD	
48	Selective Uptake of Silicate Minerals by Plants	126
	Akagi T, Fu FF and Yabuki S	
49	Difference in Silicon Concentration in Leaves among Tree Species : Implication for Supplement of Mechanical Strength	130
	Nakanishi T, Onishi R and Akagi T	
50	Silicon Forms in Cell Wall of Rice and Tomato Plants	134
	Inanaga S and Chen NC	
51	Organosilicates in Nature	138
	Knight CTG, Gillson AME, Deguns EW and Kinrade SD	
52	Exogenous Silicon (Si) Increases Antioxidant Enzyme Activities and Reduces Lipid Peroxidation in Roots of Salt-Stressed Barley (<i>Hordeum vulgare</i> L.)	140
	Liang Y, Chen Q, Zhang W and Ding R	
53	Influence of Silicon on the Tolerance of the Upland Rice to the Soil Water Stress	152
	Korndörfer GH, Faria RJ and Datnoff LE	
54	Accumulated Silicon in Tropical Forage Species (<i>Brachiaria decumbens</i> and <i>Brachiaria brizantha</i>) and Tolerance to Hydric Deficit	153
	Melo SP, Korndörfer GH, Korndörfer CM, Lana RMQ and Santana DG	
55	Isolation and Characterization of a Rice Mutant Defective in Si Uptake	154
	Tamai K, Wu G, Ichii M and Ma JF	
56	RFLP Mapping of a Gene for Si Uptake in Rice (<i>Oryza sativa</i> L.)	157
	Arimura M	
57	Microarray Analysis of Transcript Profiles in Response to Si Nutrition	160
	Watanabe S, Ohkama N, Hayashi H, Yoneyama T, Yazaki J, Fujii F, Maho K, Yamamoto K, Sakata K, Sasaki T, Kishimoto N, Kikuchi S and Fujiwara T	
58	Fine Structure and Development of Rice Husk Accompanied with Silica Shell	163
	Fujita M and Kawamura K	
59	Some Industrial Utilizations of Rice Husks and Silica-Carbon Shells	168
	Kawamura K, Suzuki M and Fujita M	
60	Increased Co-accumulation of Iron and Silicon may be Responsible for Greener Leaves in Sugarcane Treated with Silicated Amendments	172
	Kingston G, Berthelsen S, Hurney AP, Rudd AV and Noble AD	
61	In Vitro Effects of Potassium Silicate Application and Nitrogen Fertilization on Shoot and Root Growth in <i>Tagetes erecta</i> 'Lady First'	173
	Shirazi AM, Kwang F, Roberts KC and Jordan SL	
62	Effect of Silicon on Photosynthetic Rate, Chlorophyll Fluorescence and Chlorophyll Content of Tomato (<i>Lycopersicon esculentum</i> Mill.) Plants under Salt Stress	174
	Al-aghabary K and Zhu ZJ	

Session 4. Silicate Fertilizers and Crop Production (71-98)

71	Silicate Fertilizers in Japan	175
	Owa N	
72	Silicon Application in Nutrient Solutions for Horticultural Crops	181
	Voogt W	
73	Role of Silicon in "Potassium Silicate Fertilizer"	191
	Mizuoichi T	
74	Si Fertilizers: Past, Present and Future	195
	Matichenkov VV, Bocharnikova EA and Calvert DV	

