BNI International Consortium

Biological Nitrification Inhibition

BNI-International Consortium

The 4th Biennial Meeting

(17th to 19th November 2022)

Genetic Mitigation and Nitrogen Use Efficiency Improvement in Agriculture

BNI-Technology Development & Validation

International Congress Center, Epochal, Tsukuba


JIRCAS

Objectives

JIRCAS has started its MLTP (Medium- & Long-term plan, started from April 2021; 2021-2025). It is time that JIRCAS and its collaborators review progress in BNI research since the last meeting (i.e. September 2018), as well as connect with more researchers not yet associated with the BNI consortium.

The primary objectives of the meeting

1. **Learning & Knowledge-sharing across projects**
   Review progress since Sept. 2018 in BNI research among Consortium-members and beyond
   - Gain new insights of BNI-function in staple crops
   - Validate BNI-technology under field conditions and in different eco-production systems
2. **Agree on shared and distinct research objectives that drive individual and collective research work/action plans for 2022-25 and beyond**
   - Understand where we are in establishing the base-line data to target model crop/forage-systems (maize, wheat, sorghum and *Brachiaria*) and what needs to be done further to develop BNI-technology.
   - Have consent on framework and approaches to develop ex-ante analysis to determine potential benefits from BNI-technology for staple-food-crops (wheat, maize, sorghum) and BNI-enabled Agro-pastoral systems.
3. **Agree on positioning BNI-research in CC adaptation/mitigation measures portfolio**
   - Assess BNI contribution to larger food systems transformation agenda *(taking into account of MAFF-MeaDRI-net-zero-emission strategy by 2050, CCAFS 11 actions, WRI menu as baseline, and EU-EJP Soils)*
   - How to position BNI-technology as genetic-mitigation to reduce N_2O emissions with Climate Change – scientists & funders?
4. **Conclusions and next steps**
   - JIRCAS/one-CG-Inter-Institutional-Research-Initiatives *(based on JIRCAS, other bilateral & W1 & W2 funding)*
   - (Current) non-members
   - Private seed companies and fertilizer companies' participation
5. **Actions needed to expand BNI-Consortium**
   - Positioning of BNI-technology as part of new sleuth of initiatives needed to double global food production sustainably by 2050 without damaging ecosystems further.
   - Validation of BNI-technology in field conditions
   - Identification of Agro-climatic niche regions where BNI-function is optimally expressed from production perspective.
   - Identification of critical research areas to be developed and addressed for BNI-technology adoption

The 4th BNI International Consortium Meeting

Genetic Mitigation and Nitrogen Use Efficiency Improvement in Agriculture

BNI-Technology Development & Validation

Date: 17th & 18th November 2022, 09:30 to 18:00

Venue: Room 102, International Congress Center "EPOCHAL TSUKUBA"

PROGRAM

Chairs: K. Hayashi & GV Subbarao

Day1

Opening remarks

Mr. Koyama Osamu, President, JIRCAS

(10 min)

Welcome address

Mr. Nakazawa Katsunori, Research Councilor
(Deputy Director-General), AFFRC, MAFF, JAPAN

(5 min)

Keynote Lectures

1. The Ammonium Solution (TBD), **Prof. Timothy Searchinger** (Princeton Univ., USA), (20 min)
2. Status of Nitrogen Management Activities in the World, **Prof. Kentaro Hayashi** [(RIHN, Kyoto)/(NARO, Tsukuba)] (15 min)
3. BNI-wheats and their potential impact on wheat in the Global South: Future Research Priorities, **Dr. Hans-Joachim Braun** (ex-CIMMYT, Mexico) and **Victor Kommerell** (CIMMYT) (20 min)
4. Nitrifier diversity in BNI research, **Prof. Cecile Gubry-Rangin** (Univ. Aberdeen, UK) (20 min)
5. Opportunities for BNI as a viable N_2O mitigation option in temperate livestock systems, **Prof. Cecile deKlein (**AgResearch, New Zealand) (20 min)
6. BNI research partnership between Texas A&M and JIRCAS – A new beginning, **Prof. David Baltensperger** (Texas A&M Univ. US) (20 min)
7. My thoughts on BNI-research and sustainability in agriculture, **Dr. Thomas de Bang** (Novo Nordisk Foundation, Denmark) (15 min)
8. Importance of BNI research from a sustainable bioeconomy perspective, **Dr. Kuwabara Asuka** (Center for Research and Development Strategy, Japan Science and Technology Agency, Tokyo) (10 min)
9. TED talk on BNI-Wheat - **Recorded at TED (TED-Vancouver 2022) – 10 min video**

Conference photo (10 min)

Lunch break (12:30 to 14:30) (120 min)

Session 1. Current status of BNI research (14:30 to 15:20)

Chairs: Hayashi K. & Yoshihashi T.

