Japan’s work on activities related to improving nutrient use and manure management towards sustainable and resilient agricultural systems

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Outline

1. Japan’s experience I. Technical activities for improved fertilizer use efficiency and increased productivity
2. Challenges and expectation to the Koronivia joint work on agriculture and UNFCCC constituted bodies
3. Japan’s experience II. Social awareness raising
1. Technical activities

General background

i. AFOLU activities accounts for 82% of nitrous oxide emissions from human activities (2007-2016). IPCC Special Report on Climate Change and Land, 2019

ii. Nutrient use and manure management and associated greenhouse gasses are related with many elements (e.g. crop yield and quality, N and C dynamics in soil)

iii. Improved nitrogen use efficiency is often related to multiple benefits (e.g. reduced cost/yield, reduced leaching, possibly also with biodiversity)
1. Technical activities

Examples of research

➢ Model-based visualization tool for agricultural soil carbon sequestration and GHG emissions
➢ Biological nitrification inhibition (BNI)
➢ Promotion of Smart Agriculture
Need to evaluate the total Global Warming Potential (GWP)

e.g. Mitigation option: “Increase C inputs to soils”

Possible trade off: Management practice to increase soil carbon may increase emissions of other GHGs

Soil C increase (CO₂ decrease)  \[\xrightarrow{\text{Trade-off}}\] Total GWP?

CH₄ and N₂O increase

Source: Dr. Shirato, NARO, Agriculture is the solution! workshop, May 2019, Shiga
Web-based visualization tool for agricultural soil carbon sequestration and GHGs emission

Simple and easy interface

Click on map ➔ get weather and soil data

Select crop and management

Show results of changes in soil carbon

Total evaluation of 3 greenhouse gases (CO₂, CH₄, N₂O)

Source: Dr. Shirato, NARO, Agriculture is the solution! workshop, May 2019, Shiga
The concept and function of Biological Nitrification Inhibition (BNI)

Rapid nitrification results in inefficient N-use by crops, leading to environmental pollution. **BNI** is an active plant-mediated natural function, where nitrification inhibitory substances released from plant roots suppress the soil-nitrifying process.
Evidence of benefits (Environment)

$N_2O$ emission negatively correlates with the activity of BNI secretion from the species planted (adapted from Subbarao et al., 2012).
Evidence of benefits (Agriculture)

Corn grain yield in fields with previous land use of Brachiaria (BNI field) and crops (non-BNI field). Data and image are provided by Dr. Jacobo Arango, CIAT, Colombia.
The BNI technology

- Primarily discovered the phenomenon by Japanese scientists in Latin America.
- A lot of efforts have been paid by JIRCAS and collaborators for the scientific recognition of the existence and significance of BNI.

- Breeding efforts for high BNI with use of wild relative *Leymus*
- High-BNI maize lines being selected from genetic resources of CIMMYT collection
- Doubled haploid sorghum populations being made from high- and low-BNI cultivars to elucidate the BNI-responsible gene(s)

Modified from Coskun et al., 2017
Development of cultivation management system to reduce greenhouse gas derived from agriculture

MAFF-CIAT project, 2018-

High-BNI capacity grass

Introduce to degraded pasture

High-BNI capacity pasture

Monitoring and analysis of environment, on-farm management and growth

AI and IoT technology management based on data

➢ Increased productivity on degraded pasture
➢ Reduced N₂O emission
Automation of operation by advanced technologies such as robot tractors and water-management system operated by smartphones enables scale-up of business.

ICT technologies enables succession of agricultural skills of expert farmers to young farmers.

Highly managed agriculture will be realized by accurate prediction of growth and diseases to utilize and analyze sensing data, etc.
Development of Agriculture by Making Full Use of the Data - Agricultural Data Collaboration Platform “WAGRI” -

For everyone involved in agriculture to be able make a good use of data for better productivity and management, ICT vendors, agricultural machinery manufacturers, and research institutes start to use “The agricultural data collaboration platform (WAGRI)”.