75	Solubilities of New Silicon Source, Fused Potassium Silicate Fertilizer, Produced from Steelmaking Slag	196
	Yao Y, Takahashi T and Akiyama T	
76	Effect of Silica Gel Application on Growth and Silicon Contents of Rice Seedlings in Nursery Beds with Different Available Silicon Contents	198
	Niizuma S, Kubo S and Morikuni H	
77	Effect of Acidified Porous Hydrate Calcium Silicate Applied in a Nursery Bed Soil on Growth and Nutrient Uptake of Rice Seedling	200
	Saigusa M, Heinai H, Shibuya K, Okazaki H and Yoshida K	
78	Effects of Porous Hydrated Calcium Silicate on Silicon and Nitrogen Concentration of a Young Leaf Blade in a Rice Plant (<i>Oryza sativa</i> L.) as Nutrients Influencing its Resistance to Rice Blast (<i>Magnaporthe grisea</i>)	205
	Yamamoto K, Sibuya K and Saigusa M	
79	Neutralized Autoclaved Aerated Concrete as Silicate Fertilizer for Rice Seedlings	208
	Yoshida K, Okazaki H and Saigusa M	
80	A New Determination Method for the Solubility of Silicate Fertilizers: Examination of Silicate Dissolution using Citrate Buffer Solutions	211
	Tomita M and Furukawa Y	
81	Evaluation of the Solubility of Silicate Fertilizers using an Ion Exchange Resin	215
	Furukawa Y and Tomita M	
82	Silicon in Fertilizers Evaluated by Sodium Carbonate Plus Ammonium Nitrate	219
	Pereira HS, Korndörfer GH, Reis CB and Correa GF	
83	Comparison of Silicon Methods for Fertilizers and Slag	220
	Pereira HS, Korndörfer GH, Moura WF and Correa GF	
84	Role of Silicon on the Production of Rice	221
	Saigusa M	
85	The Role of Silicon on Tropical Crops	227
	Korndörfer GH	
86	Effect of Root and Foliar Applications of Silicon on Growth and Quality of Five-Selected Vegetables in Deep Flow Technique	228
	Jaenaksorn T and Nokyoo W	
87	The Application Method of New Silicon Sources	240
	Mayumi H, Ando H, Fujii H, Hayasaka T, Yokoyama K, Ando T, Inoue T and Honda T	
88	How Dose Silicon Influence on Resistance of Rice Blast Disease?	243
	Hayasaka T, Fujii H, Mayumi H, Ando H and Namai T	
89	Categorization of Soil Type with Reference to Behavior of Silicon in Soil	247
	Ando T, Fujii H, Yokoyama K, Ando H and Mayumi H	
90	Early Growth of Rice Plants as Affected by Silica Gel Application to the Nursery Bed in Different Condition of Wind	249
	Yokoyama K, Fujii H, Hayasaka T, Ando H and Ando T	
91	Effect of Silicon on Growth of Hydroponically Grown Cotton Genotypes	252
	Aziz T, Gill MA, Irshad M, Ahmad I and Akhtar MS	
92	Effect of Si Fertilizers on Citrus	253
	Calvert DV, Matichenkov VV and Bocharnikova EA	
93	Yield Response of Sugarcane from Uptake of Applied Silicon in Australia	254
	Kingston G, Hurney AP, Berthelsen S, Rudd AV and Noble AD	
94	Silicon Content in the Native Brazilian Savanna's Fruits	255
	Korndörfer CM, Ribeiro KP, Salles DRM, Moura WF and Álvares TC	

95	Silicon Uptake by <i>Brachiaria decumbens</i> and its Influence on Rumen Dry Matter Degradability	256
	Korndörfer CM, Korndörfer GH, Abdallal AL and Bueno ICS	
96	The Silicon Role on <i>Brachiaria decumbens</i> Degraded Pasture	257
	Korndörfer CM, Korndörfer GH and Cardoso K	
97	Foliar Silicon Content, Extrafloral Nectaries, Ants and Herbivory at Brazilian Tropical Savannah	258
	Oliveira FR, Del-Claro K and Korndörfer GH	
98	Evaluation of Candidate Silicon Fertilizers	259
	Snyder GH, Rich DW, Barbosa-Filho MP and Elliott CL	

Section 5. Silicon Studies in Asian Countries (101-106)

101	Recent Research of Si-alleviated Stresses in Plants in China	261
	Liang Y, Sun W and Ding R	
102	Research on Agricultural Utilization of Silicon in Korea: Progress and Prospects	262
	Kang YS and Jung YT	
103	Status and Utilization of Silicon in Indian Rice Farming	266
	Prakash NB	
104	Fertilizer Application and Integrated Crop Nutrition Management in Vietnam	274
	Thanh LQ	
105	Soil Sciences Research in Thailand	275
	Sutigoolabud P	
106	Field Excursion Outline of the Yamagata Prefectural Agricultural Experiment Station Shonai Branch	279
	Fujii H	

Conference Schedule

Thursday August 22

14:00 — *Registration*
Poster Mounting
 18:00 — *Welcome Reception*

Friday August 23

8:40 — 9:00 *Welcome and Opening Addresses*
 Tomizuka Y, The Mayor, Tsuruoka City
 Takahashi E, Chairperson,
 Second Silicon in Agriculture Conference Organizing Committee

Plenary Lectures

9:00 — 9:50 **1** **Epstein E**
 Silicon in Plant Nutrition
 9:50 — 10:40 **2** **Takahashi E**
 An Introduction to the Silicon Research in Japan
 10:40 — 11:00 Coffee Break