1. Current state of progress in BNI research, **Dr. Guntur V. Subbarao**, JIRCAS (30 min)
2. How could we position BNI research within the portfolio of One CGIAR Research initiatives? **Dr. Victor Kommerell**, CIMMYT (20 min)

Session 2. Progress of BNI in Staple Crops (15:20 to 18:00)

Chairs: Ephrem Habyarimana & GV Subbarao

1. Upstream BNI-wheat research - *Leymus racemosus* vs *L. mollis* as 'Genetic-Platforms" – Current Status, **Dr. Kishii Masahiro**, JIRCAS/CIMMYT (20 min)
2. Biological Nitrification Inhibitor-Trait enhances nitrogen uptake by suppressing nitrifier activity and improves ammonium assimilation in two elite wheat varieties, **Dr. Adrian Bozal-Leorri**, University of the Basque Country (15 min)
3. BNI-wheat characterization in field trials at CIMMYT (TBD), **Dr. Hannes Karwat**, CIMMYT (15 min)
4. BNI-wheat development for Texas, **Prof. Amir Ibrahim**, Texas A&M Univ., US (15 min)

Coffee break (10 min)

5. Maize BNI-isolation – Current Status, **Junnosuke Otaka**, JIRCAS (20 min)
6. Maize-BNI function and GWAS analysis of hydrophobic-BNI capacity in mini-core CMLs (TBD), **Dr. Cesar Petroli**, CIMMYT (15 min)
7. Marker development for sorgoleone release in sorghum – Where are we? **Dr. Odeny Damaris**, ICRISAT (20 min)
8. Update on Sorghum BNI Research at Texas A&M, **Mr. Dinesh/Prof. Nithya**, Texas A&M Univ., US (15 min)

Day2 (09:30 am)

Organizer – Yoshihashi T (9:30 to 10:00 am)

Release of BNI-special issue

"Biology and Fertility of Soils" – by Koyama Osamu, JIRCAS President (9:30-9:35)

Cozzarelli Prize Award Celebration

- Video of Cozzarelli Prize announcement from NAS (5 min video from PNAS/NAS)
- Facilitation of Cozzarelli Prize award winners by JIRCAS President (10 min)
- Photo session (10 min)

Session 2 cont'd. Progress of BNI in Staple Crops (10:00 to 12:30)

Chairs: David Baltensperger & GV Subbarao

1. Gene-editing approaches for accelerating sorgoleone production/release from sorghum roots – A roadmap, **Prof. Michel Thomson**, Texas A&M, US (20 min)
2. Role of Proteomics and Metabolomics to understand BNI function, **Prof. Wolfram Weckwerth**, Univ. Vienna (20 min)
3. Possibility of using wild-sorghum to improve agroecological properties, NUE, and adaption to low-N production systems in cultivated sorghum, **Dr. Ephrem Habyarimana**, ICRISAT (20 min).
4. Scope and Opportunities (Genetic tools and Genetic-stocks available) for improving BNI-capacity in pearl millet, **Dr. Rakesh Srivastava**, ICRISAT (15 min)
5. A two-pronged approach to increase BNI-capacity in sorghum; Biochemistry and Plant Breeding, **Drs. Sakiko Okumoto/Bal Krishna Maharjan**, Texas A&M Univ., US (15 min)
6. Characterization of BNI-function in wild-sorghum (*S. halepense,* Johnson grass) (TBD) **Dr. Nithya Subramanian/ Dr. Muthu V Bagavathiannan**, Texas A&M, Univ., US (15 min)
7. Syringic acid from rice root exudates as a new BNI and its synergism with 1,9-decanediol, **Prof. Weiming Shi**, Inst. Soil Science, CAAS, China (15 min)
8. A new approach for measuring nitrous oxide emission in field, **Dr. Maeda Koki**, JIRCAS (15 min)

Lunch break (12:30 to 14:30 hrs - 120 min)

Session 3a. BNI in Pastures (14:30 to 17:00)

Chairs: Cecile deKlein & GV Subbarao

1. BNI-function in natural grassland/savanna systems from an ecosystem and agroecology perspectives, **Prof. Jean-Christophe Lata**, iEES-Paris, Sorbonne Univ., France, (20 min)
2. Progress in BNI research on *Brachiaria*-based production systems, **Dr. Jacobo Arango Mejia**, CIAT, (20 min)
3. Characterization of BNI function in *Brachiaria humidicola* pastures, **Prof. Frank Rasche**, University of Hohenheim, Germany (15 min).
4. Opportunities and challenges for developing BNI in cover crops as a N_2O mitigation technology for annual croplands, **Dr. Bryan Emmett,** USDA, Ames, USA (20 min).