Current status and tasks

### Agricultural ICT services in Japan

Most of public data is scattered and not suitable for ICT use

- [Weather data](#)
- [Soil data](#)
- [Market data](#)
- [Cultivation data](#)

It is bothersome when data that you want to use are scattered across different places.

### the agricultural data collaboration platform “WAGRI”

#### Functions

**Coordination**
It will enable different vendors and manufacturers to share data on various ICTs, agricultural machinery, and sensors.

**Sharing**
Data sharing will create new services that will lead to data comparison and better productivity.

**Providing**
It enables to provide useful data for farmers such as soil, weather and market.

#### [Basic structure ]

- [Farmers, etc.](#)
- [Agricultural machinery manufacture A](#)
- [Agricultural machinery manufacture B](#)
- [ICT vendor C](#)
- [ICT vendor D](#)

#### The agricultural data collaboration platform

- **Public data**
  - To provide various data such as weather, land or map (may be charged.)

  - **Weather API**
  - **Map API**
  - **Sensor API**
  - **Growth Prediction API**
  - **Soil API**
  - **Stats API**

  - **Private business**
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  - **Researcher (NARO)**
  - **Government**

#### Private data (Closed data)

- individuals store and manage their own data in safe manners.

#### Master data

- Provide processed data of public’s and private’s raw data.

#### Authentication system

- Use Open ID Connect.

### <Effects of “WAGRI”>

#### [An effect of data collaboration]

It increases yield and quality of products, by data aggregation and analysis.

#### [An effect of open data utilization]

Various open data will be provided on the agricultural data collaboration platform, which will help farmers make strategic management decisions.

- **Market data**
- **Climate data**
- **Map data**
- **Material data**
- **Cultivar/cultivation data**

According to the market and weather data, it looks like it would be more profitable to sell to the market B rather than to market A!
2. Challenges and how KJWA and the UNFCCC Constituted bodies can help

1. Implementation of best practices, innovations and technologies in **farmers’ fields**
2. Inter-disciplinary collaboration
3. Communicating science to users and beneficiaries of the technologies (e.g. farmers, consumers, national and local policy makers)

KJWA and UNFCCC bodies can advance work by connecting science to the broader community and national tools
3. Social awareness activities

International symposiums held in Japan (2019)

➢ Agriculture is the Solution! for Climate Change
➢ Scaling up and out climate-smart technologies and practices for sustainable agriculture
  “Climate change and agriculture business”
All participants highlighted the extreme vulnerability of agriculture to climate change and the urgency of accelerating action before it is too late.

Key messages

1. **Multi-stakeholders exchanges** are fundamental for inclusive decision making and successful uptake of actions on the ground.

2. **Farmers are at the center of addressing climate change** and are key to scaling up proven solutions.

3. Consumers, governments and all stakeholders in this common challenge must recognize the valuable role of farmers.

The symposium was organized by MAFF with support from Shiga Prefecture, the Food and Agriculture Organization, the World Bank and the 4per1000 initiative.

Opening by H.E. Minister Takamori Yoshikawa

Program and presentations available at http://www.maff.go.jp/e/policies/env/agsol.html
MAFF Japan also organized a symposium for scaling up and out climate-smart technologies and practices, as part of the follow-up international workshop of G20 Meeting of Agriculture Chief Scientists (April 2019, Tokyo).

Website of the symposium:
(http://www.maff.go.jp/j/kanbo/kankyo/seisaku/kikouhendou/symposium/cs.html)
Farmers’ voices

• We feel the crisis – plant diseases, extreme weather events, etc…
• Farmers care about climate change, but didn’t know what was happening at global scale. Even if they intend to do good thing, they might burden the environment, because sometimes they don’t have scientific knowledge.
• Farmers bear the operational risk when installing new equipment and machinery to introduce new practice.