Session 1. Silicon and Plant Diseases

Chairperson **Ishiguro K**

11:00 — 11:40 **11** **Zeyen RJ**
 Silicon in Plant Cell Defenses Against Cereal Powdery Mildew Disease
 11:40 — 13:00 Lunch
 13:00 — 13:40 **12** **Kanto T**
 Research of Silicate for Improvement of Plant Defense against Pathogens in Japan
 13:40 — 14:00 **13** **Kobayashi T**
 Relationship between Susceptibility of Rice Plants to Blast Disease and Leaf Silica Content under Different Atmospheric CO₂ Conditions
 14:00 — 14:20 **14** **Rodrigues FA**
 Silicon Induces a Defense Response to Rice Blast Infection
 14:20 — 14:40 **15** **Chang SJ**
 Effect of Silicon Nutrient on Bacterial Blight Resistance of Rice (*Oryza sativa* L.)
 14:40 — 15:00 Coffee Break

Session 2. Silicon in Soils

Chairperson **Kingston G**

15:00 — 15:40 **21** **Sumida H**
 Plant-Available Silicon in Paddy Soils
 15:40 — 16:00 **22** **Bollich PK**
 Silicon Status of Selected Louisiana Rice and Sugarcane Soils
 16:00 — 16:20 **23** **Ito S**
 Persistence and Availability of Rice Plant Si in Soils
 16:20 — 16:40 **24** **Berthelsen S**
 Effect of Ca-Silicate Amendments on Soil Chemical Properties under a Sugarcane Cropping System
 16:40 — 17:00 **Poster Review (Session 1 and 2)**
 17:10 — **Poster Presentation**

Saturday August 24

Session 3. Silicon in Plants

Chairperson **Ma JF**

8:30 — 9:10 **41** **Hodson MJ**
 Silicon and Abiotic Stress
 9:10 — 9:50 **42** **Datnoff LE**
 The Role of Silicon in Turfgrass Disease Management
 9:50 — 10:10 **43** **Ma JF**
 Characterization of Silicon Uptake by Rice
 10:10 — 10:30 Coffee Break
 10:30 — 10:50 **44** **Iwasaki K**
 Comparison of Silicon Uptake Characteristics between Two Cultivars of Pumpkin (*Curcubita moschata* Duch).
 10:50 — 11:10 **45** **Kitajima K**
 Silicate Accumulation in Aging Leaves of Dicotyledonous Canopy Trees: Effects of Phylogeny, Climate and Soil Silicate Availability
 11:10 — 11:30 **46** **Hossain MT**
 Silicon Stimulates Oat Leaf Growth by Modifying Cell Wall Properties
 11:30 — 11:50 **47** **Knight CTG**
 The Aqueous Chemistry of Organosilicate Complexes
 11:50 — 13:00 Lunch

Session 4. Silicate Fertilizers and Crop Production

Chairperson Snyder GH

13:00 — 13:40	71	Owa N Silicate Fertilizers in Japan
13:40 — 14:20	72	Voogt W Silicon Application in Nutrient Solutions for Horticultural Crops
14:20 — 14:40	73	Mizuochi T Role of Silicon in "Potassium Silicate Fertilizer"
14:40 — 15:00		Coffee Break
15:00 — 15:40	84	Saigusa M Role of Silicon on the Production of Rice
15:40 — 16:20	85	Korndörfer GH The Role of Silicon on Tropical Crops
16:20 — 16:40	86	Jaenaksorn T Effect of Root and Foliar Application of Silicon on Growth and Quality of Five-Selected Vegetables in Deep Flow Technique
16:40 — 17:00	87	Honda T The Application Method of a New Silicon Sources
17:00 — 17:20		Poster Review (Session 3 and 4)
17:30 —		Poster Presentation

Sunday August 25

Section 5. Silicon Studies in Asian Countries

Chairperson Asanuma S

8:30 — 8:55	101	Liang Y Recent Research of Si-alleviated Stresses in Plants in China
8:55 — 9:20	102	Kang YS Research on Agricultural Utilization of Silicon in Korea: Progress and Prospects
9:20 — 9:45	103	Prakash NB Status and Utilization of Silicon in Indian Rice Farming
9:45 — 10:10		Coffee Break
10:10 — 10:35	104	Thanh LQ Fertilizer Application and Integrated Crop Nutrition Management in Vietnam
10:35 — 11:00	105	Sutigoolabud P Soil Sciences Research in Thailand
11:00 —		Field Excursion
18:00 —		Banquet

Monday August 26

Satellite Symposia