Session 3b. Ex-ante analysis of BNI research

Chairs: Jean-Christophe Lata & GV Subbarao

1. Ex-ante analysis of BNI-wheat – Current Status, **Dr. Leon Ai**, JIRCAS, (20 min)
2. Evaluation of welfare benefits of Sorghum research and Integrated modeling framework for the ex-ante assessment of BNI technology, **Dr. Nedumaran Swamikannu**, ICRISAT, (20 min)

General discussion (30 min)

Closing Remarks – Dr. Keiichi Hayashi (5 min)

Day3

Meeting for BNI research collaborations (Closed session)

Date: 19th November 2022, 09:30 to 18:00

Venue: Room 304, International Congress Center "EPOCHAL TSUKUBA"

- **Opening address** (Dr. Hayashi Keiichi - 5 min)
- **Outline of JIRCAS BNI project** (in MLTP 2021-2025) (Dr. Yoshihashi Tadashi - 15 min)

Session 1a

Wheat-BNI research

Chairs: Hans-Joachim Braun & GV Subbarao (10:00 to 12:10)

Brief introductions and outline of their work related to BNI-wheat development

(Short explanation from each participant - 5 min each)

- JIRCAS group (GVSR/Kishii Masahiro)
- CIMMYT group (Hannes/Victor)
- Texas A&M group (Amir)
- CIMMYT-BISA (Uttam Kumar)
- IIWBR-India (GP Singh)
- UPV/EHU group (Mª Begoña González Moro)
- AAFC Group (David Pelster/Santosh Kumar)
- Univ. Copenhagen Group (Kristian)
- PGG Wrightson seeds (Steve Shorter)
- Novo Nordisk Foundation (Thomas de Bang)
- Japan Science and Technology Agency (Kuwabara Asuka)

< Discussion on BNI-enabled wheat development >

Session 1b – Formulation of Barley-BNI research team

(JIRCAS and University British Colombia partnership)

A new partnership to initiate BNI-barley research with a long-term goal of developing BNI-enabled barley for both Global North (developed countries) and Global South (Developing and under-developed parts of the World), **Dr. Gurcharan Brar / Dr. Ana Badea – University of British Colombia and AAFC**, opening statement of about

10 to 15 min, followed by discussion on research strategy and partnerships. Announcement on formation of International barley-BNI consortium and website.

< Discussion on Barley-BNI research >

Concluding remarks on future direction of BNI-wheat & barley research

– Dr. Hans-Joachim Braun (10 min)

Lunch Break (12:30 to 14:00 - 90 min)

Session 2

Maize-BNI research

Chairs: Victor & GV Subbarao (14:00 to 14:35)

Opening Statement of 5 min from each participant group followed by Discussion

- JIRCAS group (Tadashi/Otaka/GVSR)
- CIMMYT group (Cesar)
- USDA group (Bryan)

< Discussion on Maize-BNI research >

Session 3

Sorghum-BNI

Chair: Michael Thomson & GV Subbarao (14:45 to 15:25)

Opening Statement of 5 min from each participant group followed by Discussion

- JIRCAS group (Papa/Gao/GVSR)
- ICRISAT group (Damaris /Ephrem)
- Texas A&M group (Sakiko)
- Gene editing group (Michael Thomson)

< Discussion on Sorghum-BNI research to establish "proto-type" of BNI-enable sorghum >

Session 4

Pasture systems-BNI

Chair:Michael Peters & GV Subbarao (15:45 to 16:30)

Opening Statement of 5 min from each participant group followed by Discussion

- JIRCAS group (Nakamura/Otaka/GVSR)
- CIAT group (Jacobo)
- Univ. Hohenheim group (Frank)
- RedNit group (Lata)
- NZ group on temperate pastures (Cecile/Saman)
- USDA on cover crops (Bryan Emmett)

< Discussion on Pastures-BNI research - Expanding from tropical to temperate pastures >

Session 5

Wrap up Discussion

Chairs: Timothy Searchinger & GV Subbarao (16:45 to 17:20)

- *Validation of BNI-technology – what needs to be done?*
- *Collaborations & Partnerships – Issues need to be addressed*
- *Members' Forum: Q&A about our BNI Consortium: Mid-term objectives (all domains including resource mobilization, admin), organizational and communications matters, new members*

Concluding remarks on BNI-consortium meeting from Timothy Searchinger (17:20 to 17:30 – 10 min)

Closing Remarks – Dr. Keichi Hayashi, Program Director, JIRCAS (5 min)